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Sport practice and physical activity - the social function of sport in contemporary societies

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Sport practice and physical activity - the social function of sport in contemporary societies

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Editorial: Sport practice and physical activity—the social function of sport in contemporary societies

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Editorial on the Research Topic
Sport practice and physical activity—the social function of sport in contemporary societies

Sport and physical activity are essential for developing healthy, dynamic, and cohesive societies. Besides its recreational dimension, sport has a significant impact on aspects such as health, education, social inclusion, and local development. That is why various public policies promote greater participation and equitable access to facilitate the practice of sports and physical activities.

The thematic focus of this special issue is to analyse the complex interactions between sport, physical activity, active living, mobility, and the factors that influence the adoption of an active lifestyle. This integrative perspective is essential to understand better how social structures, urban design, individual motivation, and public policies may or may not facilitate the adoption of active habits.

Understanding the main drivers and barriers that motivate or demotivate physical activity, also considering the intrinsic complexities of each of the societies analysed in the case studies presented, is crucial to designing better policies that foster physical activity. By transferring theoretical advances into practical strategies that promote healthier and more active lifestyles, these heterogeneous and pluralistic approaches could contribute to the development of more targeted policies and interventions adapted to different population groups (according to age, gender, socioeconomic status, and socio-cultural context).

Special consideration has been given to the multidimensional impact of sport and physical activity, with particular emphasis on their socio-economic influence, their innovative potential, and their role in promoting health, inclusion, and cultural identity. Ethical issues, psychosocial effects on well-being, and the relationship between sport and urban development, as well as physical barriers, have also been considered.

The 11 articles that we present belong to a diverse group of 41 researchers from universities and research centres in Australia, Belgium, China, Finland, Germany, the Netherlands, Norway, Spain, Turkey, the United Kingdom and the United States. We provide a summary of them below in order from newest to oldest based on their publication dates.

Physical activity in the EU was analysed by Martín and Moreira using data from the latest Eurobarometer on sport and physical activity. They applied a hybrid fuzzy analysis approach to calculate a synthetic index measuring the physical activity of EU citizens. The method was applied to the entire dataset obtained from 26,578 respondents. The results revealed, among other findings, territorial inequalities in Europe, mainly between north and south and, to a minor extent, between east and west. Higher rates of exercise and physical activity in northern countries could be attributed to the development of infrastructure for non-motorised mobility. Southern and some eastern European countries are more sedentary, mainly due to cultural and climatic factors, as well as a possible lack of integrated strategies to promote physical activity. They also analysed the influence of other covariates that affect the latent variable under study, such as age, social class, educational level, gender, life satisfaction and positive perceptions of the EU. All of which provides interesting information for the potential development of specific programmes to reduce a sedentary lifestyle.

Koç et al. studied the relationship between perceived freedom in leisure time and multifaceted leadership orientations among 633 residents of Turkish provinces who participate in recreational sports in nature. They concluded that participants demonstrate high levels of perceived freedom in leisure time and moderate levels of leadership orientation. Analysis of several variables revealed a strong positive relationship between levels of perceived freedom in leisure and multifaceted leadership orientations, which would derive from the willingness to prioritise one's own desires, emotions and thoughts to feel free during leisure time. It also highlights that there are no significant differences according to age, educational level, and gender, confirming the findings of other studies on gender equality in open-air sports. However, higher scores in political leadership were observed in men. In relation to marital status, they conclude that single people have a higher perception of freedom in leisure than married people. Other variables that influence the perception of freedom and leadership characteristics are the type of discipline, its duration, and the level of personal well-being.

Currently, only around half of US citizens achieve the recommended physical activity patterns, according to Martin et al. In their article, they highlight that personality characteristics, encompassed by determination and resilience, should be beneficial in overcoming common barriers that inhibit participation in physical activities. Authors performed a literature review aligned with the guidelines for preferred data sets for systematic reviews and meta-analyses (PRISMA), focusing on 33 studies of 37,370 respondents of diverse ages, genders, and cultures. Most studies found positive relationships between determination, resilience, and physical activity outputs, such as adherence, intensity, and performance in competitive environments. Results indicated that the personality characteristics of determination and resilience play an essential role in supporting participation in physical activity. And that individuals who show higher resilience are more likely to engage in physical activity more regularly and achieve better performance results, highlighting the association between tenacity and resilience with participation and adherence towards physical activity.

Meanwhile, Chen et al. presented a study on leisure restrictions and the negotiation of structural relationships among recreational divers. They indicated that diving has become a very popular recreational activity in China over the last two decades. The study combined in-depth interviews with 20 diving enthusiasts with the Positive and Negative Affect Schedule (PANAS). The study found that diving enthusiasts predominantly use cognitive strategies to address personal and interpersonal constraints, while behavioural strategies are more effective on structural constraints. This supports the theoretical perspective on the relationship between types of constraints and negotiation strategies. Compared to Western contexts, family dynamics in China have a more pronounced influence on the configuration of interpersonal constraints, as well as economic constraints and more limited access to resources.

Indelicato studies women's participation in sport, using data from Special Eurobarometer 525. Using the Fuzzy-Hybrid approach and multinomial logistic regression, he analysed the influence of gender, age, income, education, political beliefs, and country of residence on such participation. The results highlight some geographical differences: Nordic countries, headed by Sweden and Finland, have more favourable scores in terms of opinions on women's equality of participation in sport. Meanwhile, Austria and Eastern European countries maintain a more traditional and conservative view of gender roles. More favourable opinions are also expressed by those with leftist beliefs and the highest degree of life satisfaction.

The impact of social exclusion on participation in experiential sports was analysed by Li and Qu. Based on the theory of social exclusion, they developed a conceptual model in which social exclusion is the independent variable, the intention to participate in experiential sports is the dependent variable, and loneliness and the need for social connection are the mediating variables. Using an online survey of 415 respondents in Shanxi Province (China), they analysed the data using structural equation models and the Bootstrap method. Results indicated that social exclusion significantly and positively predicts the intention to participate in experiential sports consumption. It also has a significant positive effect on loneliness and the need for social connection. However, loneliness does not mediate the relationship between social exclusion and the intention to consume experiential sports, while the need for social connection does.

Spruijtenburg et al. studied the role of teammates, coaches, and support in adolescent sports participation. In the study, they analysed the associations between different social actors (family, teammates, coaches, professors) and types of support (emotional, instrumental, co-participation) and the hours of participation in organised sports among secondary school students in the USA ($N = 294$). Using multilevel fixed-effects linear regression models, they found significant associations between various social actors and types of support and participation in organised sports. Support from teammates and coaches, as well as instrumental support, emerged as the strongest predictors of participation. Furthermore, they observed that these associations remained stable over time. However, they

also observed substantial individual variability in the relationship between social support and participation.

Regarding the impact of large-scale sporting events on national identity, Wang et al. analysed the profound effects on improving residents' national identity. They took the 2023 Asian Games in Hangzhou, China, as a case study. They analysed the responses of 1,096 residents to a survey, evaluating their interrelationships using structural equation modelling and bootstrapping. The results highlighted that these Games had a significant positive impact on national identity, subjective well-being, and city image. They concluded that the degree of participation in large-scale sporting events has a direct positive effect on national identity, and that subjective well-being and city image partially mediate this effect.

Morgan et al. present an exploratory qualitative study on the experiences of women in non-sporting volunteer roles in Australian community football clubs. The aim was to understand the barriers and facilitators to such participation. Semi-structured interviews were conducted with six women from four clubs. The analysis of barriers highlighted high self-expectations, limited resources, organisational structure, ethnicity, maternity, and gender roles. Facilitators included self-confidence, social connection, and institutional support. The results also revealed the considerable joint interaction of gender, ethnicity, maternity, and organisational and socio-cultural variables.

According to Biz and Schubert, the participation of famous athletes in supporting social causes has become a frequent practice in recent years. Based on 12 semi-structured interviews with active professional athletes from different continents and recently retired, the authors explore the most remarkable attributes of their personal brands. They conclude that, in contrast to the commercial characteristics of products, the attributes of athletes' personal brands are considered more critical for the achievement of social causes. Attributes in the field of sport, such as professional achievements and behaviour during competitions, are considered the primary sources of credibility. Consistency and alignment between the profiles of sponsors and social causes are perceived as relevant and determining factors in the success of sponsorship activities.

Gil-Beltrán et al. analysed how physical activity in the company of others and the prioritisation of positivity contribute to it becoming a habit, through the upward spiral theory of lifestyle change. They evaluated the impact on the relational loop of physical activity, emotions, and commitment. Using structural equation modelling and multilevel analysis, they analysed two studies in Spain ($N = 553$ and $N = 146$, participants who exercised regularly). The results indicated that people exercise more frequently when they experience higher levels of commitment and positive emotions, especially when they exercise with other people, and prioritise positivity. Furthermore, positive emotions during physical exercise enhance the relational cycle between emotions and exercise.

Author contributions

PM: Writing – original draft, Writing – review & editing. JM: Writing – review & editing, Writing – original draft.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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How physical exercise with others and prioritizing positivity contribute to (work) wellbeing: a cross-sectional and diary multilevel study

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Introduction: This work is a dual study employing a cross-sectional approach and a diary method to investigate how physical exercise can become a habit. Guided by the Upward Spiral Theory of Lifestyle Change, we examined the role of prioritizing positivity and engaging in physical exercise with others as advantageous resources and their impact on the relational loop of physical exercise behavior, emotions, and engagement.
Methods: The first study involved a sample of 553 participants, and the second study included 146 participants, all of whom were employed and regularly engaged in physical exercise. We utilized structural equation modeling and multilevel analysis for the respective studies.
Results: The results of the first study indicate that individuals exercise more when they experience higher levels of engagement and positive emotions, particularly when exercising with others and prioritizing positivity. The findings of the second study reveal that prioritizing positivity acts as a precursor to positive emotions during physical exercise, which in turn reinforces the relational loop between emotions and exercise behavior.
Discussion: Both studies conclude that individuals who prioritize positivity experience better psychological wellbeing and higher engagement in physical exercise.

KEYWORDS

physical exercise, engagement, positive emotion, prioritizing positivity, upward spiral theory of lifestyle change

1 Introduction

One of the growing lifestyle challenges in today's world is sedentary behavior. Work and free time are increasingly related to technology, consequently leading people of all ages to spend more time interacting with technology in the form of the Internet, video games, interactive television, mobile phones, and other platforms; also, commuting from home to work and vice versa is done frequently by car, further limiting physical activity. Due to the pandemic, technologies have become even more crucial, with teleworking, digital socializing, and online hobbies becoming integral parts of our lives. This results in the average adult spending more than half of their day sedentary, contributing to an increase in sedentary lifestyles in industrialized countries over recent decades (1). Specifically, Eurobarometer studies between 2005 and 2017 have shown an increment in the prevalence of sedentarism among adults, with the increment being

higher in men than in women (2). This concern about sedentary lifestyles stems from different studies indicating that people who accumulate more than 4 h of sedentarism every day face an increased risk of suffering from cardiovascular diseases and premature death (3, 4), which makes sedentary lifestyle an important risk factor.

Already at the beginning of the 21st century, large world organizations proposed physical activity as a palliative for sedentary lifestyles; for instance, the World Health Organization introduced the Physical Activity and Health in Europe report (5), the EU released the Physical Activity Guidelines (6), and the United States published the Physical Activity and Health Report (7). These guides are based on the fact that leading an active life not only provides numerous physical health benefits but also enhances social and psychological wellbeing.

How can we ensure that physical exercise (PE) becomes a lasting habit rather than a temporary fad? Some studies suggest that behaviors associated with enjoyment are more likely to be sustained; that is, behaviors such as performing PE are more likely to be repeated in the future if they are considered pleasant rather than merely beneficial (8). This highlights the role of the affective part of the behavior in fostering consistent behavior, leading to greater benefits and creating a positive vicious circle.

A theoretical explanation of this fact is given by the Upward Spiral Theory of Lifestyle Change (9). This theory consists of two loops, which are based on two theories: (1) the incentive salience theory of addiction (10, 11) and (2) the broaden-and-build theory of positive emotions (12–14). The first loop, explained by the incentive salience theory, tells us how the positive affect that we experience when adopting a behavior creates unconscious motives associated with the signals that the behavior is going to occur, and over time, these unconscious motives strengthen the decision to persist in this behavior. The second loop, explained by the broaden-and-build theory of positive emotions, tells us how, over time, repeated exposure to positive affect creates the so-called vantage resources, which strengthen the relationship between behavior and positive affect. These vantage resources can be biological (vagus nerve or the oxytocin system), social (social support), or psychological (prioritizing positivity) (14).

The added value of the current study lies in testing some of the mechanisms that convert a behavior into a habit, following the Upward Spiral Theory of Lifestyle Change (9). Following the principles of the above-mentioned theories, the vantage resources taken into account are (i) performing PE with other people and (ii) prioritizing positivity, as exemplified by how individuals make decisions in organizing their daily lives to make themselves happier. The innovative idea is that when people are doing PE with others and prioritize positivity, the frequency and intensity of PE increase because they are feeling well psychologically (i.e., engagement and emotions related to PE). We examined this wellbeing that is experienced from two aspects: the hedonic aspect, which includes satisfaction with life and affective components (PE emotions), and the eudaimonic aspect, which focuses on optimal psychological functioning (PE engagement) (15).

To achieve our purpose, we used two complementary approaches. On the one hand, we tested the mechanism using a between-subjects design through a cross-sectional study (Study 1). The objective of this first study was to verify the mediation of psychological wellbeing (i.e., PE engagement and PE emotion) in the relationship between vantage resources (i.e., prioritizing positivity and doing PE with others) and performing PE. That is, we investigated whether individuals who prioritize positivity and perform PE with others experience more engagement and affect during PE and thus have an increased habit in PE—performing PE more frequently, for longer durations, and/or at higher intensities.

On the other hand, we tested the mechanism from a within-subject perspective; we supported our research model in the Upward Spiral Theory of Lifestyle Change (9), testing our hypothesis using a diary study (Study 2). The objective of this second study was to observe whether daily variations in the frequency, intensity, and duration of PE sessions are positively associated with the PE-related affect (i.e., PE emotion). In addition, we examined the modulating role of prioritizing positivity as an advantageous resource in the relationship between PE and PE-related affect on that day. We expect that when people prioritize positivity in their life, their sense of effectiveness in physical exercise will be boosted, and this will have a positive effect on their affect at the daily level. Prioritizing positivity each day boosts the sense of control of individuals because they feel in charge of their life agenda. According to Bandura's Social Cognitive Theory (16), feeling more effective while doing an activity (i.e., physical exercise on a daily basis) leads to more positive feelings and wellbeing.

First, we present the hypotheses, methods, and results of Study 1, followed by the corresponding sections for Study 2.

2 Study 1

Study 1 is a between-subject study in which we want to see whether people who prioritize positivity and perform PE with others experience more PE emotions during PE. Also, in turn, we aimed to determine whether these people perform PE more frequently, for longer sessions, and at higher intensities.

Following the Upward Spiral Theory of lifestyle Change (9), the hypothesized model was explored through the following hypotheses and is depicted in Supplementary Figure S1:

- Hypothesis 1: We expect that vantage resources (i.e., prioritizing positivity and doing PE with others) will be positively associated with psychological wellbeing [i.e., PE engagement (a1, a3) and PE emotion (a2, a4)].
- Hypothesis 2: We expect that psychological wellbeing [i.e., PE engagement (b1, b2, b3) and PE emotion (b4, b5, b6)] will be positively associated with the practice of PE (i.e., frequency, duration, and intensity).
- Hypothesis 3: We expect psychological wellbeing [i.e., PE engagement (c1, c2, c3) and PE emotion (c4, c5, c6)] to fully mediate the relationship between vantage resources (i.e., prioritizing positivity and performing PE with others) and the characteristics of the PE (i.e., frequency, duration, and intensity).

2.1 Materials and methods: study 1

2.1.1 Participants and protocols

This study was conducted online during the COVID-19 confinement period in 2020 and consisted of two phases. Phase 1 took place during the lockdown period and involved a cross-sectional study, for which a call for participation was launched through social networks, encouraging people to participate in the study. For this, a link giving access to the survey was shared, and 1,266 individuals participated anonymously. The sample for Study 1 was selected from this general sample, by choosing only those individuals who were performing PE during the confinement. It consisted of 553 participants, of which 61% were women, with a mean age of 41 years (SD = 10.62), and 77% of them were working from home.

In this phase, the participants were asked if they wanted to participate in Phase 2, from which the sample for the second study would be drawn.

2.1.2 Measures

The variables and questionnaires used for the study are described as follows:

- Prioritizing positivity: This was evaluated through a six-item scale (17) ($\alpha = 0.83$) (e.g., "A priority for me is experiencing happiness in everyday life"; "I look for and nurture my positive emotions"). It was measured with a Likert-type scale, ranging from 0 (never) to 6 (always).
- PE with others: This was evaluated with a behavioral item that refers to whether, during confinement, they performed PE alone or with others ["Generally, you are doing physical exercise alone (1 = 70.3%) or in company (2 = 29.5%)"].
- PE engagement: This was evaluated using the UWES-3 using three items (18) ($\alpha = 0.88$) but adapted to PE ("When I do physical exercise, I feel full of energy"; "During confinement, I feel excited doing physical exercise"; "During confinement, time flies when I do physical exercise"). It was measured with a Likert-type scale ranging from 0 (never) to 6 (always).
- PE emotions: This was evaluated using a 7-point visual analog scale (19, 20), where a single item asked them to indicate the face that best expressed how they had felt at the level of emotional affect while doing PE (0 = sad face and 6 = happy face) (mean = 5.1; SD = 0.88).
- Physical exercise: This was evaluated using three indicators. First, the frequency with which the participants carried out physical exercise during the week (1–2 days, 3–4 days, 5–6 days, every day, more than once a day); second, the amount of time the participants spent in physical exercise sessions, indicating how long the session lasted (20–30, 31–45, 46–60, 61–90, 91–120, more than 120 min); and third, the intensity with which they did the physical exercise session, which was evaluated using a six-point visual analog scale (19, 20), where a single item asked them to indicate the battery level that best expressed the intensity of their physical exercise sessions (0 = almost empty battery and 5 = full battery) (mean = 2.91; SD = 1.24).

2.1.3 Data analysis

We used IBM SPSS Statistics 26.0 for the descriptive analysis (means, standard deviations), internal consistency analysis (Cronbach's alpha), and internal correlations of the study variables. Also, the common variance bias was checked using the Harman single-factor test (21).

Then, we tested the complete mediation model, including indirect effects, using structural equation modeling [SEM; AMOS 26.0 (IMB Corp., Armonk, NY, USA)]. This allowed us to test all relationships within a single serial mediation model using confidence intervals (22). The mediation of the hypothesized model (Supplementary Figure S1) proposes that wellbeing in PE (PE engagement and PE positive emotions) completely mediates the relationship between vantage resources (prioritizing positivity and PE with others) and performing PE.

2.2 Study 1 results

2.2.1 Descriptive analyses and Harman's test

In Supplementary Table S1, the means, standard deviations, and intercorrelations between the study variables can be found. The results show that the PE engagement scale ($\alpha = 0.88$) and the prioritizing positivity scale ($\alpha = 0.83$) meet the reliability criteria proposed by previous scientific research (23); the rest of the variables are measure using single items; therefore, reliability cannot be measured. The frequency data of the variables in which we used intervals are PE frequency (1–2 days = 22.8%; 3–4 days = 33.6%; 5–6 days = 22.4%; every day = 18.8%; more than once a day = 2.4%) and PE duration (20–30 min = 25%; 31–45 min = 23.5%; 46–60 min = 36.3%; 61–90 min = 11.9%; 91–120 min = 1.8%; more than 120 min = 1.3%).

The questionnaire consisted mostly of a single item to reduce response time. This is also based on evidence validating the use of single-item scales for assessment (18, 24). The correlation analyses show that the variables are positively related, except for performing PE with others, which did not correlate positively with prioritizing positivity and all of the PE variables (frequency, duration, and intensity).

Second, the results of the Harman test revealed that a single factor explains 38% of the variance. Since it is less than 50%, it can be said that there is no common variance bias (25). Furthermore, the recommendations of Podsakoff et al. (26) were followed, differentiating the different parts of the questionnaire by titles, as well as using different response scales, to minimize the impact of the variance bias of the common method. Therefore, it can be considered that this bias does not affect the study data, so the variance in the variables can be attributed to the evaluated constructs rather than the evaluation method.

2.2.2 Structural equation models

The results of the analyses testing the hypotheses are reported in Supplementary Table S2. Pathways that are central to hypothesis evaluation are depicted in Supplementary Figure S1 and mentioned in Supplementary Table S2 to facilitate readability.

The results fully confirm Hypothesis 1, with significant and positive relationships between prioritizing positivity and both PE

engagement ($\beta = 0.37$, $p < 0.001$) and PE emotions ($\beta = 0.27$, $p < 0.001$). Similarly, performing PE with others is significantly and positively related to both PE engagement ($\beta = 0.29$, $p < 0.01$) and PE emotions ($\beta = 0.18$, $p < 0.05$).

Hypothesis 2 is confirmed only for the relationships between PE engagement and the three PE variables: frequency ($\beta = 0.28$, $p < 0.001$), intensity ($\beta = 0.41$, $p < 0.001$), and duration ($\beta = 0.48$, $p < 0.01$). However, the relationships between PE emotions and PE variables were not significant, except for intensity ($\beta = 0.15$, $p < 0.05$).

Finally, Hypothesis 3 is also partially confirmed. On the one hand, PE engagement is confirmed as a full mediator in the relationships between vantage resources (prioritizing positivity and PE with others) and PE variables (PE frequency, PE duration, and PE intensity). The indirect effects were all positive and significant, as listed in Supplementary Table S2 (indirect effect 1 = 0.10, $p < 0.001$; indirect effect 2 = 0.15, $p < 0.001$; indirect effect 3 = 0.18, $p < 0.001$; indirect effect 7 = 0.08, $p < 0.01$; indirect effect 8 = 0.11, $p < 0.01$; indirect effect 9 = 0.14, $p < 0.01$). On the other hand, PE emotions are confirmed as a full mediator only in the relationship between PE with others and PE intensity (indirect effect 12 = 0.03, $p < 0.05$). The rest of the mediations through PE emotions did not occur since the indirect effects were not significant. All given mediations are full since all the direct effects are not significant (see Supplementary Table S2).

3 Study 3

In Study 2, we proposed an intra-individual analysis to observe whether daily variations in the frequency, intensity, and duration of PE are positively associated with PE-related emotions on a daily basis. Furthermore, we examined the role of prioritizing positivity as a vantage resource that enhances the effectiveness of PE and its effects on PE-related emotions.

So far, following the Upward Spiral Theory of lifestyle Change (9), the hypothesized model was tested with the following hypotheses and is depicted in Supplementary Figure S2:

- Hypothesis 1: Different characteristics of PE, such as its frequency, duration, and intensity, will be positively associated with PE emotions.
- Hypothesis 2: PE-related emotion will be positively associated with PE characteristics (i.e., frequency, duration, and intensity).
- Hypothesis 3: PE-related emotions will be positively associated with prioritizing positivity.
- Hypothesis 4: Prioritizing positivity will modulate the relationship between PE characteristics (frequency, duration, and intensity) and PE-related emotions.

3.1 Materials and methods: study 2

3.1.1 Participants and protocols

For study 2, we invited voluntary participants from study 1 to join a diary study, where they would have to fill out a questionnaire three times a day (M1, before work/in the morning; M2, after work/in the afternoon; M3, in the evening) for a full week (Monday to Sunday). Of the 1,266 people who answered the first questionnaire, 343 agreed to participate in Study 2. During this phase, COVID-19 restrictions were still in place, but people were allowed to leave their homes. We began Phase 2 by emailing 314 participants with details about the study and links to the questionnaires. In this email, they were also given the option of having the researchers send out reminders at each moment of every day. Participants who chose this option could choose to be part of an instant messaging group or to be notified by email. During the week of the study, daily reminders were sent to the people who requested it, in addition to a mass mail in the middle of the week, encouraging their participation. To stimulate participation, 40 checks of 40€ each were also raffled among the participants who reached the end of the study.

Finally, of the 314 subjects we initially contacted, we were left with a sample of 146 participants, according to the following criteria, with the second criterion applied to the result of the first:

1. They had responded at least four full days or 16 moments throughout the entire week (76% of the total moments).
2. Answers at each moment of the day were separated by a minimum of 15 min.

Of these 146 participants, 77% were women, with a mean age of 34.8 years (SD = 13); In addition, 49.3% worked during confinement, with 42% of them working from home.

3.1.2 Measures

The variables and questionnaires used for the study are described as follows:

- PE characteristics were evaluated using three indicators, and the hypothesized model was tested separately for each: first, the frequency with which the participants carried out physical exercise during the week (from once a week to more than once a day); second, the duration of the physical exercise session in minutes; and third, the intensity level of the physical exercise session, which was measured using a six-point single-item visual analog scale (19, 20), asking them to indicate the battery level that best represented the intensity during their physical exercise sessions (1 = almost empty battery/low intensity and 6 = full battery/maximum intensity) (mean = 3.87; SD = 1.15).
- PE emotions were measured using a 7-point visual analog scale (19, 20), where a single item asked them to indicate the face that best expressed their emotional wellbeing that day (0 = sad face and 6 = happy face).
- Prioritizing positivity was measured through a three-item scale (17) ($\alpha = 0.92$), ("A priority for me today has been experiencing happiness"; "Today, I have sought and nurtured my positive emotions"; "Today, I have structured my day to maximize my happiness"). It was measured with a Likert-type scale ranging from 0 (never) to 6 (always). These items were only included in the third measurement of the day.

3.1.3 Data analysis

Descriptive statistics, including means, standard deviations, correlations, and Cronbach's alpha, are presented in Supplementary Table S3. Prior to conducting further analysis and hypothesis testing, we calculated the intra-class correlation coefficient (ICC) to examine the between-person and within-person variance in day-level variables.

The between-person variance was 45.41% for PE emotions and 60.52% for prioritizing positivity. Thus, our variables exhibited both between- and within-person variance, warranting further examination of predictors at the person and day levels.

To test all four hypotheses, we followed the same procedure, utilizing multilevel analysis in MLwin 2.32 software (27). Following the recommendations of Ohly et al. (28), all day-level variables were person-centered.

First, for Hypotheses 1 and 4, we tested a null or intercept-only model. Next, we introduced control variables in Model 1, namely, gender as a categorical value and day number, to test the potential growth effects of PE emotions during the week. We did this as a strategy to capture "contaminating" variables that could bias the results. Specifically, there is previous research that indicates that levels of PE emotions vary depending on the day of the week (29, 30), and PE depending on gender (31). In Model 2, we introduced the main effect variables for the different hypotheses. Finally, in Model 3, we tested for the interaction effect of prioritizing positivity and PE characteristics, mentioned in Hypothesis 4.

For Hypotheses 2 and 3, we ran four separate equations for each of the PE characteristics and prioritizing positivity as dependent variables. We started with a null or intercept-only model, followed by Model 1, which introduced control variables such as gender and day of the week. Finally, in Model 2, we tested for the main effects, specifically introducing PE-related exercise as a predictor.

3.2 Study 2 results

Hypothesis 1 proposed that PE characteristics (frequency, duration, and intensity) will be positively associated with PE emotions. As shown in Supplementary Table S4, daily PE frequency ($\beta = 0.18$, SE = 0.09, $p = 0.038$) and intensity ($\beta = 0.21$, SE = 0.03, $p = 0.001$) were significant predictors of PE emotions. On the contrary, PE duration was not a significant predictor ($\beta = 0.01$, SE = −0.03, $p = 0.92$). Thus, Hypothesis 1 is only partially supported since two out of three PE characteristics showed a positive association with PE emotions. Regarding control variables, in the final model (Model 3) that included interaction terms between prioritizing positivity and PE characteristics, neither gender ($\beta = 0.22$, SE = 0.142, $p = 0.17$) nor day of the week ($\beta = -0.02$, SE = 0.02, $p = 0.25$) was a significant predictor.

Hypothesis 2 proposed that PE emotions will be positively associated with PE characteristics (frequency, duration, and intensity) as a predictor. Supplementary Tables S5–S7 present the results of the models tested for each of the PE characteristics as dependent variables. For PE frequency, the relation with PE emotions was not significant ($\beta = 0.03$, SE = 0.02, $p = 0.17$). For PE duration and intensity, the relation with PE emotions was significant in both cases (duration: $\beta = 0.21$, SE = 0.06, $p = 0.035$; intensity: $\beta = 0.39$, SE = 0.05, $p = 0.004$). Therefore, Hypothesis 2 is partially supported since PE emotions were a significant predictor of only two PE characteristics, namely, duration and intensity. Among the control variables, day of the week was the only significant predictor of PE duration ($\beta = 0.09$, SE = 0.02, $p = 0.021$), while the rest of the relations were non-significant.

Hypothesis 3 proposed that PE emotions were positively associated with prioritizing positivity. Results shown in Supplementary Table S8 indicate the PE emotions were a significant predictor of prioritizing positivity ($\beta = 0.35$, SE = 0.05, $p = 0.005$). Among the control variables, day of the week was the only significant predictor ($\beta = 0.10$, SE = 0.02, $p = 0.007$). Therefore, Hypothesis 3 is supported.

Finally, Hypothesis 4 proposed that prioritizing positivity modulated the relationship between PE characteristics (frequency, duration, and intensity) and PE emotions. Results presented in Supplementary Table S4 indicate that prioritizing positivity was a significant predictor of PE-related emotions ($\beta = 0.32$, SE = 0.08, $p = 0.004$). As per the interaction terms, we tested for the interaction between prioritizing positivity and frequency and intensity. Since PE duration was not a significant predictor in the first place, we excluded it from further analyses. The interaction terms for both PE frequency ($\beta = 0.06$, SE = 0.04, $p = 0.143$) and intensity ($\beta = -0.03$, SE = 0.02, $p = 0.109$) were not significant. Therefore, Hypothesis 4 is not supported.

4 Discussion

This study examined the mechanisms that help PE become a recurring habit using two approaches (between-subjects and within-subject) based on the Upward Spiral Theory of Lifestyle Change (9). On the one hand, we conducted a between-subjects study (Study 1) to know whether individuals who prioritized positivity experienced more positive emotions when performing PE and, in turn, whether these individuals performed PE more frequently, for longer sessions, and with higher intensity. On the other hand, from a within-subject perspective, we conducted another study (Study 2) to test whether daily variations in the frequency, intensity, and duration of PE were positively associated with PE-related emotions. Furthermore, we examined the role of prioritizing positivity as a vantage resource that improves the effectiveness of PE and its effects on PE emotions. The results we obtained from both studies were mixed.

4.1 Theoretical and practical implications

The evidence from Study 1 suggests that the mechanism that promotes more frequent, longer, and higher-intensity PE sessions is driven by positive psychological constructs such as engagement and positive emotions experienced doing physical exercise. Even more, it occurs when individuals are doing PE with others and

prioritize positivity organizing their day to include behaviors that are a source of positive emotions. In line with previous research on cognitive appraisals and their impact on perceived self-efficacy and distress during challenging periods, such as the COVID-19 lockdown (32), our findings also highlight the significant role of psychological factors in influencing physical exercise behaviors and wellbeing. However, the psychological mechanisms involved in these processes differ when it comes to PE engagement vs. positive emotions. On the one hand, when PE engagement is the psychological mechanism that explains these relationships, individuals who prioritize positivity experience higher levels of engagement when performing PE, which, in turn, leads to more frequent, longer, and more intense PE sessions. The same thing happens when doing PE with others —a greater sense of engagement in P, leads to increased frequency, duration, and intensity of the PE. On the other hand, when emotions serve as the psychological mechanism, only performing PE with others acts as the driver, which also leads to (only) higher PE intensity. So far, it seems that engagement in physical exercise is the main psychological mechanism that explains how prioritizing positivity and doing PE with others influence the frequency, duration, and intensity of the physical activity. Anyway, it is interesting to highlight that when people are doing physical exercise with others, they not only experience greater engagement but also positive emotions that influence their exercise-related physical behaviors.

This leads us to think that for the PE sessions to become more frequent, intense, and longer in duration, the positive psychological experience when performing PE should be rather eudaimonic (i.e., engagement in the PE) than hedonic (i.e., positive emotions).

Furthermore, Study 2 focused on daily variations in the relationship between prioritizing positivity and other variables from a within-person perspective. We focused on variations of PE frequency, duration, and intensity as predictors of PE-related emotions and vice versa. As well, we looked at how prioritizing positivity as a vantage resource could potentially amplify the effect of physical exercise on PE emotions. The results showed that the relation between PE intensity with PE-related emotions was reciprocal and positive over time. Similar results were obtained in Study 1, where emotions were only related to the PE intensity (rather than frequency and duration). This suggests that daily PE intensity could play a more prominent role compared to PE duration and frequency.

Regarding the modulating role of prioritizing positivity, it did not moderate the relationship between PE characteristics and PE emotions. The explanation for these partial results could be that a daily study may not capture the changes required for a change in habit since these potentially need more time to become a habit. Regarding prioritizing positivity as a vantage resource, the explanation can go along the same lines, understanding that prioritization tends to be more stable over time, more characteristic, and, therefore, more difficult to capture in a daily study.

However, prioritizing positivity was positively and reciprocally associated with PE emotions, showing its role as a driving mechanism rather than a moderator. This shows the recurrence between emotions and prioritization positivity. Creating a loop that begins with the behavior (PE) that promotes positive emotions, which, in turn, promotes prioritizing the positive, which influences the emotion again. In other words, a linking positive cycle of affective and behavioral wellbeing is created (a positive spiral). This leads us to rethink the theoretical model, where instead of asking under what conditions vantage resources moderate the link between PE and emotions, we can ask how these same resources could predict and link the psychological process among PE, emotions, and resources.

Anyway, our results confirmed the hypotheses regarding prioritizing positivity, described by Fredrickson et al. (17), who found that individuals who prioritize positive activities in their lives experience better psychological wellbeing, greater life satisfaction, and more engagement in their activities, similar to what we observed with PE in our study. In this way, teaching people how to prioritize positivity in their lives, for example, by implementing positive psychological interventions based on goal setting (33) and life crafting (34), will affect their ability to prioritize positivity and engage more effectively and positively in activities like doing physical exercise and abandoning a sedentary lifestyle.

4.2 Study limitations and future research

Despite the strengths of our studies, we acknowledge several limitations. The first limitation is that the studies were carried out in a very extreme and unusual context, such as pandemic confinement. Emotions could have been affected by psychological factors (e.g., fatigue, depression, chronic stress, and languishing) or physical factors (e.g., physical limitations, uncomfortably built environments, and limited time), which may have been more unexpected and abrupt during the confinement and were not considered in our research (35–38). Therefore, it would be beneficial to repeat the studies in a more normalized context while controlling for these variables.

A second limitation relates to Study 2 (the diary study), where we aimed to determine how today's feelings influence the repetition of tomorrow's behavior. However, we can have a behavior that is established as a habit in life, but maybe this behavior is generated by other causes, such as family obligations, rather than what that behavior generates.

A third and final limitation relates to the variable of prioritizing positivity. This limitation is related to the previous limitation, as it asks about prioritizing positivity levels in general. This implies that when participants report prioritizing positivity, they may not necessarily be prioritizing PE but focusing on other activities that provide positive emotions, and on that day, PE might not be one of them. Therefore, in future studies, framing the question specifically around prioritizing positivity in relation to PE could help address this limitation, as well as partially address the previous limitation.

5 Conclusions

This study aimed to understand the psychological mechanisms that help physical exercise become a habit. On the one hand, a

cross-sectional study demonstrated that resources such as prioritizing positivity and PE with others are good drivers of higher PE frequency, intensity, and even longer sessions, provided these behaviors are mediated by PE engagement, which involves a genuine and stable commitment to PE. Since something more ephemeral, like PE-related emotions, only predicts a more intense PE and not more frequent or long-lasting sessions, the diary study revealed additional insights. We found two loops, established by the Upward Spiral Theory of Lifestyle Change (9), but these loops did not occur since prioritizing positivity does not modulate the relationship between PE and PE-related emotions. However, we were able to observe a spiral in which a concatenation of recursive effects was produced: behavior, emotion, prioritization and emotion, and back to behavior. Furthermore, this recursive spiral was found only with PE intensity, not with frequency or duration. We found that this is in line with a cross-sectional study, where emotions only influence the PE intensity rather than the rest of the characteristics of the PE, such as frequency and duration.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of Universitat Jaume I (Verification code CD/33/2020). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

EG-B: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft. CC: Conceptualization, Data curation, Formal Analysis, Investigation, Writing – original draft. IM: Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing. SL: Conceptualization, Investigation, Supervision, Writing – review & editing. MS: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fspor.2024.1437974/full#supplementary-material

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Perceptions of celebrity athletes involved in social cause endorsement

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Introduction: Due to their ability to evoke unique associations in people's minds, professional athletes are considered prime ambassadors for companies, brands or organisations to add intangible values, credibility and awareness to their products or services. Based on that premise, using celebrity athletes for supporting social causes has also become a frequent practice over the past years. Empirical knowledge on how such activities are being perceived by involved athletes is scarce. Little is known about what they consider to be relevant attributes of their personal brand that make them suitable for endorsing social causes.
Methods: Based on semi-structured interviews with ($n = 12$) current and recently retired professional athletes from four different continents, we explore the most prominent attributes of athlete brands as well as other important features in that regard.
Results: Our results indicate that, in contrast to product endorsement, on-field attributes of the athlete brand are considered more important in relation to social causes. On-field attributes, such as career achievements and the behaviour shown during competitions, are seen as the main sources of credibility.
Discussion: Congruence and fit between endorser profiles and cause is perceived as highly relevant for successful cause endorsement activities. Our study is useful for a variety of stakeholders, such as athletes or organisations considering getting involved in social cause endorsement.

KEYWORDS

athlete brand, cause marketing, brand image, Laureus, ambassador

1 Introduction

Along with the increasing professionalisation and massification of sport, the role of professional athletes has considerably changed (1). Superstar athletes nowadays are popular not only as a consequence of their achievements on the field, but also due to the impact they have on the public by off-field information (2). They demonstrate attributes that lead to an emotional attachment of fans. Based on that, athletes often work as endorsers in different businesses and can become very influential, especially among younger members of society (3–5).

Off-field attitudes and statements from celebrity athletes are also influential to social causes. Even though some critics hold that sports should be apolitical (6), there is a growing list of athletes that use their popularity to support social causes (e.g., Megan Rapinoe, Marcus Rashford). While global sports mega-events, such as the Olympic Games and the FIFA Football World Cup, have always been a vehicle to deliver messages (7), the proliferation of social media increasingly allows and facilitates athletes to speak freely and straight to their fans about their beliefs. In response to the demand

for positioning in societal discussions, well-branded athletes are increasingly promoting their philanthropic efforts (8) to guarantee beneficial image protections (6, 7, 9). Being linked to social causes is also an important way of differentiation (8) and an attribute of an athlete's brand (10).

Due to their perceived credibility, athletes have also become very successful ambassadors and endorsers in a great variety of organisations and there is a significant growth in donation intentions to causes once they are supported by athletes (6). There is, however, a lack of empirical knowledge about how such activities are being perceived by involved athletes. In particular, little is known about the relationship between an athlete's personal brand and his/her role as social cause endorser. In order to contribute filling that research gap, the study sought to answer the following research question: What dimensions of an athlete's personal brand are considered relevant and suitable for endorsing social causes by athletes involved? To address this, semi-structured interviews with 12 current and recently retired professional athletes involved in supporting social causes were used to elaborate the attributes they consider relevant in this context.

The study largely builds on a conceptual framework suggested by Hasaan et al. (11), featuring antecedents, on-field and off-field attributes of an athlete's personal brand. Results of the interviews were compared to previous data about the influence of athlete brands in product endorsement contexts.

The paper is structured as follows: In the following two chapters we illustrate the concepts "athlete brand" and "athlete endorsement", which, together with our theoretical framework presented subsequently, build the conceptual basis of our research. Our methods of data collection and analysis are laid out next. We then present and discuss our results. Practical implications are derived from the key findings and the paper concludes with mentioning limitations of our project as well as directions for future research.

2 Literature review and theoretical framework

2.1 Athlete brands

A brand may refer to the obtaining of a "certain amount of awareness, reputation and prominence" [(12), p. 7]. The fundamental characteristic of a brand is its differentiation of other offers around, and the main reason to build a brand is to stand out (13). These concepts can be applied to individuals. Consumers are not only attached to traditional brands but also to human brands, which are defined as "any well-known persona who is the subject of marketing communication efforts" [(14), p.104]. Such as traditional brands, athletes are able to evoke unique associations in people's minds as a result of the public recognition of their talents and physical appearance (15). Usually, the athlete is linked to "valued characteristics, such as strength, courage, toughness and power, reflecting integrity, competitiveness and success" [(9), p. 457].

Scholars have been researching athlete brand characteristics (11), the measurement of these brand's equity (10), as well as how fans perceive the personality of the sports celebrity brands (3). Previous studies sustain that the main purpose of establishing an athlete brand is to strengthen the bond between that athlete and fans (11, 16) and that well-branded athletes attract companies seeking effective endorsers (17) and maintain fan support even when performance declines.

Hasaan et al. (11) reinforce Keller's idea (1993) that the creation of an athlete brand starts with awareness. The familiarity with an athlete brand is possible due to different antecedents (11). Based on Keller's brand knowledge scheme (1993), Arai et al. (18) developed the so called "Model of Athlete Brand Image" (MABI) that classified brand attributes into (a) product-related – meaning the elements necessary for performing the product function, and (b) non-product-related, referring to the external aspects related to its consumption. Applying the brand knowledge scheme to an athlete brand, it can be linked to two different dimensions of an athlete's life: performance-related to on-field results as well as behaviour and non-performance related to the off-field lifestyle.

2.2 Athlete endorsement

Organisations link themselves to celebrity brands, what can add intangible values, credibility and awareness to their products or services (19). Sports brands and other businesses often count on the great credibility of athletes as supporters or endorsers (3). Due to the attachment of fans, athletes experience a great level of influence among consumers and are very desirable endorsers to brands.

According to Ohanian (20), an endorser has three primary sources of credibility: trustworthiness, perceived attractiveness, and expertise. Trustworthiness refers to the capacity of the celebrity of making himself/herself believable to people, and expertise, how much they dominate. Also, endorsers with a better physical appearance will have a greater chance to influence fans and consumer believes (21). Overall, the more trustworthy and the more attractive a spokesperson is, the better results he/she will have in persuading the public (21, 22). Hoffner and Buchanan (23) state that an endorsement will be better accepted when the public identifies with the spokesperson for having common features, such as gender, race or origin, or due to a wish of being like the endorser (24). Cunningham and Regan (25) have raised the importance of endorser-product fit. Also von Felbert and Breuer (5) highlight the importance of congruence between the endorser and the product or brand. The authors show that the existence of a sports celebrity endorser *per se* does not have a positive direct influence on consumers purchase intentions. Consumers purchase intentions can, however, increase due to a perceived endorser-product congruence.

Previous studies such as Arai et al. (10) consider that an athlete brand has three components that may influence an endorsement: athletic performance (on-field achievements), attractive appearance, and marketable lifestyle (both off-field attributes). According to the authors, the latter has the highest contribution in product endorsement, as it reflects the personality of an athlete. In general, product endorsement is more influenced by

the off-field lifestyle of an athlete. Achievements due to athletic performance is only the second most influential element.

Media continuously report about athletes' off-field activities and the rise of social media contribute to the relevance of lifestyle (8). Also, athletes have more freedom to build their image perceptions when manipulating lifestyle, which is more easily controlled than athletic performance, which depends on a series of factors, such as their opponents' results (10). Having an attractive appearance, found to be one of the most important factors of credibility in celebrity brands endorsements studies (26), did not show the same effectiveness in athletes' brands (10).

There is also the factor of fans' loyalty to be considered. Brands are aware that once fans are loyal to a well-branded athlete, there is a good chance they will also develop a loyal relationship with the athlete's endorsed organisations (3). The admiration the public has for the athlete leads to great influence, as youth and children learn by emulating models. "Sport is a basic social institution that shapes individual and collective models and cultivates social values" [(27), p. 30] and thus it is expected that the athlete takes over this responsibility of spreading the values of the sport to society and the public demands them to show high standards of behaviour (9). Equally, low-performance on-field or controversial attitudes off-field can both easily damage their personal brand and athletes must be aware of it as their image has a fragile nature (28). Also bad behaviour can affect athletes' brand images and also their credibility as endorsers (18).

Having a positive brand image, which can be explained as the current view people have about a brand (29, 30), depends on building strong and favourable associations (31). Studies influenced by Corporate Social Responsibility (CSR) and Cause Marketing theories show that people have a better perception of brands seen as socially responsible (32, 33) and being associated to social causes is positive also to an athlete brand (8).

Based on these assumptions regarding athlete endorsement in general, the main objective of this research is to provide an academic advance in understanding the endorsement of social causes by looking at it through the lenses of professional (former) athletes involved in such activities. In this paper, celebrity endorsement of social causes in sports is understood as any forms of advocacy by (former) athletes to support social causes by advocating campaigns that aim to raise awareness of issues among the general public [cf. (34, 35)]. We intend to identify what involved athletes consider to be relevant attributes of their personal brand that make them suitable for endorsing social causes. Further, we explore how such dimensions can be compared to those that influence product endorsement, highlighting points in common and in opposition. Thus, the paper aims to deliver information about experiences of social cause endorsement that can be relevant to social projects managers and athletes that wish to engage in this type of partnership.

2.3 Theoretical underpinning

The conceptual framework suggested by Hasaan et al. (11) was used as a guiding thread of this analysis. This framework was developed by the authors based on a thorough review of the literature (more than 400 peer-reviewed articles) related to celebrity branding, brand equity, brand loyalty and athlete branding. The search was conducted on two databases (EBSCO, ProQuest) and the Impact Factor of the publication source was take into account for the final selection. In total, 168 studies informed the framework, with publications from the years 1963–2016. Generally, the authors affirm that every brand starts with familiarity (31), meaning that before developing a positive association towards an athlete brand, the fans must be able to identify it and perceive it as different from other athlete brands (36). There is a set of five antecedents that can make an athlete brand identifiable by the public, which are: *Media*; *Oral Communications*; *Impression Management*; *Social Agents*; and *Sport & Team*.

Media refers to every sort of communications technology to promote brands to a large public (37) and has a main role in the awareness of an athlete (11, 38, 39). Mass media, including national newspapers, magazines, local and national radio and television and the internet (40), was the first communication channel to athlete brands since the last century and turned athletes into local or global celebrities (41, 42). Nowadays, social media offer to the athletes the opportunity of producing and exchanging content in applications like Instagram, Facebook, or YouTube without a third party's filter (43), strengthening the differentiation of an athlete brand (44). Social media is very popular among sports fans because it allows them to feel closer to their clubs and celebrity athletes (45). Media in this understanding also includes mega-events, such as the Olympic Games or the FIFA Football World Cup, in which athletes experience an intense growth of journalists and sponsors' interest.

Oral Communications refer to informal knowledge spread by the public about a celebrity brand (46). The rumours and narratives combined with facts are elements of an athlete image (47) and building a narrative can generate buzz about an athlete (48). Rumours can impact an athlete brand (49) as the public may trust more on word-of-mouth about a celebrity brand than in media (50). *Impression Management* can be defined as "efforts by an actor to create, maintain, protect, or otherwise alter an image held by a target audience" [(51) p. 1080]. It includes planned changes in gestures, dress, appearance and patterns of talking in order to improve the image projected to the public (52) and is a regular artifice in brand strategies (53), helping to turn athletes into celebrity brands (54). *Social Agents*, such as family members, friends, colleagues and also the community a person belongs to will have a role in the perception of the world (55). The information we get from trusted people about an athlete may influence our perception positively or negatively (56). Last, the awareness of an athlete is directly connected to the relevance of the *Sport* practised as it allows him/her to have more space in the media (57, 58). The *Team* is also relevant as it is highly likely he/she will be admired by the team's supporters and have a negative perception from rival fans (59, 60).

Further to antecedents, considering that an athlete brand is a sum of his/her features and values he/she expresses (61), Hasaan et al. (11) divided the athlete brand in on-field and off-field attributes as a derivation of the product-related and non-product-related brand knowledge scheme (31). That said, athletes become a distinguished

brand not only by their on-field achievements but also for what they can show in public off-field activities (47, 62).

On-field attributes are all connected to the performance of an athlete and Hasaan et al. (11) list five different aspects here: athlete's behaviour; team; achievements; style of play; and skills. Being able to exhibit unique skills is an important manner of differentiation from other athletes (63, 64). Fans are also interested in how the athletes behave under pressure, how they connect with teammates and if they exhibit leadership and mental toughness (65). Those who cannot keep focused will be negatively judged by the audience (66). Therefore, people tend to attach themselves to on-field winners (67). Achievements, such as records, trophies, medals and individual prizes are the career's most relevant factors in making an athlete popular (47, 68). To sharpen the focus during the interviews and based on other findings, we merged the different aspects to the concepts of *Behaviour* and *Achievements* in our study (see also Table 2).

Off-field attributes are the set of values a sportsperson will exhibit in moments outside of his/her sporting activity. The bundle in Hasaan et al.'s (11) framework includes physical attraction; lifestyle; personal appeal; ethnicity; and entertainment. The public usually connects athletes with an image of glamour (69), which increases the curiosity about the clothes they wear to their personal relationships (68). Also, in social media, athletes also got a new role as entertainers (70), posting stories about their routines and showing people more of their personality (71). The physical features of a sportsperson are important to fans, both male and female (72–74). It is known that off-field attitudes of the athlete are capable of damaging his/her personal brand (61), but can also be really influential among fans, who may be willing to imitate traces of their idols (10). Again, to narrow down the focus and thus enhance data collection, we reduced the different aspects to *Lifestyle*, *Physical Attraction* and *Ethnicity*.

3 Methods

3.1 Research design and ethical consent

A qualitative approach was chosen as the information sought after includes predominantly data that is not quantifiable, such as feelings, thoughts and experiences (75). We conducted semi-structured interviews with 12 high-level professional athletes who are either still competing or have recently retired. The study was approved by the research ethics board of the affiliated organisation of the lead author.

3.2 Study population and data collection

All interviewees are volunteer ambassadors of Laureus Sports for Good worldwide. According to their own information, Laureus is a global organisation founded in 2000 by two high profile company's (Mercedes-Benz and IWC Schaffhausen) with the objectives of celebrating sports excellence and using it to transform the lives of children and youth in need. The structure of the organisation combines the Laureus World Sports Academy, the Laureus World Sports Awards and its philanthropic wing, the Laureus Sports for Good foundation. The foundation was planned to be a powerful but cost-effective manner to support social causes around the world. Instead of developing the projects themselves, Sports for Good has built a global network of charity structures that have a deeper understanding of local needs. Nowadays, they offer support to over 160 organizations in 40 different countries. One thing that differs Laureus from other organisations is their stake on athletes' endorsement as the focus of the project since day one. Their work is championed by the Laureus ambassador scheme. Laureus ambassadors are a group of around 235 current or recently retired athletes who have made contributions to the sport and are well recognized by their communities. The ambassadors are distributed all over the world and support the Sport for Good in a more local base by giving their time to raise the credibility and the awareness of a project. They are invited to join the group for their past achievements in sports but also for their relevance in their local community. The group has been successful in the past years in raising funding and getting the public's attention to causes and social projects. That said, all the ambassadors were eligible to be part of the sample as they have a well-recognized image as athletes and are successful as social causes endorsers.

To guarantee diversity in terms of interviewee demographics as well as causes and projects represented, a process of quota sampling was applied. The overall population was divided into categories and volunteers were selected from each bundle in the proportion desired (76). In collaboration with a Laureus officer, we identified three groups that could intensify the diversity of causes and motivations: gender (male or female), disability (able-bodied or disabled) and origin. The last item refers to the assumption that being born in developed or underdeveloped countries affects the degree to which athletes were exposed to social problems or had access to resources through life. Considering these groups, it was established that the interviewees should be at least 40% women, 10% of them should have a disability, and 40% should be natives of underdeveloped countries. Superpositions were accepted.

12 out of 30 athletes contacted accepted the invite. The group fulfilled the sampling exigences and we thus managed to achieve considerable diversity: the group consists of six women, two athletes with a disability and six that were born and competed for/in underdeveloped countries. The interviewees come from seven countries across four continents and are professionals of eight different sports (rugby, cricket, judo, swimming, skating, athletics, cycling, softball). In addition, they have a remarkable athletic background: all of them competed on international level, seven of them were in Olympic or Paralympic Games, four got medals in these events, two hold a record for the number of Olympic and Paralympic medals in their disciplines, five are World Champions and six Continental Champions. Table 1 provides further details about each interviewee and how they fit in the sample. In order to avoid disclosing the interviewees' identity, it was not possible to mention the sport practised and the personal achievements.

Due to the geographical spread of the interviewees across the globe, interviews were conducted via video calls in previously scheduled meetings between March and May 2021. The interviews lasted between 40 and 60 min. The interview manual was based

TABLE 1 Set of interviewees and their data.

Athlete	Gender	Origin	Region of residence	Disability	Active	Main causes endorsed
A	Female	Europe	Europe	No	Yes	Gender equity; Mental Health; Sustainability
B	Male	Europe	Europe	No	No	Children's Health; Mental Health
C	Male	South America	South America	Yes	Yes	Disabled People's Rights; Inclusion
D	Female	Europe	Europe	No	Yes	Sports for Refugees as a Tool of Integration; Gender Equity
E	Female	South America	South America	No	No	Sports as a Tool of Development for Children from Poorer Backgrounds; Sports as a Tool of Empowerment for Women
F	Female	North America	North America	No	Yes	Working Mother's Rights; Equal Pay
G	Female	Europe	Europe	No	No	Sports as a Tool of Development for Children from Poorer Backgrounds; Body Positivity for Girls
H	Male	South America	South America	No	Yes	Sports as a Tool of Development for Children from Poorer Backgrounds
I	Male	Africa	Africa	No	No	Sports as a Tool of Development for Children from Poorer Backgrounds
J	Male	Europe	Europe	Yes	Yes	Disabled People's Rights; Inclusion
K	Female	Africa	Africa	No	No	Sports as a Tool of Development for Children from Poorer Backgrounds; Sports as a Tool of Empowerment for Women
L	Male	Africa	Africa/Europe	No	Yes	Racism; Social Entrepreneurship

TABLE 2 Coding system.

Theme	Code
Antecedents	Media
	Oral communications
	Impression management
	Social agents
	Sport & team
On-field attributes	Behaviour
	Achievements
Off-field attributes	Lifestyle
	Physical attraction
	Ethnicity

on the framework developed by Hasaan et al. (11) as it allowed us to start from already established concepts about athlete brands and to apply them in social cause endorsement. The schedule included questions about antecedents, on-field and off-field attributes of an athlete brand with a particular focus on the context of social cause endorsement (see ch. 2.3). To ensure the questions were approaching the subject in the right way, they were tested with a set of voluntary participants that included native and non-native English speakers. Were considered necessary, rephrasing of questions was carried out jointly within the research team. Questions on the personal background served as ice-breaker questions at the beginning of each interview.

3.3 Data analysis

Under consent of all participants, the interviews were recorded. Data was manipulated and analysed following Miles and Huberman's (77) suggestions of procedures, starting with data transcription, what amounted to 160 pages of text. The text was reduced by discarding all irrelevant information, repetitions or meaningless expressions, resulting in 118 pages. During the reduction process, personally identifiable information such as names, countries, sponsors, personal prizes and awards, were also excluded. The files with transcript interviews of each athlete were then identified only by letters (A, B, C, D, E, F, G, H, I, J, K, L), following the order of conducting the interviews. We decided for a deductive coding approach (78) based on the theoretical framework utilized in this research (11). This pre-existing framework served as our "lens" to assess and interpret the data via a "top-down" approach. Thus, our raw data was assigned to the pre-existing themes and their respective codes. The coding system is depicted in Table 2.

Quotes were cropped to exclude information that could lead to the athlete's identification, and received researcher interference in parentheses to ensure comprehension where needed. Quotes were reunited by themes and codes displayed in a sheet. Data was then analysed and the most prominent and frequent opinions among the interviewees were identified. Coding was done manually by one the lead author. In order to ensure reliability in the sense of intersubjective verifiability, the research team frequently met to discuss selected sections of the data (79). During these regular meetings, the research team also discussed whether interpretations and the coding procedures conducted by the lead author were valid and accurate and refinements were taken whenever considered necessary. Relevant information retrieved from the interviewees was then exposed on findings and then compared to current knowledge about athletes' endorsement in general, in order to identify what is unique to the context of social cause endorsement. All interviewees were offered to review their transcripts after coding, which, however was not claimed by anyone.

4 Results and findings

The structure of the following results sections reflects the coding system, i.e., the role of the different antecedents as perceived by the interviewees will be presented first, followed by the respondents' views on on-field and off-field attributes of their personal brand.

4.1 Antecedents

Interviewees highlight the role mass *Media* (in particular, television) had in turning them into known names in their

countries. Being proactive in extending the presence on the screen is considered a natural development of their careers, working also as broadcasters, being constantly seen in sports channels in their countries and talking to journalists about causes they support. Interestingly, participants believe media is mainly interested in their on-field activities and not in their private lives. It was also pointed out that there is a difference not only in quantity but also in quality of coverage about women and men in sports, which is seen by them as a cause related to the lower popularity of female athletes among fans.

Interviewees agreed that global events like the Olympic Games or World Championships have a massive impact on one's brand awareness because of the intense interest of the national press and the exposition in sponsors activations:

> "The coverage definitely intensifies, especially dealing with an Olympic sport and in [country], because it's the only time that the public really takes notice. And [sport] is not one of the major sports in [country]. It's this two-week period where people really take notice" (Athlete F).

Although the event is momentous, the growth in popularity accompanied the interviewees. It is therefore possible to perceive that the reasons for the popularity of the participants start with how their brands got known by the public. Similar to earlier findings (41, 80, 81), mass media is the main source of the popularity of these athletes and a necessary platform for the athlete to be highly visible. Event live coverage makes athletes popular, even in countries where the sport is not popular (82). Being more present in traditional media reflects on interviewees' credibility, as the fast spread of online outlets caused scepticism about them and people perceive the statements made in traditional outlets as more reliable (83).

Interviewees also recognize the power of social media in increasing an athlete's awareness in general [cf (84).]. However, some reported low use of social media and pointed to the occurrence of pushback and abuse from the public as the main reason to keep away from it. Some restrict their posts on social media only to their careers, achievements and causes. The main reason for not exposing their private lives is to avoid negative stories that can affect their reputation [cf (85).]. The interviewees that reported a continuous use of social media as a communication tool justified it with two recurrent intentions: engaging with fans and having an open channel to talk about the sport and the causes they support:

> "I use my social media as an opportunity to highlight what's happening in the women's game, to share some of the experiences that I'm having with some of my work, and to kind of just highlight that there's loads of opportunities out there for women" (Athlete A).

Impression Management tools are commonly applied by body organisations in order to develop the capacity of athletes as spokespersons for the entity. Yet most of the interviewees claim that any improvement on their public persona was not part of a planned strategy, but rather an organic consequence of a maturing process that they went through in the public eye during their careers:

> "I never really tried [consciously] to improve anything with my public image. [..] But I think, through the years, I probably got better at doing interviews or appearances and talks just because when you start out as a teenager, you have no idea what you're doing" (Athlete F).

Interviewees state that in many of the social cause opportunities they are involved in, they do so with no vested interests. However, some claim they are better perceived by society since they started doing this job:

> "I wouldn't say I gained fans by promoting social causes. But your image as an athlete changes. You become somebody that has all of these attributes that are related to the field and your athletic career but is also somebody that is careful and aware of the causes" (Athlete D).

Our interviews indicate that endorsing products and social causes is mainly seen by the participants as part of their role and something that is expected from them. Although interviewees do not express this intention, the findings support previous information that standing for a social cause can improve an athlete's image (8, 9). However, as a conflicting partnership could affect their image, athletes are careful in their choices. They also claim brands are more open to working with them also in causes:

> "I am very proud of the work I have been doing for years together with a few sponsors. (..) I see these companies evolving the HR and hiring people with a disability. I have a lot of freedom to go to these companies and defend this cause with their support" (Athlete C).

All participants say they are truthful in their public appearances, but some of them actively avoid expressing themselves on a few topics in order to prevent negative perceptions from some groups in the population:

> "I avoid a lot of subjects and already answering, I don't feel 100% free. I see what we are at a time of great caution in some matters. So, you better not expose that opinion you better keep it to yourself" (Athlete C).

Although they are in this position for their own individual reasons, participants perceive the societal pressure for speaking up on some topics due to being considered as a role model. At this point, they understand that they may be judged if they do not say anything but also if they say something wrong and that both options may affect negatively their image:

> "There's a little bit of an insistence on this debate if talking about a cause is mandatory. [..] And it is difficult to judge based on the idea that someone who is very good at something should speak about this other thing" (Athlete H).

Participants believe that rumours and stories about them that circulate among the public, constituting *Oral Communication* about them, are in general positive. Stating that while people do not know all about their private life, participants affirm that what is known by the public is pretty genuine.

> "I do think it's close, very close [to the truth]. (…) obviously people don't know everything about me, but I think they get a good idea from what's out there" (Athlete F).

Also the importance of *Social Agents* was confirmed, as interviewees believe that the local prominence of the respective sport is key to gaining awareness towards the general population. There is also a common feeling among them that football receives a level of attention that does not reflect the reality of sports in general. Participants believe that their main link with fans is their passion for a certain *Sport* or a *Team*. Still, there is a relevant attachment based on gender and ethnicity. The idea of the athlete as part of a community is an important source of reliability of the athlete celebrity brand (3). It also relates to the identification model that states a celebrity brand will be more accepted when people recognize common features on the athlete (23, 24).

4.2 On-field attributes

Interviewees were able to point to a few traces of their *Behaviour* and skills on-field that pleased their fans and made them stand out from colleagues or competitors. Interviewees, on the stage, focused on winning, not on improving their image. Still, they highlight the need of showing morally strong behaviour to the public, especially values connected to fair play. The athletes also claim that a good performance is a great source of credibility, as people are more open to listening to them when they can back up the speech with good results:

> "I think that the achievements bring credibility. You have doors open, let's say to the president of any company if you have an Olympic medal. It is a good business card because it shows your commitment" (Athlete H).

This confirms earlier research that identifies "source credibility" as an important factor in endorsement processes (5). The interviewees reinforce the idea that *Achievements* are not composed just by what they win, but also by other personal records (e.g., being the best of the country), by unprecedented (e.g., the first of the country to be in a final) or even by improbability (e.g., a surprising classification or comeback). The perception of achievements is also influenced by how they reach this peak in their career:

> "So not everyone has the physical attributes of Usain Bolt. And even though he has to work extremely hard to win all the medals he did. So, for some people to even just make the Olympics would be an achievement in itself. I think if you give your best, then people appreciate that honesty. And I would have just given them my best that I could have each week" (Athlete J).

Another recurring perception among interviewees is that the public especially appreciates the achievements that result from overcoming difficulties. Some interviewees speak openly about these challenges with the aim that the narrative of their careers is inspiring for their fans:

> "I think they like someone that comes from adversity. And throughout my career, I've come back from a few injuries, disappointments to become [country] captain winning the [championship]" (Athlete B).

Interviewees believe society has a favourable perception of them for knowing the challenges they surpassed (e.g., injuries and comebacks), and this storytelling can be used to further boost their image (49). It is also believed that having surpassed a difficulty is a meaning source of credibility.

Participants are conscious of the relevance of on-field attributes to their reputation. They can point to particular features that distinguish them from other athletes, as differentiation is a necessary condition to establish an athlete's brand (63). There is a consensus among athletes that the achievements in sport are the most relevant factor in their popularity (47) as fans get more easily attached to successful athletes (67). Athletes say that in competition they show their skills live in front of people with no margin to feint (86), so, in the public perspective, they demonstrate expertise (skills) and trustworthiness, two out of three sources of credibility described by Ohanian (26). The higher weighting of on-field attributes by our interviewees is also due to the fact that performance in competitions is not staged but real (86), what is different to e.g., creating an image in social media. Further, although interviewees have a victorious career, they do not necessarily connect achievements with victories, but with the pursuit of their best and persistence through difficulties (e.g., sexism, disability, pregnancy, injuries, lack of resources). The narratives connect to the archetype of the heroic journey, associated with the role of the athlete since ancient times (87). The hero is someone who stands out from a moral or physical standpoint for realizing an exceptional deed that surpassed his/her possibilities (88).

4.3 Off-field attributes

In general, interviewees stated that the focus of their communication efforts is on sport and also on their charity projects, including Laureus events. They try not to show much of their personal *Lifestyle* to the public. The main reasons for this being that they do not see any relevance in doing so or that they want to maintain privacy for themselves and their families. There is, though, some willingness in sharing some information about their personal trips, readings, pets and especially the role as parents:

> "I think probably the only thing I really share is that about my dog and I enjoy being outside and that's it. I choose to not share about my boyfriend. Maybe when I do, they [fans] enjoy it because I don't share much, but we give so much when we are on media and that actually it's nice to be able to have some stuff just for me" (Athlete A).

Interviewees tend to avoid sharing negative information about their personal lives (such as break-ups or divorces) and rather share things about parenthood that make them look like ordinary people:

> "[Fans] they really like to follow what I do with my kids at home. If my children will be athletes like the father. If I teach them to [sport]" (Athlete C).

Regarding *Physical Attraction*, our interviewees are aware it is an attribute recognized by both male and female fans, but they do not appreciate this type of attention and try actively not to expose their bodies image on off-the-field activities:

> "I've chosen not to post pictures of me in a bikini on the beach or training in a sports bra and that type of thing. I definitely haven't used my body as a way to engage with people. I know that that gets more engagement for certain reasons" (Athlete A).

There is a special interest among female interviewees in not reproducing or stimulating stereotypes related to the woman's figure in society in general, such as thinness:

> "I was always judged on my body [when competing], so I try to send the message that everybody is ok and I don't promote diets or diet products, for example" (Athlete G).

Off-field attributes are growing in relevance in studies about athlete brands as, due to the intense media coverage, there is a tendency in society to think about athletes in general as pop stars (69). Our interviewees seemed to value the importance of privacy and claim the glamour imagined by people does not apply to their routines. Protecting their privacy is also a manner of image management. It is known that the credibility of an athlete starts on-field, but negative information about off-field activity on media receives great attention from the public and can impose damages to the brand's image (89). Still, in some cases, they expose enough of their routines focusing on common activities, like parenthood, that show similarities with the public. The identification model states that sharing the same experiences with the community makes the athlete more trustworthy (23).

According to previous research, physical attraction also influences the relation between athletes and fans (74) and is a primary dimension of the celebrity's source of credibility (20). Our interviewees consciously avoid benefiting from it, even if this attitude diminishes the influence they have as endorsers. Participants also perceive that physical attraction is only an asset when it fits society's standardized ideal (20). Also referring to the credibility model (ebd., 1991), not exposing off-field problems make them admirable on and off-field, reinforcing the athlete's trustworthiness. The fact they do not expose much of their private lives also keeps the attention to their on-field achievements, their field of expertise and another source of credibility.

Research states that when an athlete share a common characteristic with fans (such as gender, race or ethnicity), he/she is perceived better (90, 91). When asked to identify if their most engaged followers shared features or interests in common with them, the majority of the interviewees pointed that they are mainly the public representative of the respective sport itself. Some athletes claim that they are connected to fans due to their representativity as a person of certain *Ethnicity* in the sport:

> "We are known as [place] team. That's not a racial thing. We are a nation full of very colourful people from diverse backgrounds with different thinking. But in the end, we are a team that gives hope and has shown to give opportunity to people from a [place] that hasn't existed in this sport" (Athlete L).

Choosing the right causes to talk about is key for participants: they agree that an ambassador is credible if he/she has a sincere interest in the cause.

> "Actually, as I went through my career, I realized that a lot of what I was experiencing in sport as a female was actually replicated and also mirrored in the business world for women around lack of opportunity and growth and support and also visibility" (Athlete A).

When choosing the causes, interviewees claim a sincere interest and connection to the subject as the main source of credibility. We can relate this behaviour to Ohanian's definition of trustworthiness as a source of credibility, as it "refers to the consumer's confidence in the source for providing information in an objective and honest manner" [(20), p. 47]. According to the interviewees, having experienced the social challenges they speak about also guarantees credibility, as they have expertise on the subject. In previous studies about athlete endorsement, having expertise and trustworthiness was found to be the most influential bundle to influence the public's attitude (86). Further, the importance of credibility and also authenticity also reminds us of the importance of a high degree of congruence between an endorser and a cause, as outlined by von Felbert and Breuer (5) as well as Cunningham and Regan (25). Our findings support these assumptions to the extent that certain characteristics of the interviewees are reflected in the selection of causes endorsed (cf. Table 1). Athletes deliberately choose causes that align with their experiences based on e.g., their cultural or geographical background or other characteristics.

The following quote from a disabled athlete who supports causes such as Disabled People's Rights or Inclusion clearly illustrates this.

> "If you have lived it, I think it just gives an extra argument that you can draw on these experiences and say, yeah, this thing happened to me. But look, I've come from the other side and this is what can be achieved. And I think that can give people hope for continuing on or trying to better themselves" (Athlete J)

Our interviewees do not see themselves as different but similar to the people in their communities. They understand that they

become role models due to this proximity: they are not perfect, but people from the community that are worthy to be emulated because they achieved good things. Participants talked about their focus on surpassing their possibilities and social bias to succeed (e.g., sexism, disability, pregnancy, injuries, lack of resources, lack of support) and believe that these factors increase the admiration they receive from society. In fact, the athlete as a hero is a paramount character (92) and has, for this, the capacity of inspiring fans. Participants acknowledge this and actively publicise the surpassing journey as a manner of inspiring their public to overcome similar bias or difficulties they have in life, This can refer to, for example, a disabled person feeling encouraged to try something new by watching the Paralympics or to a professional woman when facing a male-dominated industry inspired by a female athlete that succeeds in a male-dominated sport.

5 Discussion and practical implications

Athletes are valuable spokespersons for both products and social cause organisations. Past research identified athlete characteristics that guarantee their credibility as product endorsers. Our research applied such criteria in the context of social cause endorsement. With a qualitative analysis of data, the study presented the findings obtained from 12 interviews made with high-profile athletes that volunteer as ambassadors in the Laureus Sports for Good Foundation.

In relation to earlier findings about athlete brands and endorsement in general, we can perceive an exchange of priorities between on-field and off-field activities in the context of social cause endorsement. Our interviewees base their image largely on their on-field attributes, whereas earlier research in product endorsement has highlighted the importance of off-field attributes, as this is more easily controllable by athletes in opposition to on-field attributes such as performance and success (10). This is relevant to their reputation (93) and believed to make their endorsement more effective as, for what people know, the ambassadors walk the talk. The relevant professional achievements plus the values expressed during their careers sustain their statements in endorsements. Having athletes with great on-field achievements is also perceived by the interviewees as the main strength in the Laureus project, as the presence of sports idols and celebrities generate the buzz needed to get attention to the causes.

Overall, we perceived consistency in many aspects of an athlete brand: interviewees indicated the importance of expressing the same values on and off the field; conscious of being role models to many, they choose causes connected to their own experiences and work with commercial partners and sponsors that relate to their beliefs. This coherence and congruence in the construction of their image, whether planned or unplanned, is also believed to bring depths to their statements.

Based on our findings, practical recommendations can be derived for stakeholders involved in celebrity endorsement, in particular athletes looking to endorse social causes. Past research has shown that bad behaviour off-field generates negative stories on media and affects the image of the athlete and of the organisation. However, based on our interviews it is plausible to assume that acceptable attitudes off-field do not suffice to make an ambassador effective when supporting a social cause, as the main source of credibility is connected to on-field attributes, such as career achievements and the behaviour shown when competing. Also, organisations may need to look beyond the "big names". Although global stars have an impressive impact on campaigns, our findings suggest that it can be very effective to pick up as ambassador an athlete well known locally, as the attachment between the athlete and his/her community makes him/her more appealing to that group of persons.

Further, interviewees perceive to be more effective when representing social causes they are authentically interested in and believe that fans are fast to notice when a partnership is made only for financial or public relation purposes. That said, our results indicate the high perceived relevance of endorser-cause congruence, such as a disabled athlete talking about the inclusion of people with a disability or a black athlete talking about racism. However, also athletes that are not directly affected by the social cause they endorse can have good results as ambassadors if they can prove a sincere interest to justify their role (e.g., an athlete with a wealthy family born on a place with a lot of poverty, may have not been directly affected by the lack of resources, but he/she is still part of that community). Also, narratives about resilience of athletes that faced challenges in their careers can be replicated in other people's lives and inspire the public of the organisation in general (e.g., an athlete that surpass a serious injury may be inspiring to anyone who is fighting against a disease). Lastly, interviewees pointed out the insecurity of talking to the press about a subject that they do not master. Therefore, once an athlete is considered a good spokesperson, he/she should be provided with safe and relevant information about the organisation or cause, as an incorrect statement can harm both the organisation's and the athlete's reputation.

6 Limitations and scope for future research

This study is the first to discuss perceptions of athletes involved in social cause endorsement and relate this to characteristics of an athlete brand. It thus contributes to a lively (academic) debate on the value and impact of athlete endorsements. The study is, however, not void of some limitations. The first to mention is the lack of calculation of an inter-rater coefficient. While intersubjective verifiability was ensured via frequent consultations of the research team, a coefficient would certainly have increased the quality of the data. Further, the limited set of sample size certainly affects the possibility of drawing generalised results. Also, while restricting our sample to athletes involved in the Laureus ambassador programme made the recruitment of interviewees more feasible due to the support of the organisation, this is of course a considerable delimitation regarding the diversity of our sample. Further, although the study prioritised diversity, none of the twelve participants was or is a professional football player. During the interviews, this fact became a limiting

factor, as interviewees pointed out numerous times the gap existent between football and any other sport in most countries. Future qualitative studies should therefore aim for larger samples with more diversity in terms of sports represented (including football). We also hope that our paper has paved the way for quantitative approaches to further investigate social cause endorsement by sport celebrities.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee Research UZ, KU Leuven. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MB: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Formal Analysis, Data curation, Conceptualization. MS: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Formal Analysis, Data curation, Conceptualization.

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An exploratory qualitative study of the experiences of women in volunteer non-player roles in Australian community football clubs

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Introduction: Women are underrepresented in volunteer non-player roles in community sporting clubs, particularly in traditionally male sports such as football (soccer), where participation rates for men and boys remain higher than women and girls. Experiences of women volunteering in community sporting clubs are not well-represented in research literature. By exploring women's experiences volunteering in community Australian Football clubs, the present research aimed to understand the barriers and facilitators of women's participation in volunteer non-player community sport club roles. Our intention is that our findings will provide empirical basis for the design of efficacious evidence-based interventions and initiatives to help close the gender gap of volunteerism rates and experiences, thus facilitating equal opportunities for women to access associated individual social, physical, and mental health benefits of sports volunteering.
Method: We conducted individual semi-structured interviews with six women from four Australian Football clubs, to determine barriers and facilitators to volunteering.
Results: Reflexive thematic analysis of barriers generated six themes: high expectations of self, intersectionality (of gender with motherhood or race), constrained resources, interpersonal disconnection, lack of organisational support and structure, and gender role assumptions and stereotypes. Analysis of facilitators produced six themes: having or building confidence, positive reinforcement, social connection, deliberate efforts to engage women, role autonomy and shaping, and supportive culture within a club or governing body.
Discussion: Findings revealed that impacts on women's development in non-player roles exist at the individual level, including the interaction of gender, race, and parental status, but also extend beyond this to personal, interpersonal, organisational, and sociocultural factors. Given our research findings we make seven recommendations for governing bodies and community football clubs to enhance volunteering gender equity: 1. Establish support for women by dividing work evenly among volunteers; 2. Provide clear descriptions of non-player roles; 3. Match the skill sets of new women volunteers to suitable roles; 4. Implement mentorship programs to aid collaboration among women who volunteer; 5. Educate communities about gender biases and assumptions; 6. Monitor and seek feedback on gendered task allocation to ensure women's unpaid labour is not disproportionate to men's; and 7. Promote and publicise women in non-player roles to enhance women's visibility and acceptance in community football clubs

KEYWORDS

community sport, thematic analysis, gender stereotypes, participation, barriers, facilitators, intersectionality, soccer

1 Introduction

Community sporting clubs are important to their local communities as they offer opportunities for physical activity involvement and interaction with others (1) while providing a strong sense of belonging and mutual support for club members, including non-player volunteers (2). Non-player roles are those positions responsible for essential tasks that enable sport to occur and include coach, official (e.g., referee), team manager, committee member, and other support roles. As community sporting clubs in Australia are predominantly non-profit organisations, they frequently rely on volunteers who freely elect to give their time for no monetary reward (3) fulfilling non-player roles (4).

Women are underrepresented in non-player roles in sport (5). In Australia, of the 5.9 million people who volunteer through an organisation or group annually, women are more likely to volunteer than men. Conversely, men are more likely than women to volunteer for sport and physical recreation organisations [47.5% and 30.5% respectively; (6)], especially in sports with higher participation rates in men and boys (5). For example, in football (soccer) in Australia, the context of this study, women account for only 32% of the 475,400 volunteers in non-player roles in community clubs (7). Further, there are gender differences in the types of roles undertaken with coaches, officials, and committee members more likely to be men, and team managers more likely to be women (8).

By exploring the experiences of women volunteering in community football clubs, the present research aims to understand the barriers and facilitators of women's participation in community sport volunteer roles. The purpose of this aim is that our findings will provide empirical basis for the efficacious design of evidence based interventions and initiatives that will help close the gender gap in terms of volunteerism rates and experiences between men and women. The intention is that our suggestions will not simply increase the already disproportionate unpaid labour load experienced by women. The intention, instead, is to enrich women's experiences of volunteering such that they can access the social, physical, and mental health benefits associated with volunteering in sport (9) in parity with men. Furthermore, through the suggestions based on our findings, this research will have impact not only upon women at a personal individual level, but also for sport and society.

The underrepresentation of women in non-player roles is a problem for sport, society, and women. Research shows that women in non-player roles also benefit by developing life skills and acting as a positive role model for other women and girls (10, 11). Individual benefits for women volunteers can include opportunities to build social networks, personal and career development, and increasing self-confidence (12–14). While this does rely on additional unpaid labour from women who may already hold a significant load, there are systemic benefits for women collectively that arise from women's volunteer efforts (15). Role models, such as women coaches, can strengthen girls' sense of inclusion in sports environments and enhance their confidence and self-efficacy (16, 17). The lack of representation of women in non-player roles at the community level introduces a negatively reinforcing cycle in which most participants are not exposed to women in non-player roles, which in turn is a barrier to women undertaking or remaining in non-player roles (18). This cycle constitutes a substantial limitation given the benefits of women role models in sport and can reinforce the negative perception that sport should be a predominantly men and boys' endeavour (19). Gender equity in non-player roles in community sport is crucial as it is often in this context that young people's sporting experiences begin, and often continue (20). Therefore, greater visibility of women in these roles can have profound impacts upon sporting communities and broader society by disrupting traditional institutional norms and challenging stereotypes relating to the suitability of men and women for particular roles (18, 21).

LaVoi's (22) ecological-intersectional model is a useful theoretical framework to examine and understand the multifaceted challenge of women's underrepresentation and experiences in sporting non-player volunteer roles along with the significant impact potential of women's involvement for the complex social issues at play, such as gendered power relations and gender role stereotypes, to move beyond tokenism. LaVoi's model – based around a feminist approach, intersectionality, and power – asserts that women coach development is complex, is influenced by various factors with powerful effects, positions intersectionality at the heart of the model, and can be conceptualised as being affected at four key levels. These four levels extend from micro to macro perspectives: (1) the individual level, involving factors such as self-perceptions, experience, and burnout; (2) the interpersonal level, encompassing social-relational influences such as relationships, colleagues, and friends, and immediate settings such as home, school or workplace; (3) the organisational level involving organisational practices, job descriptions, issues of discrimination, and opportunities (or lack thereof); and (4) the socio-cultural level, incorporating norms and cultural systems that indirectly influence women coaches. Intersectionality emphasises that a person's identities, such as gender, age, race, sexuality, social class, and ability interact on multiple levels with various forms of prejudice and contribute to systemic social inequality (23). Intersectional identities influence women and girls in non-player roles in sport, such as the intersection of gender and motherhood (10). Power was integrated at each level of LaVoi's (22) model and is bidirectional, indicating that power permeates all facets of social life from both top-down and bottom-up perspectives. Researchers draw on multiple conceptualisations to define power (24), such as hegemonic masculinity (25), which refers to the most dominant, socially-valued and socially-defined form of masculinity. In modern Western societies, this masculinity typically includes being strong, competent, and rational. Although comprehensive and well-established in the research of women coaches [e.g., (26, 27)], and recently used to explore barriers faced by women referees and officials in basketball (28), there is limited research utilising the ecological-intersectional model (22) across other non-player roles, and in community sporting contexts, such as football (soccer) clubs. Non-player roles in football clubs include coaches and officials, and other roles that are similar in that they have been traditionally held by men thus women in these roles may

experience the same barriers at the individual, interpersonal, organisational, and socio-cultural levels. The present research provides a novel opportunity to explore women's non-player roles in Australian community football clubs from the ecological-intersectional lens, thus extending LaVoi's ecological intersectional model in the broader community sport volunteer context. The novelty of this research is that it extends the understanding of women's experiences in volunteer non-player roles beyond coaching and officiating roles [e.g., (27, 28)], contributing to the current body of knowledge to facilitate more equitable job crafting for women volunteers in sporting organisations.

Research examining the underrepresentation of women in non-player roles is evident in other non-voluntary areas of the sport labour force including governance, leadership and management (29–31). While the need for increased representation and inclusion of women in non-player roles has been recognised (29, 32), research on women's experiences volunteering in these roles in community sports organisations is scarce. Existing research suggests the representation of women in non-player roles in sport broadly is impacted by factors including dynamics of gender and power, role conflict, and available supports (27, 33). Sport is an important social institution, particularly in Australia, evidenced by its high participation rates and cultural dominance (34). Sporting club settings are commonly built on traditionally masculine values, such as toughness and competitiveness (35), thus gender and power dynamics influence women's involvement in non-player roles (18, 27, 36). Because non-playing roles in Australia were historically dominated by men (37), sporting volunteer contexts often reproduce traditional gender roles. Roles women undertake in clubs often replicate domestic roles, such as running the canteen and arranging uniforms (36). Women are regularly overlooked for sports coaching, officiating, and leadership roles due to presumptions they do not possess the required qualities such as toughness, competitiveness, and loudness that men do (38). Consequently, gendered discourses are perpetuated. Even when women undertake roles traditionally held by men, they often face gender stereotype challenges. For example, Tingle, Warner, and Sartore-Baldwin (18) interviewed eight former women basketball officials from American high school and college levels who concluded repetitive, low-intensity, disrespectful behaviours from male peers and supervisors led to their withdrawal from officiating. They concluded the women officials threatened the hegemonic masculinity and were therefore often overlooked for appointments based on gender, not ability. Hogan, Bowles, and Kitching (27) found women coaches from community Gaelic football clubs reported feeling like outsiders and experiencing gender and age-related bias after being treated differently by older men coaches. These studies illustrate some challenges women face in sport that are attributable to power and gender dynamics, and further highlight the need for systematic, structural changes to dismantle entrenched sexism.

While there are benefits to volunteering, gender impacts women's volunteering experience both directly, in the volunteering context, and indirectly, through their circumstances more broadly. A significant barrier to women's volunteering capacity in sport has been identified as the balancing of multiple social roles (10, 33). Research has identified that women in Australia perform 4.13 h of unpaid labour per day compared to men's 2.14 h (39) and this inequity has been linked to constraints in pursuing additional sport activities (40). Leberman and Lavoi (10) proposed a work-family-volunteer role triad in their qualitative exploration of lived experiences of eight mothers who coached their children in youth soccer in America. The study focused on how mothers negotiated multiple roles, as workers outside the home, mothers, and volunteer coaches. All women reported experiencing pressures between these roles and at times felt guilty, although women reported feeling they needed to justify their coaching involvement to themselves, and that their passion for sport provided this justification. Similarly, Sotiriadou and de Haan (33) reported that among women members of sports governing bodies there was a strong sense that it is harder for women with young children to juggle their roles. As such, the multiple social roles that women fulfil, in multiple contexts, may deter them from taking on a "third shift" (e.g., volunteer) in the role-triad – however, this is also under-examined in sports research.

Research has identified support that can increase the acceptance of women in sports and create a culture that values gender diversity (26, 33). Sotiriadou and de Haan (33) interviewed 18 men and women on triathlon boards and found that male equity champions (men who play a central part in supporting the inclusion of women and ensuring their viewpoints on gender equity are expressed) challenged existing stereotypes and introduced organisational changes that encouraged women to engage in leadership roles. This championing from men allowed women to feel valued in sports leadership roles and endorsed acceptance of women in sports organisations. Another study showed mentorship programs can also support women's development in non-player roles. Banwell, Kerr and Stirling (26) interviewed seven women from several different sports in Canada, following their participation in a 12-month women's coaching mentorship program. Findings suggested mentorship is beneficial on a personal and interpersonal level, however, has little influence on organisational practices and cultural norms impacting women in sport. As such, support has a positive influence on women in non-player roles, however, little is known about supports for community sport volunteers.

Overall, there is limited research directly examining experiences of women in volunteer non-player roles in community sport. Much of the recent literature is focused on women in paid roles or at intercollegiate and professional sports levels [e.g., (18, 33)]. Non-player roles in professional settings differ from those at a community level, as individuals in community sporting clubs are typically volunteering their time for no monetary reward. Furthermore, most studies focused on coach roles, and not on other non-player roles such as team manager, club president, or secretary. Additionally, many studies investigated organisational conditions in North America, which has cultural differences to Australian community sport organisations. These limitations necessitate further research specific to volunteer non-player roles in community sporting clubs in Australia.

Given women sporting volunteers' experiences are poorly represented in research literature, this project explored the

involvement and experiences of women volunteers in Australian community football (soccer) clubs, to determine barriers and facilitators to volunteering in non-player roles. The context of football was selected as it has the most volunteers of all sports in Australia [467,000; (8)] and is heavily associated with masculinity (36) yet played by increasing numbers of women and girls (7). Based on the importance of this topic area and identified gaps in the current body of knowledge, the specific research question for this investigation was, what are the barriers and facilitators to women volunteering in non-player roles in community football clubs?

2 Materials and methods

2.1 Research design overview

A qualitative methodology with a social constructivist approach was employed in recognition that human development is socially situated, and knowledge is jointly created through interaction with others. Given the social nature of volunteering in community sporting clubs, this approach was considered appropriate to explore women's experiences in non-player roles. Data were collected using semi-structured interviews and analysed using Braun and Clarke's (41, 42) method of reflexive thematic analysis.

2.2 Researcher description

During this study the lead author JM, a white, female, feminist, Australian woman, was concurrently undertaking a volunteer non-player role in a community football club. She shares characteristics such as gender, age group, and motherhood with some participants, and experiences such as volunteering in the same southeast Queensland football region. Given her background, knowledge, and experiences, she adopted a constructivist standpoint and acknowledges how her identities and personal experience in sporting clubs undoubtedly influenced the questions posed and the stories presented. During her 18 months of experience as a volunteer on a community sporting club committee, she has witnessed some of the barriers and facilitators faced by women volunteering in non-player roles in community football clubs. This lived experience enhanced data collection and analysis by serving as a resource to build rapport and empathise with the participants' experiences, and produce knowledge (42).

Prior to research, author JM had met several participants through her volunteer role at a community football club. Interactions occurred at area meetings conducted by a football governing body, and at JM's club committee meetings or football games. As meaning and knowledge are recognised as contextual in reflexive thematic analysis (42), JM's subjectivity following these prior interactions helped to shape knowledge rather than jeopardise credibility.

The co-authors, KT and GL, also have experience in community sporting organisations. KT is a white, middle-aged cisgendered feminist Australian woman. She has previously volunteered for a community cycling group of which she was a participant, and which comprised mostly male cyclists. Her research work includes adults' connections with others. GL is a white heterosexual married male with dual Australian and UK citizenship. GL has children in sport and extensive experience of volunteering in sport as well working in sport as a professional in non-player role.

2.3 Study participants

Following institutional ethical approval from University of the Sunshine Coast Human Research Ethics Committee (S221726), participants were recruited June-August 2022 using several strategies. Football Queensland, the state governing body for the sport, emailed a recruitment flyer to all community clubs in one of their southeast regions. Participants were also recruited directly via phone or email contact details obtained from community football club websites, and through author JM's non-player volunteer networks.

Participation in this research was voluntary, with no participation incentives, and all participants provided informed consent. Homogenous purposive sampling (43) was used; eligible participants were aged over 18 years, identified as women, actively volunteered in a non-player role at a community football club within a southeast Queensland regional area, and had done so for a minimum of six months. Exclusion criteria stipulated participants must not have been in a paid role in a community sporting club or professional sports association.

Participants were six volunteers in non-player roles at one of four community football clubs, within a southeast Queensland regional area. All participants were mothers aged 36–57 years ($M = 44.7$, $SD = 8.6$), and working in paid employment concurrent to their volunteer role and parenting responsibilities. Five women had at least one child playing at their club, and one woman was a former player at her club. Volunteer non-player roles undertaken by participants included treasurer ($n = 2$), secretary ($n = 2$), coach ($n = 1$), and female football director ($n = 1$). Time in role ranged from 7 months to 11 years ($M = 3.9$ years, $SD = 3.7$). Specific participant details can be found in Table 1.

2.4 Procedure

Data were collected from individual interviews with participants regarding their involvement and experiences of volunteering in their community football club. The interview process was semi-structured to allow for flexibility of responses to open-ended questions, and for the researcher to probe these responses, thereby yielding richer data (44). The focus of the questions was as follows: (1) reason for volunteering (What led you to start volunteering? How did you come to be involved as a volunteer?); (2) preconceptions (Did you have any reservations about volunteering before you started? What did you see as the positives and negatives of volunteering?); (3) reality (What do

TABLE 1 Participant details.

	Age in years	Connection to club	Volunteer role(s) undertaken for club	Time in role(s)
Volunteer 1	37	Former club player	Executive title holder for women's participation	2 years
Volunteer 2	36	Two children play at club	Committee title holder	3 years
Volunteer 3	53	Two children play at club	Committee title holder	4 years
Volunteer 4	43	Two children play at club	Committee title holder	4 years
Volunteer 5	42	One child playing at club	Coach	7 months
Volunteer 6	57	One child playing at club	Committee title holder	11 years

For participant anonymity given the relatively few women holding identifiable roles in the region, specific roles have not been provided. "Executive title holder" refers to chief executive/operations/financial officers, directors and board members. "Committee title holders" refers to club presidents, vice-presidents, treasurers and secretaries.

you now see as the benefits and challenges of volunteering? Do you consider that these challenges differ from those experienced by men volunteers? Do the challenges differ from your expectations?); and (4) women volunteer development (What would you have liked to have known before volunteering? What could have helped you?). Interviews were conducted in person over a three-month period. Interviews were recorded and professionally transcribed verbatim. Field notes were written during the research process to document what the digital voice recorder may not capture, such as emphases placed on certain issues and words, or any facial reactions or emotions displayed. Transcripts of audio recordings were reviewed and edited for accuracy then uploaded to NVivo qualitative data analysis software (45) for analysis.

2.5 Analysis

Given the exploratory nature of the research question, an inductive approach was utilised (46). Two separate thematic analyses were undertaken, one to determine barriers and one to determine facilitators. The first transcript was inductively coded into discrete nodes jointly by authors JM and KT, with the remaining transcripts coded by JM. The initial nodes were then reviewed, and duplications were removed before being divided into barriers or facilitators. Reflexive thematic analyses were conducted on these two separate categories, following methods outlined by Braun and Clarke (41, 42), which were reviewed by KT and adjusted with discussion and agreement.

Methodological integrity was maintained through the procedures of fidelity (how closely the method was followed) to the subject matter and utility in achieving research goals (47, 48). Fidelity was increased through data adequacy, achieved by interviewing women in non-player volunteer roles as they can shed light on the barriers and facilitators faced by women in community football clubs through lived experience; through recognition of the influence of JM's own perspectives and appropriately limiting that influence during interviews; and through inclusion of a balance of interpretive commentary and supporting quotes, to ensure findings are grounded in the data (47). Utility was maximised by considering and reporting findings that are insightful and meaningful given the dearth of literature on women volunteers in community sporting clubs, and by the research question being adequately addressed by the method and design of the study (47).

3 Results

Initial coding produced 63 nodes. These were reviewed for relevance and overlap, with four nodes removed at this stage. Nodes were then separated with 21 nodes identified as barriers to women volunteering in non-player roles in community sporting clubs, and 38 nodes identified as facilitators; these were thematically analysed separately. The thematic analysis of barriers generated six themes: gender role assumptions and stereotypes; lack of organisational support and structure; constrained resources; high expectations of self; intersectionality (of gender with motherhood or race); and interpersonal disconnection. Six themes were produced from thematic analysis of the facilitators: supportive culture within a club or governing body; deliberate efforts to engage women; role autonomy and shaping; having or building confidence; social connection; and positive reinforcement. Table 2 shows themes and sample quotes for barriers and facilitators.

3.1 Barriers

3.1.1 Gender role assumptions and stereotypes

It is evident from the women interviewed that gender has influenced their experiences in non-player roles, particularly relating to gender stereotypes with one volunteer reporting:

> I think sometimes, there's that perception around male dominated sport, you know, "what would you know, you're a female?", type of thought process. I guess it's that understanding of the game. That would be one of the stereotypes around it. (Volunteer 3)

Traditional male practices or an "old boys" club' were identified as a barrier as they can cause feelings of intimidation, with one volunteer explaining:

> We would have our meetings at the tavern [an Australian tavern is a pub or bar]. It doesn't bother me, but I know for a lot of women it would be a real put-off to be going and sitting there by yourself with men that all played football. They all play as well, that's the other thing, whereas I had no idea, I didn't even know the rules of the game properly when I started (Volunteer 2).

TABLE 2 Themes and sample quotes regarding the barriers and facilitators to women in non-player volunteer roles.

Themes	Illustrative quotes
Barriers	
Gender role assumptions and stereotypes	"I think one of the downfalls of being female is that you do get roped into all those extra things that aren't being done… you know, like the cleaning, and the canteen as well." (P2)
Lack of organisational support and structure	"I feel like volunteer organisations aren't always as supported with structure as they should be. It would be nice if there was some support, in our case, a Football Queensland or a Football Australia, or someone else who can provide solid administrative toolkits for a club. I think you'd find then more women can meaningfully contribute without baulking." (P1) "No, we had to find our feet ourselves - self-taught." (P3)
Constrained resources	"Time would be the biggest barrier. The biggest barrier. Without question." (P1) "Challenges are the lack of volunteers, so it puts a strain on the committee." (P4)
High expectations of self	"I knew it would be my demise [taking on a senior committee role]. You know, it would be a total set up for failure moment and which I wouldn't be okay with. I, I would put myself under pressure before I would give up." (P1)
Intersectionality	"I think it's hard because of the time that's involved. Especially for single parents, to find extra time on top of bringing their kids to games, it would be a struggle." (P4) "I also had reservations because I didn't know if I could do it, because I hadn't done it before in Australia." (P5)
Interpersonal disconnection	"I don't have the day to day or hands on approach with the club. I'm not down there on a Saturday. I'm not getting to the games. While other people are really, really active, really, really present and understand the day-to-day stuff. I think if you can't be as present, it does take longer to understand operational stuff." (P1)
Facilitators	
Supportive culture within club and governing body	"I suppose I'm a woman in a man's game, but I've never felt or been made to feel that way at all. I've always been welcomed, and I think I've always felt respected by the males in our game, be it players, be it club members, be it committee members, be it life members. I've never felt different because I'm a woman." (P6)
Deliberate efforts to engage women	"A phone call from the president…. It was a call from, from the club's president, to say the club was really wanting to invest in women, in female football." (P1)
Role autonomy and shaping	"Basically it became more of a conversation of, "what is the role about? What are we trying to achieve?", and less about how you achieve it. So, I kind of was given a little bit of freedom….generating support that demonstrates it can be done differently." (P1)
Social connection	"Positives definitely was that it was a very good club community. Very supportive, inclusive and yeah you could see that those positions became friendships as well as volunteer roles." (P3)
Positive reinforcement	"When I talk to parents, they acknowledge that without me checking in and stuff, they probably wouldn't be at the club. That's always nice." (P4)
Having or building confidence	"I had no reservations at all [about volunteering at a football club]." (P6)

The "old boys" club' also reportedly influenced the level of support received, with one women volunteer experiencing less support compared to peers who are men:

> If you take a look at the teams in the age group I coach. The male coach has other males stepping up to help out. Whereas I haven't had any other male coaches or an assistant coach or parents step up to help (Volunteer 5).

Men and women adhering to traditional gender roles in clubs formed a barrier to women taking on roles typically undertaken by men. A volunteer, for example, reported:

> It tends to be that the men have more structured positions of volunteering. The women still hold very traditional roles of volunteering – secretary, treasurer, canteen, kits, registrar… those types of things. You do still tend to see men in the higher and more authoritative positions and women more in the administrative (Volunteer 1).

3.1.2 Lack of organisational support and structure

Several women conveyed that the lack of support from governing bodies, in providing structure for volunteers, was a barrier. For example, a volunteer stated, "*there was no real job description or position description given either, and I know they [Governing Body] don't actually have those either to give out, because I have enquired*" (Volunteer 2). The absence of a structured role description prevented women from volunteering and led to burnout due to no clearly defined parameters of the volunteer role, "*I think people get nervous about not knowing what's required of them*" (Volunteer 3), and "*If you try and do everything it just doesn't work then you burn out. I've definitely experienced volunteer burnout*" (Volunteer 2).

Most volunteers reported a lack of training from their club when beginning their volunteer role, resulting in more time being required than expected because they had to work out how to do tasks and source help themselves. One woman stated, "*I don't think I quite realised how much was gonna be involved. Like I thought there'd be some sort of a handover, which there wasn't. So, I basically had to figure everything out from scratch…*" (Volunteer 2).

3.1.3 Constrained resources

Time constraints were identified as a barrier by most of the volunteers. For example, volunteers reported, "*I had reservations about my ability to commit the hours, the time more than anything*" (Volunteer 1), and "*I was spending a lot of time each week doing things for the club and then just got to the point where I was like, I can't keep doing this*" (Volunteer 2). A reported lack of volunteers exacerbates time constraints as more work is required from a small number of volunteers:

> I'm extremely time poor. When you work 35 h a week and are probably still doing 20 h a week for the club, more at times – there's not enough hours in the day, and unfortunately there's not the same amount of volunteers coming through the door as there used to be (Volunteer 6).

Another volunteer stated, "the negatives are just that you see the same faces doing all the work all the time" (Volunteer 3).

3.1.4 High expectations of self

Volunteers' own high expectations contributed to role overload, with some women reporting:

> For me personally, I can't leave things so if I know it's gotta be done and I can see it needs to be done but no one else is doing it, I'll just do it. And so yeah, it was taking up a lot of my time (Volunteer 2).

Another stated, "That's me personally because if I give to a position then I like to give as much as I can, rather than doing a half effort job" (Volunteer 3). A self-expectation that one must have a rich understanding of a role to be able to volunteer in it prevented them from taking up that role. For example, one volunteer stated, "I love soccer, but I don't think I understand the game well enough to be able to implement good coaching sessions" (Volunteer 3).

3.1.5 Intersectionality

Participants identified additional roles or identities that may have interacted with forms of prejudice to affect their experience as a woman volunteer in a community football club. The intersection of gender and motherhood was a challenge with most participants conveying difficulties in juggling multiple roles:

> My level of involvement has to be managed around kids and work and everything else. Irrespective of what era we are in, women are still balancing a lot in any given day. And typically, it's disproportionate. There's usually a dominant role that women have to play in the house, in the family. Not have to but do (Volunteer 1).

It was noted by one woman that this was a distinct difference between men and women volunteers:

> If one of the men who'd played at the club, in the same situation as me, had played at the club and continue to be involved..I'm not sure that they would have to contemplate the balance of priorities the same way (Volunteer 1).

Being from a different race and culture was also identified as a barrier:

> I think a lot of kids have trouble understanding my accent. So, there's some cultural differences, not a lot, but I obviously speak differently and some of the words that I use are not the same words that are used here (Volunteer 5).

3.1.6 Interpersonal disconnection

Women reported having reservations about volunteering due to not knowing others on the club committee with one stating, "*Only working with people that I didn't know…You work quite closely with the president and other committee members and what if you don't get along, that could make it hard*" (Volunteer 4).

3.2 Facilitators

3.2.1 Supportive culture within club and governing body

Several volunteers identified that set role descriptions from the club or governing body would facilitate more women volunteering. For example, one woman stated:

> I think to attract more females, maybe having those set role descriptions so they know what it is. I think maybe females would feel more keen to say yes to the role if they knew they just had to stick to that, and they weren't going to be forced into doing a bunch of other things (Volunteer 2).

Support from a club in accepting the level of service a volunteer could contribute was a facilitator experienced by one woman:

> Being able to be really honest about what I could do..And then, having that acknowledged as okay. There was no, "Oh, well then, you're not the right person because you're not available enough." It was, "no, this is what we need, and you don't have to be there [for more time than you can provide]" (Volunteer 1).

3.2.2 Deliberate efforts to engage women

Being personally invited to a volunteer role, or encouraged to become involved was a facilitator for successfully recruiting women:

> The leaders are always open to new ideas and they don't stereotype against women. They do try and empower you and say, "yes you can do this role", or "would you be interested in this role?", so that builds confidence in your abilities which is nice. (Volunteer 3).

3.2.3 Role autonomy and shaping

The ability for women to shape a volunteer role to suit one's individual skills and time availability was a reported facilitator:

> I think if there was consideration for skill-based appointment, rather than time-based availability, it might be helpful. Because it might be that, you know, the skills of women and particularly

> balancing, and prioritizing, and targeting and focusing. Like being able to say, I can take that specific function and do it well. But I can't do that if you need me at the club 12 h a week running a bar. If what you're asking me to do is to provide strategic direction… and not be down here in a yellow vest as a ground official all weekend… I think I've got good skills for you (Volunteer 1)

3.2.4 Social connection

All volunteers reported experiencing social benefits through volunteering at their club. One woman stated, "*Definitely meeting lots of new people, and this being such a new community, everyone's really keen to get to know one another. So yeah, I've met lots of great people through it and created friendships*" (Volunteer 2). It was reported that other women being involved at the club was a facilitator for attracting other women volunteers, "*I think definitely when you have women involved initially then that attracts more to come in. I found it was much nicer once another female was there*" (Volunteer 2).

3.2.5 Positive reinforcement

Positive feedback from club members was reported as a facilitator for women volunteering. One woman affirmed:

> I do get some good feedback from the girls [young girls who are club players]. The parents tell me the girls really like having a female coach, which is really nice. Growing up I never had a female coach, but I see how it would be a positive. The girls saying, "we love you as a coach", "we hope you come back next year" is nice (Volunteer 5).

The acquisition of new skills is another reward mentioned by a volunteer, "Benefits are that it helped me with my skills…. Because there's a variety of tasks, you're upleveling in so many different areas which is great" (Volunteer 3).

3.2.6 Having or building confidence

A level of self-confidence facilitated women taking on volunteer roles in football clubs. For example, a woman stated, "*I was totally comfortable [being the only female volunteer on the committee]*" (Volunteer 6). It was also reported that interventions that build confidence would facilitate more women getting involved in coaching:

> There are mums that do help with coaching but they're not willing to step up into the coach role, so if we could provide more coaching sessions so they can actually build their confidence, instead of working under the male coach, I think that would be a really good thing. Particularly as a role model for our girls coming through (Volunteer 4).

4 Discussion

This study aimed to explore the involvement and experiences of women volunteers in community football clubs, to determine barriers and facilitators. This research addressed a gap in the literature by illuminating the lived experiences of women volunteering in various non-player roles at the grass-roots level of football, highlighting facilitators as well as barriers.

When discussing barriers, participants indicated that the role of a non-player volunteer is very demanding, requiring a high level of commitment, reliability, and time. Demand is often due to constrained resources such as a lack of volunteers, resulting in a large amount of work being distributed across a small number of people on the club committee. However, overload of a small number of volunteers may have also resulted from poor volunteer recruitment, strategy, and utilisation. These requirements placed stress on the women, particularly as all participants worked in paid employment and had family responsibilities concurrent to their volunteer role. In some cases, this stress is the result of participants' own high expectations of themselves in aspiring to do well in the role and in not wanting to let their club down or leave tasks for someone else. Many participants explained that they had to figure out how to perform the role themselves and emphasised that a lack of structure, in terms of no role descriptions or job training, contributed to them putting in more hours than expected prior to taking on the role. Consequently, some women reported experiencing burnout. It was not until specifically questioned about how the challenges women face might differ to those faced by peers who are men, that the women in this study identified any gender-based discrimination. In part, this may be due to the stigma of volunteering, whereby our participants may have been aware that it is difficult to attract and retain volunteers across a range of roles, interests and community groups (49); thus, this is not necessarily a social issue of gender but rather one of a perceived lack of time for many members of the community. Nevertheless, our participants acknowledged football is traditionally a male sport, with evidence their clubs reinforced this. Women reported occurrences of adhering to stereotypical women's roles, such as canteen or cleaning roles, and that men at the club avoided doing such tasks or left them to women. Participants also commented on experiences of feeling intimidated at the thought of having to speak to some men at the club, particularly those who had been there long-term. There was a perception that women were seen as less knowledgeable about the game.

Despite the women reporting several barriers, there was still an overall sense of enjoyment and satisfaction in volunteer roles, with various facilitators being described. Having confidence in oneself to undertake a non-player role and to fully commit to a non-player role and face any challenges that arise, especially when acknowledging that few, if any, other women were involved, were identified as facilitators. Acquiring new skills and receiving positive feedback from club members reinforced participants' enjoyment of their roles. There was an overwhelming sentiment that participants were highly motivated to contribute to the sport and/or community by

volunteering. This motivation to contribute was inspired by their passion for football, desire to make improvements to how the club was being managed, aspiration to be a role model, or their need to give back to a sport that had given so much to them and their family. Many participants reported how social connections facilitated through their non-player roles, and the strong sense of belonging that they experienced created an emotional connection to the club which was positive. Where connections to the club existed prior to volunteering, for example playing at the club themselves or their children playing at the club, volunteers were more inclined to step into a non-player role.

A supportive club culture was a facilitator for participants. This support was provided through role training, through women being included in decision-making at their club, and through committee and club members being welcoming and respectful of women. Although our participants spoke explicitly in terms of their involvement being facilitated by men at their respective clubs, many participants stressed that availability of clear role descriptions and objectives would facilitate more women undertaking volunteer roles in community football. Where clubs had made deliberate efforts to engage women in non-player roles, women were more likely to undertake them. These efforts included intentionally recruiting women in non-player roles and building confidence in women by reassuring them that they are capable of such roles. A participant reported that a deliberate effort by her club to bring together stakeholders of female football within the club, through a message group and meetings, provided support and connection. In addition to these efforts, participants reported that clubs that supported women by allowing them to shape a non-player role to fit with other responsibilities, and the time and skills available, were facilitating the involvement of women. For example, women reported engaging in non-player roles in job-share arrangements and being allowed the autonomy to work from home and shape the role to suit their availability, rather than being required to be present at the club. Through women's increasing authentic involvement in sporting organisations at all levels, women can assert their own power as active participants, ensuring current barriers are not perpetuated.

Our current study was framed within LaVoi's (22) ecological-intersectional model, and while this model was developed specifically for researching women coaches, it has been appropriate here in examining the experiences of women in coaching and other non-player roles such as committee members (e.g., secretary, treasurer). Broadly, the themes that were identified in our research illustrate that barriers and facilitators to women volunteering in non-player roles in community football clubs exist at the individual level, including the interaction of gender, race, and parental status, but also extend beyond influences of the individual. Numerous interpersonal, organisational, and sociocultural factors were found to impact upon participants' development in their non-player roles. In sharing their stories, suggestions for clubs to address some of the barriers faced by women and enhance the facilitators mentioned have been established. Practical implications are integrated throughout each section.

The impact of intersectional roles and responsibilities were compounded for the women in this study, who were unaware of the time and exact tasks required of their role prior to taking it on and therefore highlighted the requirement for support and structure through clear role descriptions and objectives. This requirement for clear and structured role descriptions is consistent with Hogan, Bowles, and Kitching (27), who proposed that volunteer coaches at the community level would benefit from a starter pack which included a clearly defined role description and the requirements of new volunteers. This could be extended to other non-player roles in community sporting clubs. Women in our study reported that the ability to shape a non-player role to suit their individual skills and abilities was a benefit. It is therefore crucial that clubs understand their volunteers, so they can match their skill sets to suitable roles or identify opportunities for skill-matching, and development with other community members. In this regard, Egli, Schlesinger, and Nagel (50) asserted that coordinating the needs and expectations of volunteers is essential to their longevity and commitment to the role, and recommended the use of an entry questionnaire, to aid in meeting volunteers' expectations. Thus, it is essential that governing bodies and community football clubs establish support for women at the organisational level by dividing work evenly among volunteers, by providing a clear outline of the non-player role, for example through the provision of a starter pack, and by understanding new women volunteers to match their skill sets to suitable roles.

Support at the interpersonal level appears key for women volunteering in community football clubs. Similar to findings by Clarkson, Cox, and Thelwell (51), this study suggests that social connections and support networks are important facilitators of women volunteering in football contexts. For participants of the present study, a volunteer coordinator may have been able to capitalise on social connection (15), deliberate efforts to engage women, and supportive club environment, while preventing or minimising the impact of constrained resources, interpersonal disconnection, and lack of club support and structure. For example, to establish appropriate support structures for women volunteering in community sporting clubs, Hogan, Bowles, and Kitching (27) recommended a volunteer coordinator role at the administration level in clubs. This role was responsible for facilitating inductions for new volunteers, regularly checking in with volunteers and arranging collaboration among other women volunteers. As with a volunteer coordinator, mentorship could provide support at the interpersonal level. Many women in the current study aspired to be role models for other women and girls, and it was reported that having other women involved in non-player roles at their club was helpful, suggesting that mentoring is valuable. Mentoring was explored in a study by Banwell, Kerr, and Stirling (26) who examined the benefits of a mentorship program for women sporting coaches. Results showed that mentorship had a strong impact at the interpersonal level of the ecological intersectional model (22) with women developing connections with other coaches and individuals in sport. A mentorship program for women volunteering in non-player roles in community football clubs may have similar success and increase the number of women volunteering.

Support for women at the organisational level, from both the sporting club and the organising body appears important. Overwhelmingly the most common barrier for participants in the present study was time demands, due to a lack of volunteers at the club, which is consistent for volunteering roles more globally and beyond the sporting community [e.g., (49)]. This was consistent with the barrier of men at the club avoiding tasks stereotypically seen as women's work, which is further reflected societally and culturally in many countries, where tension exists in the joint responsibility for care and domestic tasks (52). The consequent lack of volunteers resulted in a large amount of work being distributed across a small number of people, which has been recognised as the workload of volunteers by Nagel et al. (53), who proposed community sporting clubs could recognise and support their volunteers via workload division. Similarly, Hogan, Bowles, and Kitching (27) asserted that distributing the workload and not demanding too much from a small number of volunteers is important for women coaches as they tend to have more responsibility for caring roles in the household – a societal fact that is recognised in many countries [e.g., (52)]. High organisational support has been recognised as a strong predictor of low volunteer turnover rates (49), emphasising its importance for diverse individuals in a range of settings.

While the societal level is the most distal from the individual, all women in this study had faced gender bias or recognised it exists. There is more to be done before women volunteering in football are accepted as the norm and not affected by such bias. Societal views need to shift to allow women to be considered equal to their peers who are men as typical social norms in sports roles often impede opportunities for women (54). Nevertheless, the objective is not to consider men as the opposition but to view them as allies who can work with women in community sporting clubs, increasing awareness of unconscious biases and stereotypes so they can be removed or at the very least reduced (27). Such framing has the potential to improve club culture and ensure Australian community football clubs are environments in which women are welcomed rather than received with hostility. Therefore, education regarding biases and assumptions as well as promoting and publicising women in non-player roles is necessary for women's visibility and acceptance in community football clubs. This will further need to extend to the structural systems of the clubs, including their policies and procedures, to ensure women's participation is not just accepted but actively sought and upheld as valuable. Initiatives to improve such participation will need to ensure appropriate alignment between proposed strategies and clubs' capacity to implement women's leadership training and positions (55).

A limitation of this study is the homogeneity of participants, and future research may consider how other identities of women volunteering in non-player roles intersect to produce different experiences in community sport, for example their sexuality, ethnicity or ability. A further limitation is that only women who had been volunteering for a minimum of 6 months were interviewed, so were seemingly having an overall positive experience in their club roles. Consequently, the views of women who may have been unable to overcome barriers were not heard. It is also possible that the views presented here were of more progressive clubs, as clubs with fewer women volunteers may reveal results and themes similar to ours, experienced at more intense levels than the volunteers in our study.

To address these limitations, future research could triangulate other stakeholders' perspectives within clubs, such as players, parents, members, and a greater number of diverse volunteers (e.g., age, carer status, cultural or linguistic background, from wealthier vs. disadvantaged clubs), to further identify and respond to women's participation barriers. This may even involve reflective practice with male club stakeholders to determine self-identified behaviours and attitudes that could be targeted within clubs. Changes to study designs that may facilitate this could include more open interviewing techniques for richer scope, or a more longitudinal design to investigate the relative success of proactive strategies for women's involvement. Furthermore, research should also consider how these barriers and facilitators presented in our research are specific to women volunteers. Finally, research must be conducted on the ways in which club systems, policies, procedures, and culture can be addressed to ensure community football clubs are psychologically safe for all individuals to contribute. Failing to address the structural workings of such organisations may mean limited success for increasing women's participation.

In conclusion, our interpretation of the findings, framed within the ecological-intersectional model (22), led us to some practical suggestions to support women volunteers in non-player community sport club roles: 1. Establish support for women by dividing work evenly among volunteers; 2. Providing clear descriptions of non-player roles; 3. Matchi the skill sets of new women volunteers to suitable roles; 4. Implement mentorship programs to aid collaboration among women who volunteer; 5., Educate communities about gender biases and assumptions; 6. Monitor and seeking feedback on gendered task allocation to ensure women's unpaid labour is not disproportionate to men's; and 7. Promote and publicise women in non-player roles to enhance women's visibility and acceptance in community football clubs. It is hoped that this research will resonate with stakeholders of community football and lead to increased support and development for women in volunteer non-player roles. This research has further illustrated the application of LaVoi's (22) ecological-intersectional model in the volunteer non-player context, expanding on previous use with female coaches. While this research included some limitations such as a small and homogeneous sample, consideration of these women's experiences in this exploratory study may provide insight for future research with varied methodologies and broader samples for triangulation. Additionally, the present research may aid the design of programs to support the development of women in non-player volunteer roles to increase gender equity in community sporting clubs, thus helping to facilitate equal opportunities for women to gain access to the associated individual social, physical, and mental health benefits of volunteer in sport.

Data availability statement

The datasets presented in this article are not readily available because only the research team will have access to transcripts. Requests to access the datasets should be directed to ktulloch@usc.edu.au.

Ethics statement

The studies involving humans were approved by University of the Sunshine Coast Human Research Ethics Committee (S221726). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JM: Conceptualization, Project administration, Methodology, Investigation, Formal Analysis, Writing – original draft, Writing – review & editing. GL: Conceptualization, Project administration, Methodology, Supervision, Writing – original draft, Writing – review & editing. KT: Project administration, Supervision, Methodology, Investigation, Formal Analysis, Validation, Writing – original draft, Writing – review & editing.

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The impact of large-scale sports events on national identity: a structural equation model based on the residents' perspective

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Introduction: Large-scale sports events have a profound impact on the enhancement of residents' national identity. The study takes the Hangzhou Asian Games as an opportunity to investigate the influence of such events on national identity and the underlying factors.
Methods: The study takes the impact of residents' involvement in the Asian Games on their national identity as the research object, constructs a theoretical model with subjective well-being and city image as the mediator variables, randomly selects 1,096 residents by questionnaire survey, and analyzes their interrelationships as well as deeper influencing factors by using structural equation modeling and bootstrap.
Results: The results show that the involvement of Hangzhou residents in the Asian Games has a significant positive impact on national identity, subjective well-being and city image (Estimate = 0.237/0.287/0.3). Furthermore, subjective well-being and city image have a significant positive impact on national identity (Estimate = 0.321/0.141), and city image has a significant positive effect on subjective well-being (Estimate = 0.264).
Discussion: It can be concluded that the degree of involvement in major sports events has a direct positive effect on national identity, and subjective well-being and city image play a partially mediating role in this effect. The results of the study provide a resident's perspective for assessing the impact of large-scale sports events, and provide elements that can be used as a reference for governments, city planners and event organizers to assess large-scale sports events.

KEYWORDS

large-scale sports events, Asian Games, subjective well-being, city image, national identity

1 Introduction

As globalization continues to accelerate and deepen, global production networks have weakened the power of national economic discourses. Increased intercultural exchanges and interactions have led to dilemmas of individual identity and triggered a crisis of national identity. Furthermore, local conflicts continue to fester, and the world order is turbulent and unstated, making the promotion of national identity a necessity of the international situation.

It has become evident that large-scale sports events can have a profound impact on countries, cities and residents (1–3). As one of the primary political socialization functions of sport, large-scale sporting events have a significant impact on disseminating the national image, safeguarding territorial integrity and consolidating the national identity and sense of belonging (4). The Olympics is an important channel for transmitting values across social boundaries such as ethnicity, religion, politics, class, etc. Large-scale sports events can also have impacts on many aspects of society,

economy, and residents' lives, and these impacts may be one of the mediating factors in their influence on residents' national identity. Unanue's survey found that large-scale sports events have a significant impact on spectators' subjective well-being and confirmed the correlation between subjective well-being and national identity (5); Huang et al.'s survey found that "city popularity and image" is the most weighted economic impact of sports events (6); Huang et al. found that iconic sports events have an effect on the city's "infrastructure", "visual image" and "cultural image" (7), and that a good city image can also increase the pride of residents and stimulate cohesion. This suggests that happiness and city image play a role in the influence of sports events on national identity, and that research on them can provide insights into the specific extent and path of the influence of large-scale sports events on residents' national identity.

These previous studies provide an important research foundation for exploring the impact of large-scale sports events on residents' national identity. However, the existing studies are more experimental than empirical, focusing mostly on the direct impact of sports events on national identity and neglecting the complexity and indirectness of the impact among different factors. There are fewer studies on the construction of multi-factor influence models, neglecting the deep multi-dimensional study of influence paths.

The 19th Asian Games Hangzhou (Hereinafter referred to as "Hangzhou Asian Games") was held on 23 September 2023 in Hangzhou, Zhejiang Province, China. This research takes the hosting status as an opportunity to examine the overall social function of large-scale sports events. It incorporates the host city and the participation of residents into the research logic of influencing national identity. It explores the mechanisms and pathways through which large-scale sports events can promote national identity, providing direction and suggestions for enhancing residents' subjective well-being and promoting national identity. Furthermore, it serves as a basis for evaluating the social benefits of large-scale sports events and improving their social impact.

1.1 Involvement

The concept of involvement was first introduced by scholars Sherif & Cantril in the field of social psychology to evaluate a person's attitudes and behaviors in participating in something (8). Involvement can be defined as the level of personal relevance and psychological connection that reflects a person's level of commitment, perceived personal relevance and psychological connection to a goal, action or experience (9). In the context of sports, sports event involvement can be defined as the knowledge and awareness of the residents of the place where the sports event are held, as well as the level of enthusiasm, interest and participation in the sports event (10). Applied to the field of sports, sports event involvement refers to the knowledge and awareness of residents in the place where a sports event is held, the degree of motivation, interest and participation in the sports event, as well as the degree of satisfaction, pleasure, and pursuit of one's own value that results from participation in a particular sports event (10, 11). Kim & Kaplanido view this as an assessment of the degree to which sports activities are at the extent to which it occupies a central place in a person's life, including watching and attending various sporting events; Beaton et al. argue that sports participation occurs when individuals make participation in sports a central part of their lives and provides hedonic and symbolic value. During the Asian Games, Hangzhou residents may be affected by a variety of direct or indirect impacts as a result of the hosting of the Asian Games. This study introduces the variable of involvement to capture the degree of Hangzhou residents' relevance to the Asian Games.

1.2 National identity

Identity is a multidimensional concept, which in the field of psychology refers to the differences, characteristics and their sense of belonging formed in the interaction of individuals and groups (12). National identity is people's knowledge and acceptance of their membership of the state, and it is a complex psychological structure system including political identity, cultural identity and national identity and other components (13), which promotes citizens' sense of belonging and loyalty to the country and makes them willing to contribute to the development and interests of the country (14). He believes that national identity refers to the citizens of a country's recognition of their homeland's historical and cultural traditions, moral values, ideals and beliefs, national sovereignty, etc., i.e., national identity (15). Liu believes that national identity is a feeling of similarity, equality, and intimacy among members of a country and people's feelings and evaluations of their own or other countries, etc., which is a kind of subjective consciousness and attitudes, and is the result of the historical development of a country and the process of socialization of individuals (16). In this paper, national identity mainly refers to citizens' self-awareness of their own national identity and their status and role in the international system, and it is the intersubjective social identity formed by the interaction between a country and other countries under the constraints of the international system (17).

1.3 City image

The concept of the city image was first proposed by Kevin Lynch, and he divided the term into five elements: roads, edges, areas, nodes and signs. Lynch argued that the city image is the mental imagery and subjective feelings formed by people's perception of the physical environment (18). The concept of city image is divided into two distinct categories: physical image and virtual image. The physical image represents a city's landscape in a generalized manner, whereas the virtual image encompasses the collective beliefs and impressions of the public within and outside the city, as perceived from the perspective of cognitive psychology (19). Liu et al. point out that subjective happiness is evaluated by individuals themselves and consists of three dimensions: life satisfaction,

negative emotion, and positive emotion (20). Xing regarded subjective well-being as a psychological experience and an ideal state of existence, believing that happiness is a subjective reflection of real life, which is closely related to the objective conditions of people's lives, and also reflects people's needs and values, and that people's subjective well-being is precisely the individual's positive psychological experience of his or her own state of existence, which is produced by the joint action of these factors (21). This study considers the concept of city image as a psychological perception of the "virtual image" of the city, as influenced by improvements in city quality, city governance, city civilization and city image during the hosting of the Asian Games in Hangzhou. And that city image is the sum of the public's impressions, views and perceptions of a large amount of raw data on city layout, city environment, city culture, etc., processed and refined (22).

1.4 Subjective well-being

Subjective well-being is an important indicator of people's mental health, life happiness and social development. Studies related to subjective well-being have been conducted in the academic community since the 1940s, with most scholars focusing on how and why people experience their lives in positive ways. Among them, Andrews and Diener identified two aspects of subjective well-being: cognitive judgments of life satisfaction and emotional judgments consisting of separate positive and negative emotions, respectively (23). Ryff started from six different dimensions of the theoretical model of psychological well-being, i.e., autonomy, environmental mastery, personal growth, positive relationships with others, life goals, self-acceptance and self-reliance. Positive relationships, life goals, and self-acceptance, and explored the determinants of well-being through a survey (24).

In summary, the academic community has achieved rich academic research results on the subjective well-being, city image, national identity, such as the definition of the concept and associated factors, but more researchers discuss the positive impact of tournament hosting on national identity by way of theoretical analysis, and there is a lack of research on how tournament hosting affects national identity in terms of the internal paths and the degree of impact, and fewer researchers have tested the relationship between the four by constructing a model. Few researchers have examined the relationship between the four by constructing a model in an empirical way. In this paper, we take the Hangzhou Asian Games as an opportunity to explore how the Hangzhou Asian Games affects residents' sense of national identity from the perspective of residents' involvement in the event, and analyze the relationship between national identity and participation in the event by examining the relationship based on the theoretical model of involvement—mediators—national identity and relying on the data obtained from the questionnaire survey. Based on the theoretical model of involvement—mediating factors—national identity, the data from the questionnaire survey will be used to test the correlation between the two, and analyze the key factors and logic of residents' national identity, so as to provide new perspectives for the discussion of the impact of sports events on residents' national identity, and to provide practical management suggestions for the managers of the events.

2 Research hypothesis

2.1 The impact of sports event involvement on national identity

In event host territories, residents are the most direct stakeholders of the event. Each territory's residents have varying degrees of involvement in the event. Research has found that residents who are highly involved in sport may contribute to positive associations between sporting events and the behavioral intentions of community members (25). Iwasaki posits that individuals may derive a sense of self-identity from their involvement in leisure activities (26). Kim pointed out that people who participate more actively have a more positive view of the host country. This indicates that participation in activities plays an important role in shaping the image of the host country. In addition, the scholar suggests incorporating participation in sports events into the research framework to understand how events affect the impression of the host country (27). The development of sports events attracts an increasing number of people to participate in them. Those who are highly involved can gain a greater sense of national cohesion and pride from them. Furthermore, the expanding influence of the events also improves the recognition of China's comprehensive national strength by various circles at home and abroad. Therefore, this paper introduces the variable of involvement to reflect the degree of Hangzhou residents and the Asian Games, with the aim of measuring the effect of the Asian Games on residents' participation.

In conclusion, the following hypotheses are proposed:

H1: The degree of involvement in the Hangzhou Asian Games has a significant positive effect on national identity.

2.2 The mediating role of subjective well-being

As societal norms evolve, the value placed on happiness is on the rise. Sport, as a pro-people activity, has the potential to enhance subjective well-being. Sato examined the relationship between running sport involvement and life satisfaction. The findings suggest that psychological involvement in running sport significantly affects life satisfaction. This indicates that sport can improve the quality of life and subjective well-being through leisure involvement (28). Paul Dolan et al. found that the London Olympics increased the life satisfaction and well-being of Londoners in the short term, with a particular impact on the subjective well-being of the host country's citizens (29). Huang Ying et al. demonstrated through questionnaires and structural

equation modelling that residents' participation in major sporting events has a direct positive effect on subjective well-being. Furthermore, participation affects subjective well-being through three mediators, including the quality of life in the community, and five indirect paths of action (30). Zhang Hui and Luo Jianying constructed a theoretical model of the relationship between marathon race culture and the happiness index of city residents. Their findings indicated that marathon race culture acts on the physical and mental health of residents through the material culture phenomenon that it forms, thus enhancing happiness (31). Zhang Yong et al. demonstrated that sports interactions (participation in social sports activities, sports tourism) can foster a favorable cultural atmosphere for sports events, laying the foundation for the establishment of a positive sense of subjective well-being. Furthermore, sports participation can directly enhance subjective well-being, with greater involvement leading to greater subjective well-being (32).

A significant positive effect of national identity on subjective well-being has been demonstrated by the majority of scholars (33, 34). Furthermore, some scholars have demonstrated that national identity and subjective well-being can be significantly positively predicted by each other (35). Su-Lan Pan et al. investigated the relationship between leisure participation and well-being and the mediating role of occupation-related characteristics, organizational commitment on well-being among 406 fans. A study of a BE baseball team in Taiwan revealed that tournament participants' well-being led to a positive effect on their loyalty to the participating team (36). Katharine et al. demonstrated that social identities can satisfy or impede a range of psychological needs, including belonging and well-being (37). In other words, the acquisition of national identity and identification increases a person's well-being. Wang et al. Wisdom conducted a questionnaire survey on the residents of the area hosting the 2008 Beijing Olympic Games by developing happiness index indicators. The results demonstrated that the hosting of the Olympic Games effectively improved the happiness index of Beijing citizens and stimulated people's patriotism and national pride (38).

Sports events enhance the sense of acquisition and well-being, and also enable the people to intuitively feel and construct a sense of social belonging and identity, therefore, the subjective sense of well-being and identity of the residents may be improved to a certain extent under the influence of sports events.

In conclusion, the following hypotheses are proposed:

H2: Hangzhou Asian Games involvement has a significant positive effect on subjective well-being.

H3: Subjective well-being has a significant positive effect on national identity.

2.3 The mediating role of subjective well-being

Sporting events represent a significant opportunity to enhance the city's image and shape its brand (39). In recent years, the success of China's sports events has made a significant contribution to the creation of local city image. This is exemplified by the successful hosting of the Beijing Winter Olympics, which has led to Beijing being dubbed the "city of the two Olympics" and has accumulated valuable experience for China in the creation of a world-renowned sports image. China has gained considerable practical experience in creating a world-renowned sports image (40). Two major international sports events, the F1 Chinese Grand Prix and the Shanghai ATP1000 Tennis Masters, have had a significant positive impact on Shanghai's city image (41). Scholars such as Wang Min and others employed the Kelly square method to investigate the audience's perceptual experience of regional elements. Their findings indicated that sports events have become an integral component of regional branding, and that they play a pivotal role in disseminating regional branding and enhancing regional image (42).

The city's natural and humanistic attractions, as well as its order and law, serve to concentrate the city residents' vernacular cognition and pride. These symbolic symbols of the city's image become the city's imagination, and then realise the emotional identity (43). Zhai Lianfen posits that the city image constitutes the focal point of the city's soft environment. He further asserts that a positive city image will significantly enhance the city's visibility and reputation, which in turn will stimulate the inflow of foreign population and stimulate the citizens' sense of community (44). Shi Fei maintains that a positive city image can increase residents' pride and cohesion, and that it is one of the most important guarantees for the harmonious and sustainable development of the city (45). Zhang Hui and colleagues demonstrated that participation in sporting events can positively influence individuals' perceptions of city identity (46). Sun Wei's investigation of the Tianjin National Games revealed that the event's conceptual, participation and health images enhanced the city's image and strengthened the public's sense of identity, belonging and pride in Tianjin (47).

A significant correlation and coupling is evident between the sports event system and the city development system. This indicates that sports events and the components of the city can interact and influence each other (48). Furthermore, successful sports events have a great impact on the improvement of city infrastructure, living environment and even the quality of life of the residents. Chen Jiaqi and colleagues posit that quality of life, life satisfaction, and happiness are mutually reinforcing and examine the impact of the Nanjing Youth Olympic Games on the city of Nanjing. Their findings indicate that the hosting of large-scale sporting events can promote city development, enhance the city's image, improve the living conditions of residents, and significantly contribute to the enhancement of residents' sense of well-being (49, 50). Fan Jing's findings indicate that the Changchun International Vasaloppet Ski Festival brought more advantages than disadvantages to the city of Changchun. Furthermore, the improvement of the city's image positively affected the subjective well-being of the residents of the territory (51).

It has become a consensus among scholars that sports events can have a wide range of impacts. These impacts can be both explicit and implicit. With regard to the latter, it can be argued that sports events have an impact on the image of the host city. This, in turn, can

improve the residents' sense of well-being and cohesion. Consequently, the city's image and subjective sense of well-being may have a positive impact on the residents' sense of national identity.

In conclusion, the following hypotheses are proposed:

H4: Residents of Hangzhou who are involved in the Asian Games have a significant positive effect on the city's image.
H5: The city image has a significant positive effect on national identity.
H6: The city image has a significant positive effect on subjective well-being.

Through the analysis and research hypotheses in the literature review section, the model of the four main variables of involvement, subjective well-being, city image, and national identity was finally formed (Figure 1). This study explores the impact of major sports events on residents' national identity from the perspective of residents' involvement in the Asian Games, and uses subjective well-being and city image as mediating variables to validate the interactions between the variables and their extent.

Summarizing the previous section, this paper proposes the following hypotheses:

H1: Hangzhou residents' Asian Games involvement has a significant positive effect on national identity.
H2: Hangzhou residents' involvement in the Asian Games has a significant positive effect on subjective well-being.
H3: Subjective well-being has a significant positive effect on national identity.
H4: Hangzhou residents' Asian Games involvement has a significant positive effect on city image.
H5: city image has a significant positive effect on subjective well-being.
H6: city image has a significant positive effect on national identity.

3 Method

3.1 Pre-survey

Recruitment began on May 15, 2023 for this study. First, the first batch of questionnaires were distributed to 420 residents of Hangzhou from May 30 to June 30, 2023, and the data collected were used for the reliability test of the questionnaires. Second, a revised pre-survey questionnaire was used to survey 1,200 randomly selected Hangzhou residents from October 10, 2023 to November 30, 2023. All citizens were fully informed about possible issues related to the research process. The study procedures were approved by the Research Ethics Committee of Hangzhou Normal University (No. 2023-0501, May 12, 2023). All the participants gave written informed consent. After excluding invalid questionnaires, 394 valid questionnaires were obtained, representing a 93.8% validity rate. Among the respondents, 183 were male (46%) and 211 were female (53%). The proportion of respondents in each age group was as follows: under 18 (17%), 18–30 (28%), 30–50 (28.9%), and over 50 (26.2%). The pre-survey data should be analyzed and the formal survey scale determined by revising the items and other methods.

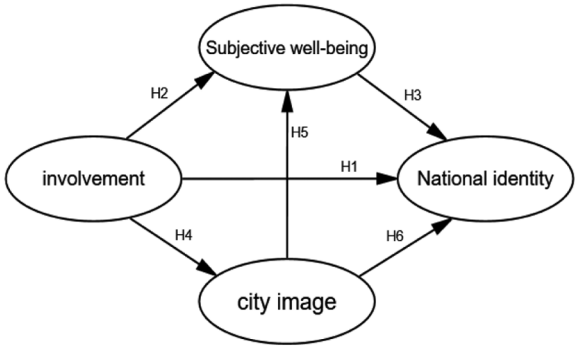

FIGURE 1
Theoretical hypothesis model.

3.2 Measurement tools

The initial scales for engagement, city image, subjective well-being, and national identity were constructed using existing mature scales. All scales were in the form of Likert 5-level scales, with 1 indicating "strongly agree" and 5 indicating "strongly disagree".

3.2.1 Involvement scale

The involvement scale was primarily derived from the study of Fengjun Zhang et al. (10), in which six items were selected. These included "It is important for me to pay attention to the event", "Paying attention to the event is one of my main ways of relaxation", "I pay a lot of attention to information about the event", "Spending time to learn about the event is worthwhile for me", "My paying attention to the event reflects my interest", and so on. Exploratory factor analysis and principal component analysis were used to perform orthogonal rotation factor analysis on the pre-survey data, and it was found that the factor loading coefficient of "paying attention to this competition reflects my value orientation" was less than 0.6, so it was deleted. The revised inclusion measurement table consists of 5 questions, with a Cronbach coefficient of 0.912 and a KMO of 0.892.

3.2.2 National identity scale

The National Identity Scale is primarily derived from Peter Gries' study (52), which is divided into 4 dimensions: patriotism, blind patriotism, nationalism, and internationalism. The scale comprises a total of 10 items, including the following statement: "I am glad to be Chinese", "Being Chinese is an important reflection of who I am", "China is the best country in the world", and "Given China's long history and splendid civilization, it is natural that China should have more influence in East Asia", and so on. The exploratory factor analysis and principal component analysis conducted on the pre-survey data using orthogonal rotated factor analysis revealed that the factor loading coefficients of "The problems faced by poor countries should be solved by themselves and have nothing to do with us" and "I regret being

Chinese" were less than 0.6, indicating that these items should be deleted. Similarly, "I regret that I am Chinese" was found to be less than 0.6, and thus also deleted. The revised National Identity Scale comprises 8 items, with a Cronbach coefficient of 0.846 and a KMO of 0.796.

3.2.3 Subjective well-being scale

The Subjective Well-Being Scale is a self-report instrument that measures an individual's subjective well-being. It is a 20-item scale, developed by Xing (53), with a total of 20 items, including "Society provides people with more and more ways out", "I have learned many philosophies from life, which makes me more determined and capable", "When encountering unpleasant things, I cannot keep my spirits up for a long time", and so on. Exploratory factor analysis and principal component analysis were used to perform orthogonal rotation factor analysis on the pre-survey data, and the non-compliant items of factor loading coefficient, such as "I am quite satisfied with my personality", "I sometimes find it difficult to communicate with my family (including parents, children, loved ones, etc.)", and "I feel particularly happy when I am with my family", were removed. The revised subjective well-being scale consists of 17 questions, with a Cronbach coefficient of 0.814 and a KMO of 0.866.

3.2.4 City image scale

The city image scale is primarily derived from Huang Haiyan's Semantic Difference Scale of city image (54), which is divided into 2 dimensions: cognitive image and affective image. This study focuses on the cognitive aspect of city image, and the cognitive image dimension was selected to obtain the data necessary to answer the research question in an efficient manner, while also avoiding overlap with the Subjective Well-being Scale. The cognitive image dimension comprises 5 items, including "traditional or modern", "low visibility or high visibility", and "regional or international", "atmosphere not unique or atmosphere very unique", and so on. The final scale exhibited a Cronbach coefficient of 0.877 and a KMO of 0.873.

3.3 Data survey

The revised pre-survey scale was used as the official questionnaire, and a random sampling method was adopted to select 1,200 Hangzhou residents as the respondents for the questionnaire survey within 2 months after the Hangzhou Asian Games were held (October to December 2023) in the city area of Hangzhou City, where the survey areas included Xihu District, Yuhang District, Binjiang District, Gongshu District, Qiantang District, etc., Gongshu District, Qiantang District, etc., in which the survey respondents include teachers, students and residents of Hangzhou Normal University, Zhejiang University, Zhejiang University of Metrology, Zhejiang University of Traditional Chinese Medicine and other universities and their affiliated primary and secondary schools, communities. The Tencent questionnaire was filled out online for college students, office workers and other young and middle-aged people; the questionnaire was filled out by primary and secondary school students through visits to campuses; and the questionnaire was read aloud to middle-aged and elderly people with a low level of education, so that they could fully understand the meaning of the questionnaire and then fill it out truthfully. The research ethics procedure was consistent with the pre-survey, and all the participants gave written informed consent. The ethical procedures of the study were consistent with the pre-investigation and all participants signed an informed consent form. Finally, excluding the invalid questionnaires with problems such as not filling in the questionnaires carefully and logical errors, 1,096 valid questionnaires were collected and collated, and the validity of the questionnaires was 91.3%. Among the valid questionnaires, 528 were male, accounting for 48.2%, and 568 were female, accounting for 51.8%. The proportion of respondents in each age group was as follows: under 18 (24.8%), 18–30 (41.7%), 30–50 (20.8%), and over 50 (12.7%) (Table 1).

3.4 Reliability testing

The internal consistency of the dimensions was analyzed using the Cronbach coefficient reliability test method in SPSS 27.0, with the reliability coefficient values observed to be between 0.853 and 0.928 (Table 2). These values exceed the criterion of 0.8, indicating that the measurement questionnaire has a high level of reliability.

SPSS 27.0 was employed to execute the KMO and Bartlett's spherical test on the scale. The KMO value was found to be greater than 0.7, indicating that the scale exhibited a high degree of reliability. Furthermore, the closer the value approached 1, the higher the reliability. Additionally, the *P* value of the Bartlett's spherical test was found to be less than 0.01, signifying a significant correlation between the variables. The results of the analysis indicated that the KMO values of the questionnaire ranged from 0.851 to 0.911, all of which were greater than 0.8. Furthermore, the

TABLE 1 Description of sample feature distribution.

Variable	Option	Frequency	Percentage
Gender	Male	528	48.20
	Female	568	51.80
Age	<18	272	24.80
	18–24	332	30.30
	25–30	125	11.40
	31–40	104	9.50
	41–50	124	11.30
	51–60	111	10.10
	>60	28	2.60
Educational background	Junior high school and below	254	23.20
	High school	103	9.40
	Undergraduate	490	44.70
	Postgraduate and above	249	22.70
Time in Hangzhou	Less than 1 year	96	8.80
	1–3 year	149	13.60
	3–10 year	268	24.50
	Over 10 years	583	53.20

TABLE 2 Reliability and validity analysis.

Index	Cronbach's α	KMO	sig	CR	AVE
Involvement	0.928	0.892	0.00	0.929	0.723
National identity	0.855	0.876	0.00	0.872	0.464
SWB	0.899	0.911	0.00	0.900	0.353
City image	0.853	0.851	0.00	0.859	0.551

TABLE 3 Differential validity analysis.

Index	Involvement	National identity	SWB	City image
Involvement	0.850			
National identity	0.302	0.742		
SWB	0.325	0.329	0.594	
City image	0.442	0.350	0.475	0.681

SWB, subjective well-being.

p-values were all 0.00, less than 0.01, suggesting that the data from the questionnaire were well suited for factor analysis (Table 2).

The average variance extraction (AVE) and construct reliability (CR) of each measurement item on the corresponding dimension were calculated using the confirmatory factor analysis (CFA) model established by AMOS 24.0. This was done through validated factor analysis. According to the established criteria, an AVE value of 0.36–0.5 is deemed acceptable, a value exceeding 0.5 is considered excellent, and a CR value of 0.7 is regarded as excellent. Among these, the AVE value of the subjective well-being scale is marginally below the acceptable range. This may be attributed to the scale's excessive number of items, but the high CR value (0.9) and good discriminant validity (Table 3) indicate that the scale's validity remains acceptable (55, 56). The AVE values of the remaining scales exceeded 0.46, while the CR values exceeded 0.8, indicating satisfactory convergent validity and combinatorial validity among the dimensions of the scales (Table 2). In the differential validity test, the standardized correlation coefficients between the dimensions were less than the square root of the AVE value corresponding to the dimension, indicating satisfactory differential validity between the dimensions (Table 3). In conclusion, the questionnaire and its dimensions exhibited satisfactory reliability and validity in this study.

3.5 Statistics

This study employs mathematical statistics and model validation through SPSS27.0 and AMOS24.0 software, as well as structural equation modelling. Descriptive statistics and correlation analyses of the scales were conducted initially, followed by validation factor analysis and model fit testing. This involved the use of packing and the establishment of correlation paths to improve model fit, as well as testing the path coefficients of each hypothesis. Finally, bootstrap was employed to test the mediating effect and analyze the research hypotheses.

4 Results

4.1 Descriptive statistics and correlation analysis

The results of the descriptive statistics analysis and correlation analysis (Table 4) indicate that the mean score of each variable is between 3.6 and 4.5, with a scoring method of 1–5. This suggests that the level of data in this study is above the medium range. Correlation analysis allows for the identification of the direction and degree of correlation between each variable. In this analysis, a correlation is observed between each variable, with the correlation coefficient r between each variable exceeding 0, indicating that each variable in this analysis is a significant positive correlation.

4.2 Model fit test and correction

In this study, the model fitness is evaluated using the following statistical indices: CMIN, RMSEA, GFI and CFI. In order to make the model concise and reduce errors, this research employed the *a priori* questionnaire method (57) based on the strategy of unique information packaging. The subjective well-being scale, comprising 17 items, was then packaged into three indicators (58) according to its component structure, namely, health experience, contentment experience, and developmental experience. These indicators were subsequently used for structural equation modelling. The results indicate that the chi-square degrees of freedom ratio of the overall model is slightly higher than 5, with the exception of the remaining indicators, which are within the acceptable range (Table 5, uncorrected results). In order to enhance the model's fit, model correction will be conducted in this study.

The AMOS 24.0 software was employed for model fit and path analysis, with the following paths being proposed according to the correction index: e1–e2, e7–e24, e26–e27, e28–e29, e28–e31, and e29–e30 (Figure 2). The correction results show that RMSEA = 0.048, GFI = 0.947, and CFI = 0.965 (Table 5), all

TABLE 4 Descriptive statistics and correlation analysis for each dimension.

	M(SD)	Involvement	National identity	SWB	City image
Involvement	3.61 (1.01)	1			
National identity	4.52 (0.53)	0.402**	1		
SWB	4.01 (0.62)	0.340**	0.434**	1	
City image	4.36 (0.61)	0.277**	0.315**	0.324**	1

Note: **At the 0.01 level (double tailed), the correlation is significant. SWB, subjective well-being.

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TABLE 5 Model fitness test.

Index	Uncorrected/corrected result	Reference standards (59)
CMIN	1,010.670/628.158	CMIN/DF ratio 1–3 is excellent, 3–5 is good
DF	183/177	
CMIN/DF	5.523/3.549	
RMSEA	0.064/0.048	<0.05 is excellent, <0.1 is good
GFI	0.917/0.947	>0.9 is excellent, >0.8 is good
CFI	0.936/0.965	>0.9 is excellent, >0.8 is good

indicators have reached an excellent level. The chi-square degrees of freedom ratio is 3.549, which may be attributed to the survey of Hangzhou residents with a large sample capacity influencing the CMIN value and its test results. However, given the model's excellent absolute fit index and the susceptibility of the chi-square degrees of freedom ratio to the characteristics of the sample capacity, the ratio is slightly higher than 3, which is acceptable (59). Overall, the model of this study has a good fitness for purpose.

4.3 The direct role of sports event involvement, city image, and subjective well-being on national identity

The results of the modified SEM standardized path relationship and hypothesis test (Table 6) indicate that the standardized path coefficient of involvement degree acting on national identity is 0.237 ($P < 0.001$); the standardized path coefficient of involvement degree acting on subjective well-being is 0.287 ($P < 0.001$); and the standardized path coefficient of involvement degree acting on city image is 0.3 ($P < 0.001$). These findings indicate that Hangzhou residents' Asian Games involvement has a significant positive effect on national identity, subjective well-being and city image. Consequently, hypotheses H1, H2 and H4 are valid. The standardized path coefficient of subjective well-being acting on national identity is 0.321 ($P = 0.001$); the standardized path coefficient of city image acting on national identity is 0.141 ($P < 0.001$). This indicates that both subjective well-being and city image have a significant positive effect on national identity, thereby establishing hypotheses H3 and H6. Furthermore, the standardized path coefficient of city image on subjective well-being is 0.264 ($P < 0.001$), indicating that city image has a significant positive effect on subjective well-being. Hypothesis H5 is thus confirmed. In conclusion, the modified structural equation model has validated all the hypotheses of this study.

4.4 The mediating role of city image and subjective well-being

A bootstrap was employed to assess the mediating role of subjective well-being and city image. A total of 2,000 sample tests were conducted, resulting in the calculation of direct, indirect, total indirect, chained mediating and total effects. The findings are

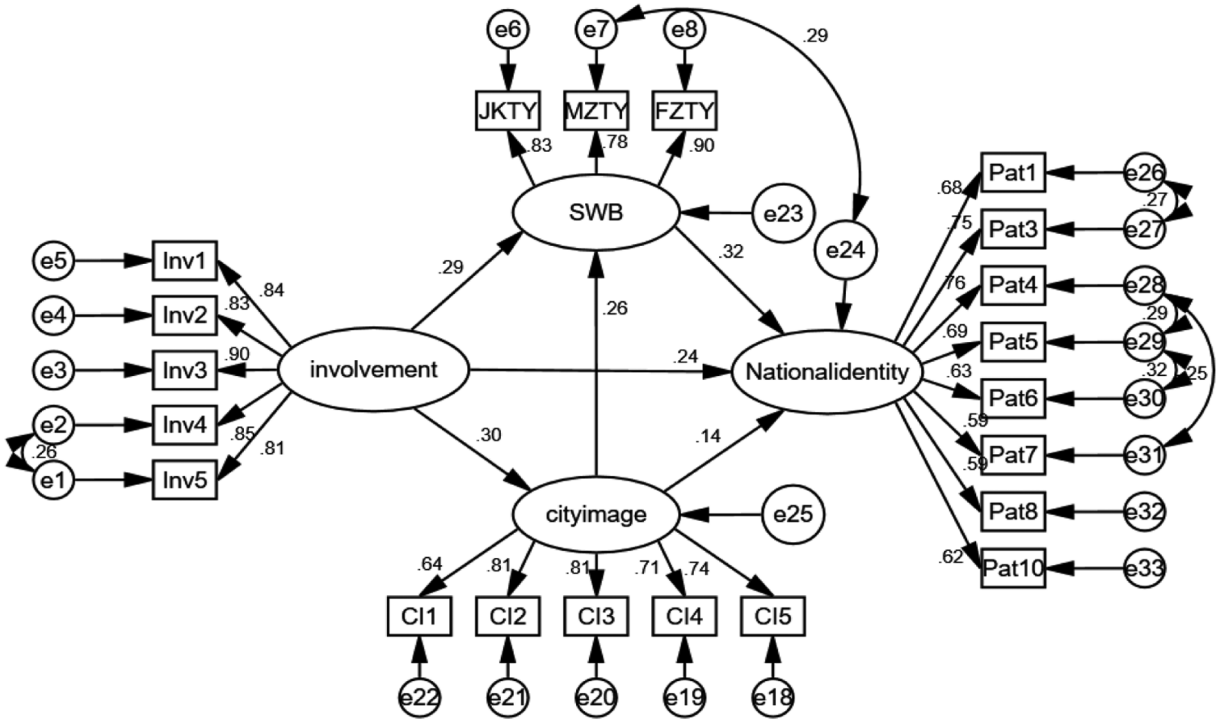

FIGURE 2
Test results of path relationship hypothesis in structural equation model.

TABLE 6 SEM path relationship test results of influencing factors.

Path relationship	Estimate	S.E.	C.R.	*P*
H1: Involvement→National identity	0.237	0.012	7.097	***
H2: Involvement→Subjective well-being	0.287	0.022	8.602	***
H3: Subjective well-being→National identity	0.321	0.02	8.633	***
H4: Involvement→City image	0.3	0.02	8.816	***
H5: City image→Subjective well-being	0.264	0.039	7.53	***
H6: City image→National identity	0.141	0.019	4.236	***

Note: *** Denotes $p < 0.001$.

TABLE 7 Structural model mediation effect test.

Path effect	Strength	Bias-corrected 95% CI confidence interval		*p*
		Lower	Upper	
Direct effects	0.082	0.052	0.115	0.001
Indirect effects	0.032	0.018	0.049	0.001
Indirect effects 2	0.015	0.006	0.025	0.002
Total indirect effect	0.046	0.032	0.063	0.001
Chain mediation effect	0.009	0.005	0.013	0.001
Aggregate effect	0.137	0.099	0.179	0.001

presented in Table 7. The bias-corrected 95% CI confidence interval for the direct effect (involvement → national identity) was 0.052–0.115, excluding 0, indicating that the direct effect of involvement on national identity was significant and the strength of the effect was 0.082. The bias-corrected 95% CI for the indirect effects (involvement → subjective well-being → national identity, involvement → city image → national identity) was 0.082, and the confidence interval for the indirect effect was 0.052–0.115. The 95% confidence intervals for the indirect effects were 0.018–0.049 and 0.006–0.025, respectively, with none of the values being equal to zero. This suggests that subjective well-being and city image play a mediating role in the model, and that their total indirect effect is 0.046, which is significant. The bias-corrected 95% CI confidence interval for the chain mediation effect (involvement → city image → subjective well-being → national identity) was 0.005–0.013, not including 0, indicating the existence of the chain mediation effect in the model. The deviation-corrected 95% CI confidence interval for the total effect is 0.099–0.179, not including 0, indicating that the total effect is significant and the strength of the effect is 0.137. The results indicate that both the direct effect and the mediating effect are present in the model. The direct effect (0.082) is greater than the indirect effect (0.046), suggesting that the mediating effect of subjective well-being and city image is a partial mediating effect. Furthermore, the involvement of Hangzhou residents in the Asian Games has a significant direct effect on national identity.

5 Discussion

This study examines the impact of Hangzhou residents' involvement in the Asian Games on their national identity. A structural equation model is constructed to analyze the interrelationship between subjective well-being and city image as mediating variables. The model fit of this study was relatively good (CMIN/DF = 3.549) and all indicators were excellent (RMSEA = 0.048, GFI = 0.947, CFI = 0.965) and all the hypotheses of this study were confirmed by structural equation modeling. Specifically, involvement has a significant positive effect on national identity, subjective well-being and city image. Both subjective well-being and city image have a significant positive effect on national identity, and city image has a significant positive effect on subjective well-being. Furthermore, the bootstrap test for mediating effects indicates that the direct effect of involvement on national identity is significant, that subjective well-being and city image play a partial mediating role in the model, and that there is a chain mediating effect in the model.

5.1 The impact of Asian games involvement on national identity

The analysis results show that the involvement of Hangzhou residents in the Asian Games has a significant positive effect on national identity (standardized path coefficient of 0.237, $P < 0.001$), i.e., the more Hangzhou residents are involved in the Asian Games events, the stronger the sense of national identity will emerge from them, which is consistent with the conclusions of previous scholars' studies (13, 27) and verifies hypothesis H1. The Hangzhou Asian Games involve a large number of people, with all the members of the Olympic Games Committee and 12,000 athletes registered to participate, and more than 130 countries and regions with more than 100 million people participating in the Games. Council and 12,000 athletes registered to participate in the Games, more than 130 countries and regions more than 100 million people involved in watching the Games, ticket sales exceeded 600 million yuan, there are also 37,600 volunteers on and off the field to provide services, people through a variety of forms of involvement in the Games (60). As the largest Asian Games ever held with unprecedented standards, the Hangzhou Asian Games featured 40 main events, 61 sub-events and 481 sub-activities (61), demonstrating China's national self-confidence to the world in every aspect: The Hangzhou Asian Games demonstrated China's national self-confidence to the world in every aspect: pioneering digital technology to promote China's traditional cultural heritage and future technology to the world, stimulating the audience's empathy for the motherland through the course ceremonies, infectious music and participatory interactive ways at the venue; and stimulating the audience's empathy for the motherland through the dissemination of vivid and three-dimensional media. The event media enhanced the public's understanding and recognition of China's culture through the dissemination of vivid and three-dimensional images of China, which further enhanced the country's image in the minds of those involved in the Asian Games. Furthermore, Hangzhou residents participated in the Asian Games events, experiencing the grandeur of the Hangzhou Asian Games and the charm of the Hangzhou Asian Games in terms of mathematics and intelligence. This enhanced the residents' sense of honour in participating in the

Asian Games, promoted their perception of the national image, and thus enhanced their sense of belonging to the country and national identity.

5.2 The mediating role of subjective well-being

The results of the analysis show that Hangzhou residents' involvement in the Asian Games has a significant positive effect on subjective well-being (standardized path coefficient of 0.287, $P < 0.001$), and subjective well-being has a similarly significant positive effect on national identity (standardized path coefficient of 0.321, $P < 0.001$), suggesting that Hangzhou residents' involvement in the Asian Games can not only directly affect national identity, but also indirectly affect national identity by influencing subjective well-being, in which subjective well-being plays a partial mediating role. This finding is consistent with previous research that event participants can significantly increase their subjective well-being by experiencing the event culture (31), and that there is a strong relationship between the level of involvement in major sporting events and the well-being generated by positive emotions as well as the sense of national identity (62). Residents' well-being is largely derived from quality of life, social support and sense of belonging. The Hangzhou Asian Games allowed people to experience changes in the quality of life around them. During the preparation period, Hangzhou stir up a national sports boom, 56 competition venues are all open to the public, "Asian Games venues online venues" has been 384 venues, of which 45 Asian Games venues, the total number of people in fitness 20 million people, the total number of orders 1.15 million (5). In the post-Asian Games period, Hangzhou is committed to transforming the legacy of the Asian Games into sustainable value, enabling digital empowerment of sports, and citizens show the confidence of "everyone is a host", and the sense of well-being brought by the Asian Games is emerging. This study suggests that the organizers of the event can fully implement the "fitness for all" policy in the context of building a sports power, and increase residents' involvement in the event by opening sports venues, organizing small-scale sports activities, recruiting volunteers, and enriching the channels for watching the event, so that residents can fully feel the atmosphere of the event and the changes in the city, thereby enhancing their subjective sense of well-being and national identity. This will enhance residents' subjective well-being and national identity.

5.3 The mediating role of city image

The analysis results show that Hangzhou residents' involvement in the Asian Games has a significant positive effect on city image (standardized path coefficient of 0.3, $P < 0.001$), and city image has a similarly significant positive effect on national identity (standardized path coefficient of 0.141, $P < 0.001$), and in addition, involvement can also affect national identity through the chain mediating effect of city image and subjective well-being (strength of effect 0.009, $P = 0.001$), and this result proves that involvement can affect city image while also indicating that city image has a significant effect on subjective well-being (strength of effect 0.264, $P = 0.001$). 001), and this result proves that involvement can affect city image, while also indicating that city image has a significant effect on subjective well-being (strength of effect 0.264, $P = 0.001$). Identity (strength of effect 0.009, $P = 0.001$), this result proves that the degree of involvement can affect city image at the same time, it also indicates that city image can have an effect on both subjective well-being (standardized path coefficient of 0.264, $P < 0.001$) and national identity. Following the concept of sustainable development, Hangzhou adopted "green power" and water recycling system, built 31 training venues, 56 competition venues and 5 Asian Games villages, and constructed 1,588 public charging stations and more than 21,000 public charging piles. More than 21,000 public charging stations were built, fully demonstrating the image of the Asian Games City of green, low-carbon, digital intelligence and humanistic Jiangnan (63). In addition, Hangzhou held more than 140 non-legacy display activities during the Asian Games, and successively launched 10 Asian Games theme tourism lines and more than 70 Asian Games tourism concessions, so that more people can feel that Hangzhou is rich in history and culture and full of creativity (64, 65). It was learned from the visited residents involved in the Hangzhou Asian Games that the improvement of Hangzhou's city image has made them feel a strong sense of belonging and happiness, and the unprecedented expansion of Hangzhou's city brand influence has made the concept of oriental wisdom and Chinese style accepted by the world, which has an important impact on strengthening Hangzhou residents' identity of the city and the country. It can be seen that if the event organizer can solve the problems of optimizing facilities and road construction before the event so as to minimize the inconvenience to residents' lives; and do a good job of cultural output and provide quality services during the event so that those involved in the event can feel the charm of the city they live in, it will have a positive effect on the enhancement of the city's image.

5.4 Research limitations and future prospects

This paper explored the relationship between Hangzhou residents' Asian Games involvement, city image, subjective well-being and national identity through structural equation modeling, but there are still some limitations. First, this study mainly explores the short-term positive effects of hosting large-scale sports events on residents' national identity while ignoring the long-term effects and negative impacts. Secondly, this study takes Hangzhou residents as a whole as the target population and does not compare the differences in the impacts on different types of Hangzhou residents after they have been involved in the Asian Games. Third, this study mainly investigated two mediating variables, subjective well-being and city image, without further exploring the possibility of the existence of other moderating variables under this theoretical framework. In future research, it is possible to track and investigate the

bidirectional impacts of various types of large-scale sports events on residents' national identity at different time periods, to consider the research hypothesis of counteracting effects, to analyze the impacts of different aspects of social impacts produced by large-scale sports events on residents' national identity, and to improve the model structure in order to analyze in a deeper way the internal mechanism of residents of large-scale sports events' territories constructing their national identities by getting involved in the events.

6 Conclusions

This study assesses involvement, subjective well-being, city image and national identity. The study uses the Hangzhou Asian Games as a case study to explore the extent and path of the impact of hosting large-scale sports events on national identity from the perspective of local residents. The findings of the study provide a resident's perspective for assessing the social impact of large-scale sports events, and also provide elements that can be used as a reference by governments and organizations in assessing large-scale sports events. This study examines the immediate positive effects of hosting events on residents' national identity, but it does not consider the long-term or negative impacts. In the future, we will conduct further research to investigate the bi-directional impacts of various types of large-scale sports events on residents' national identity in different time periods. This will enable us to enrich and improve the study.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study procedures were approved by the research ethics board of Hangzhou Normal University (No.2023-0501, 12 May 2023). Informed consent was obtained from all subjects.

Author contributions

JW: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. ZH: Data curation, Formal Analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. YL: Conceptualization, Data curation, Formal Analysis, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The key roles of teammates, coaches, and instrumental support in adolescent sports participation: a one-year prospective study

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Introduction: Sports participation is important for promoting lifelong health and well-being. However, it often declines during adolescence, highlighting the need to understand the factors related to adolescent sports participation. This prospective study examines the associations between different sources (e.g., family, peers, coaches, teachers) and types (e.g., emotional, instrumental, co-participation) of social support and hours of organized sports participation among secondary school students ($N = 294$). It also explores whether these associations change from the second to the third year of secondary education.
Methods: Data were collected using questionnaires and anthropometric measurements in October/November 2021 and October/November 2022. Multilevel linear fixed effects regression models were used to analyze relationships between sources and types of social support and sports participation. Additionally, scatterplots illustrated individual variability in these associations.
Results: Results showed significant associations for various sources and types of social support with organized sports participation. Social support from teammates and coaches and instrumental support emerged as the strongest predictors of hours of participation. Additionally, we found that the relationships remained stable over time. Yet, substantial individual variability in how social support related to sports participation was also observed.
Discussion: These findings emphasize the importance to promote social support from within the sports environment and to encourage instrumental support. Tailored approaches addressing individual differences are recommended to enhance adolescent sports participation.

KEYWORDS

organized sports, youth, social support, sources of support, types of support, longitudinal design

1 Introduction

An active lifestyle, particularly through sports, is essential for lifelong health and well-being (1–4). Despite its benefits, sports participation often declines from adolescence onwards (5–8), which highlights the need to understand and address the factors that influence sports participation of adolescents. Consistent with recent reviews (9–12), our previous research has confirmed the importance of factors such as motives and perceived competence in organized sports participation during adolescence (13, 14). Our findings also supported the

notion that social support may play a crucial role alongside these factors. However, the role of social support remains a largely unexplored area of research. This is surprising given the developmental changes during adolescence, where relationships with parents and peers evolve (15, 16). In the present study, we will examine the role of social support in organized sports participation using a prospective design.

Social support for sports participation can be provided by different sources within one's social network (e.g., parents, siblings, peers, teachers, coaches) and through different types of support (e.g., emotional, esteem, informational, instrumental, co-participation, modelling) (17, 18). Thus far, studies on social support have either examined total social support (which is expressed as a composite score) or only one or a few of the sources or types of social support (18–26). It was evident from these studies that various sources and types of social support can influence physical activity levels (17, 27–29). However, the relative importance of these sources and types of social support varies, with some exerting more influence than others (17, 27). Regarding sources of social support, positive relationships with sports participation are most commonly reported for support from parents, peers and coaches (19–21, 24, 30), while physical education teachers and siblings have a less pronounced influence (26, 27, 31). Regarding types of social support, emotional and instrumental support appear to be the most important (17, 27). Despite these valuable insights, no studies have yet examined the combined role of a wide range of sources and types of social support in adolescent sports participation. By addressing this gap, this study aims to better understand how different sources and types of support simultaneously relate to levels of sports participation.

In addition, it is essential to explore how the relationships between social support and sports participation evolve over time. The relative importance and influence of different sources and types of social support can shift as adolescents grow older (32, 33). For example, while parental support may be particularly crucial for physical activity during early adolescence, peer influence tends to become more significant as adolescents mature (32). As another example, the types of parental support that affect sports participation are likely to evolve across developmental stages (33). Specifically, the role of parents gradually often shifts from actively encouraging their children to explore various sports during childhood to becoming more passive supporters who facilitate optimal training conditions during adolescence. These findings highlight the dynamic nature of social support during adolescence and emphasize the need to consider these changes over time. Given that most studies to date have used a cross-sectional methodology (17, 19, 23, 24, 27, 30), there is a clear need for more prospective research (even over short periods). This study seeks to contribute to understanding whether and how social support and sports participation of adolescents change over time, providing insights that could inform the development of age-appropriate programs tailored to their changing needs.

In summary, this study will add to our knowledge of adolescent sports participation by (1) addressing the underexplored role of social support in organized sports participation among adolescents, (2) examining a wide range of sources and types of social support simultaneously, rather than focusing on composite scores or a limited amount of sources or types, and (3) employing a prospective design to capture how the relationships between social support and organized sports participation evolve over time. These insights can inform the development of more targeted strategies to sustain sports participation and foster lifelong health and well-being. Specifically, we examine the association between different *sources* (i.e., father, mother, siblings, friends, teammates, coach, and PE teacher) and *types* (i.e., emotional, esteem, informational, instrumental, co-participation, modelling) of social support and hours of organized sports participation among adolescents in both their second and third years of secondary education ($N = 294$). Whereas other studies primarily focus on outcomes related to sports participation (e.g., intention to continue) or to a binary measure of whether or not adolescents participate in sports (e.g., (19, 24), the present study focuses on the total time spent in organized sports. This approach provides a more nuanced understanding of sports participation and its associated factors. We hypothesize that social support from parents, peers (i.e., friends and teammates) and the coach will be most strongly positively related to hours of sports participation. In addition to this, we hypothesize that various types of social support will be positively related to hours of sports participation, with emotional and instrumental being the most influential types. As a final and more exploratory research question, we examine whether the associations between the different sources and types of social support and hours of sports participation change over time.

2 Materials and methods

2.1 Study design

This longitudinal study is part of the Transitions Into Active Living (TRIAL) project, which investigates changes in physical activity during key life transitions. We followed secondary school students from the start of their first year to the start of their third year of secondary education. Data were collected in seven waves between October 2020 and November 2022. For the current analyses, we used data from Wave 4 (October/November 2021) and Wave 7 (October/November 2022), corresponding to the start of the second and third years of secondary education. From here on, we will refer to Wave 4 as "Year 2" and Wave 7 as "Year 3". This study was approved by the Ethics Committee of the Faculty of Social Sciences at Radboud University (ECSW-2020-107).

2.2 Study sample

We selected a convenience sample of eight secondary schools with which our research team had established working relationships. These schools were located in two provinces in the eastern Netherlands. In June 2020, we informed the physical education teachers via email and invited them to participate with their schools. Five schools agreed to participate. Subsequently, we

sent information letters and informed consent forms both on paper and via email to all first-year students ($n = 1{,}127$) and their parents. The recruitment period for this study spanned from September 9, 2020, to the end of October 2020. Of the potential participants, 530 adolescents (50.9% boys) received parental consent to participate and were also asked to provide their own written consent. We included adolescents in the analysis sample if they had complete data on sports participation and all social support variables at both Year 2 and Year 3.

2.3 Assessments

We used a questionnaire and anthropometric measurements to assess the variables relevant to the present study. The questionnaire measured organized sports participation, social support, motives, perceived competence, age and ethnicity. Although additional variables were included, they were not used in the current analyses. The full version is available at: https://doi.org/10.17026/SS/LA3KIZ. Anthropometric measurements (height and weight) were taken to calculate BMI. The variables relevant to the present study are described in detail below.

2.3.1 Background measures

At the start of the study (Year 1), we collected data on adolescents' age, gender, and ethnicity through a questionnaire. Students self-reported their age and gender. Ethnicity was determined based on the definition of Statistics Netherlands (34, 35). Adolescents reported their parents' countries of birth, and we categorized them native Dutch if both parents were born in the Netherlands (34), or non-native Dutch if at least one parent was born outside the Netherlands (35). In addition, we determined BMI through anthropometric measurements conducted at Year 2 and Year 3. Trained research assistants measured height using a Seca stadiometer and weight with a Seca scale. BMI (kg/m^2) was then calculated from these measurements.

2.3.2 Organized sports participation

We defined organized sports as any sport practiced in clubs (e.g., soccer and tennis) or fitness centers, or led by a trainer or coach (e.g., boot camp). Organized sports participation was assessed using items that were based on the validated Flemish Physical Activity Questionnaire (FPAQ) (36). Adolescents were first asked if they participated in sports. If yes, they listed up to three sports, and for each sport, they indicated if they practiced it in a club/fitness center or under supervision. A sport was classified as organized if either condition was met. Weekly hours of participation were measured for up to three organized sports and summed to calculate total weekly hours of organized sports participation. Non-participants were assigned zero hours. Two outliers (i.e., 90 and 230 h) were excluded as they were deemed implausible (the highest remaining value was 24 h).

2.3.3 Social support

We assessed seven sources (i.e., father, mother, siblings, friends, teammates, coach, and PE teacher) and six types (i.e., emotional, esteem, informational, instrumental, co-participation, modelling) of social support using 14 items. For each item, students were presented with a list of the seven potential sources of social support and instructed to select all sources that applied to them. Three items each represented emotional, esteem, informational, and instrumental support, while one item represented co-participation and another item represented modelling (see Table 1). The items regarding emotional, esteem, informational, and instrumental support were adapted from validated questionnaires on social support and sport (28, 29). The items regarding co-participation and modelling were developed based on a key systematic review (17). For each source of support, we calculated the total number of items that were selected (overall score 0–14). For each type of support, we calculated the average number of sources from whom social support was perceived (overall score 0–7).

2.3.4 Covariates

Previous research indicated that sports participation is influenced by a number of factors in addition to social support (9–12). In line with the literature, we recently showed that motives and perceived competence were important factors in this study sample (13, 14). Therefore, we included these two factors as covariates in our analysis. Hereby, this paper gives insight in how different sources and types of social support relate to one another and to other relevant factors with regard to sports participation.

Perceived competence was assessed using a modified version of Harter's perceived competence scale (37). We selected and adapted six items of the physical domain. The final statements were: "I do very well at sports", "I wish I were a lot better at sports", "I do well in any new sports that I have not tried before", "I feel that I am better than peers my age at sports", "In sports, I usually watch instead of participate", and "I do not do well in new sports". Participants responded to these statements on a 4-point Likert

TABLE 1 Types of social support and items in questionnaire.

Type of social support	Item
Emotional support	1. Who encourages you to exercise/play sports?
	2. Who talks to you about exercising/playing sports?
	3. Who makes you feel like they are always there for you?
Esteem support	4. Who gives you the confidence to exercise/play sports?
	5. Who tells you what your athletic abilities are?
	6. Who tells you that you are good at exercising/playing sports?
Informational support	7. Who gives you advice about exercising/playing sports?
	8. Who helps you decide what to do?
	9. Who gives you tips to improve in exercising/playing sports?
Instrumental support	10. With whom do you go to the location where you can play sports?
	11. Who helps you plan when you can exercise/play sports?
	12. Who pays for the equipment and/or memberships so that you can play sports?
Co-participation	13. Who plays sports with you?
Modelling	14. Who is your role model for exercising/playing sports?

scale ranging from 1 (totally disagree) to 4 (totally agree). The average score of these responses, including the reversed scoring for the second, fifth, and last statements, provided the overall perceived competence score.

Motives for participating in organized sports were assessed using eight items on a 4-point Likert scale (1 = totally disagree; 4 = totally agree). Students responded to the prompt, "Why do/would you participate in organized sports?". These items were based on the Motives for Physical Activity Measure-Revised (MPAM-R) scale and prior studies on adolescent physical activity behaviors (38–41). We included items for five motives: enjoyment, social, competence/challenge, appearance, and fitness. Specifically, the items were: enjoyment ("it is a fun thing to do"), appearance ("to improve body shape"), fitness ("to be healthy"), social ("to meet up with peers", "friends participate too"), and competence/challenge ("to perform well", "to be the best", "to compete with others"). The average of these responses calculated the overall motives score.

2.4 Procedures

Data collection procedures are the same as reported elsewhere (13, 14). A team of trained testers collected data during regular physical education classes held in an indoor facility. Students completed the online questionnaire on their laptop computers or smartphone via LimeSurvey. Anthropometric measurements and motor skills tests were also conducted during the same session (motor skills tests were conducted for the broader TRIAL project, but these data are not included in the present study).

2.5 Data analysis

All analyses were conducted using Stata software (version 17) (42). Our data had a multilevel structure with repeated measures (level 1) nested within adolescents (level 2) who were clustered in classes (level 3) within schools (level 4) (43). Due to the small number of schools ($n = 5$), however, we could not perform four-level analyses (43). Nevertheless, it remained appropriate to model within-person changes over time using the repeated measures as a separate level, despite the limited number of data waves (43–47). Thus, we accounted for a three-level structure with repeated measures nested within adolescents who were clustered in classes ($n = 54$).

To achieve this, we transformed the data into long format with two measures for each participant, one for Year 2 and one for Year 3. We included a dummy variable, 'school year,' allowing us to model the repeated measures. Additionally, we declared the dataset as panel data nested within classes, aligning with the clustered nature of the data within classes.

To examine the relationships between the sources and types of social support and organized sports participation, we applied multilevel linear fixed effects regression models using the "xtreg" command in Stata. Initially, in Model 1 (the basic model), we included background measures (i.e., age, gender, ethnicity, and BMI) and organized sports participation in Year 1 (yes or no) as predictors of participation in Year 2 and Year 3. Following this, we conducted two series of analyses: one for the sources of social support and another for the types of social support. Each series consisted of five models.

The five models for the sources of social support were as follows: In Model 2a-g, each source of social support was added individually to the basic model. In Model 3, all sources were included simultaneously. In Model 4, covariates (i.e., motives and perceived competence) were added to the previous model. To examine changes in the relationships between the sources of social support and sports participation over time from Year 2 to Year 3. We introduced interaction terms (i.e., father*school year, mother*school year, siblings*school year, friends*school year, team*school year, coach*school year, PE teacher*school year). In Models 5a-g, we added one interaction term at a time. Finally, in Model 6, all interaction terms were included simultaneously. The models for the types of social support followed the same approach.

In addition to the regression models that examined average effects and statistical significance, scatterplots were used to illustrate the variability of these relationships across individuals.

3 Results

3.1 Sample characteristics

Of the 530 adolescents who had parental consent to participate in the study, 461 adolescents took part in the first measurements of the study (Year 1). By the start of their second year (Year 2), complete data were available for 430 adolescents. By the start of their third year (Year 3), the number decreased to 294, resulting in an analysis sample of 294 adolescents. Common reasons for dropout included repeating a grade, relocating, losing interest in study participation, or being ill on the day of testing.

There were no significant differences in age, gender, ethnicity, BMI and prior organized sports participation between the groups included and excluded from the analysis. However, the analysis sample had a higher proportion of adolescents enrolled in higher general and pre-university educational paths (i.e., higher general, higher general/pre-university, and pre-university) and a lower proportion of those in pre-vocational education paths (i.e., pre-vocational, pre-vocational/higher general, and pre-vocational/higher general/pre-university) compared to the excluded group ($p < .001$). Descriptive characteristics for the background measures of the analysis sample are shown in Table 2. Descriptive statistics for the study variables are shown in Table 3.

3.2 Sources of social support

Table 4 presents the results of the multilevel linear fixed effects regression models for the sources of social support. In Model 1, the background variables age, gender, and ethnicity, and baseline participation significantly predicted adolescents' hours of participation in organized sports. Boys spent more time in

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TABLE 2 Characteristics of adolescents in the analysis sample (year 2).

	n	%	M	SD
Age	282		13.47	0.47
Gender				
Boy	141	47.96		
Girl	153	52.04		
Ethnicity				
Native Dutch	263	89.46		
Non-native Dutch	31	10.54		
BMI	280		18.96	2.66
Organized sports participation in Year 1				
Yes	219	87.95		
No	30	12.05		
Educational paths				
Pre-vocational	31	10.54		
Pre-vocational/higher general	26	8.84		
Pre-vocational/higher general/pre-university	79	26.87		
Higher general	24	8.16		
Higher general/pre-university	71	24.15		
Pre-university	63	21.43		

organized sports than girls ($B = 0.77$, $p < .01$), and native Dutch adolescents spent more time in organized sports than non-native Dutch adolescents ($B = 1.23$, $p < .01$). Additionally, adolescents who participated in organized sports during their first year of secondary education participated more hours per week in organized sports ($B = 2.30$, $p < .001$). Finally, older adolescents spent less time in organized sports ($B = -0.74$, $p < .05$).

In Models 2a-g, we examined the relationships between the different sources of social support and adolescents' hours of participation in organized sports. When added separately, social support from fathers, friends, teammates, and coaches significantly predicted adolescents' hours of participation in organized sports. In contrast, social support from mothers, siblings, and PE teachers did not have a significant effect. Specifically, adolescents who reported higher levels of social support from their fathers ($B = 0.10$, $p < .01$), friends ($B = 0.16$, $p < .001$), teammates ($B = 0.22$, $p < .001$), and coaches ($B = 0.21$, $p < .001$) spent more time in organized sports. The higher explained variance between individuals for the models including social support from teammates (Between R-squared = 0.18) and coaches (Between R-squared = 0.15), compared to the models including support from fathers (Between R-squared = 0.09) and friends (Between R-squared = 0.08), suggests that social support from teammates as well as from coaches are stronger predictors of adolescents' participation in organized sports than social support from other sources.

In Model 3, where all sources of social support were included simultaneously, only social support from teammates ($B = 0.12$, $p < .05$) and coaches ($B = 0.17$, $p < .001$) remained significant predictors of adolescents' hours of participation in organized sports. Additionally, social support from PE teachers emerged as a significant predictor in this model. Specifically, adolescents who reported higher levels of social support from PE teachers spent less time in organized sports (B = −0.15, $p < .01$). The explained variance in this model, which included all sources of social support, was 0.24 (Between R-squared). This represents an increase compared to the explained variance in models that included only one source of social support at a time, suggesting that combining multiple sources of social support is more predictive of participation in organized sports.

In Model 4, after adding the covariates perceived competence and motives, social support from teammates ($B = 0.11$, $p < .05$),

TABLE 3 Descriptive statistics and comparative analysis of year 2 and year 3 ($n = 294$).

	Scale	Year 2		Year 3		*P*	Effect size
		M	SD	M	SD		
Organized sports participation							
Hours per week	N/A	3.8	2.8	4.1	3.0	.030	0.13
Sources of social support							
Support by father	0–14	7.81	3.77	7.75	3.86	.708	−0.02
Support by mother	0–14	8.04	3.31	7.74	3.47	.107	−0.09
Support by siblings	0–14	2.70	3.22	3.00	3.47	.053	0.11
Support by friends	0–14	4.12	3.38	4.72	3.46	.003	0.17
Support by teammates	0–14	4.53	3.94	5.20	3.83	<.001	0.20
Support by coach	0–14	5.38	4.07	5.62	3.64	.223	0.07
Support by PE teacher	0–14	3.10	3.15	2.75	2.90	.055	−0.11
Types of social support							
Emotional support	0–7	3.49	1.57	3.76	1.45	<.001	0.19
Esteem support	0–7	3.11	1.71	3.27	1.66	.066	0.11
Informational support	0–7	2.44	1.36	2.51	1.33	.324	0.06
Instrumental support	0–7	1.70	0.89	1.68	0.78	.700	−0.02
Co-participation	0–7	2.12	1.41	2.00	1.18	.108	−0.09
Modelling	0–7	1.34	1.48	1.14	1.32	.041	−0.12
Covariates							
Perceived competence	0–4	2.92	0.45	2.77	0.49	.047	−0.12
Motives	0–4	3.03	0.55	3.09	0.55	.023	0.13

TABLE 4 Relationships between sources of social support and organized sports participation.

	Model 1	Model 2a	Model 2b	Model 2c	Model 2d	Model 2e	Model 2f	Model 2 g	Model 3	Model 4
Age	−0.74*	−0.76*	−0.66*	−0.69*	−0.70*	−0.62*	−0.59	−0.74*	−0.61*	−0.67*
	(0.32)	(0.32)	(0.32)	(0.32)	(0.31)	(0.31)	(0.31)	(0.32)	(0.31)	(0.31)
Boy	0.77**	0.73**	0.82**	0.82**	0.89**	0.75**	0.60*	0.77**	0.75**	0.56*
	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.26)	(0.26)	(0.28)	(0.26)	(0.28)
Native	1.23**	0.98*	1.20**	1.27**	1.17**	0.95*	1.00*	1.22**	0.88*	0.98*
	(0.41)	(0.41)	(0.41)	(0.41)	(0.40)	(0.39)	(0.40)	(0.41)	(0.40)	(0.40)
BMI	−0.05	−0.05	−0.06	−0.05	−0.04	−0.04	−0.06	−0.05	−0.05	−0.05
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Sport (yes/no) in Year 1	2.30***	2.07***	2.23***	2.24***	2.27***	1.60***	1.31**	2.30***	1.11*	0.88*
	(0.42)	(0.42)	(0.42)	(0.42)	(0.41)	(0.41)	(0.43)	(0.42)	(0.43)	(0.44)
Year 3	1.05*	1.06*	1.00*	0.97*	0.93*	0.83*	0.91*	1.05*	1.11*	0.85*
	(0.44)	(0.44)	(0.44)	(0.44)	(0.43)	(0.42)	(0.42)	(0.44)	(0.43)	(0.41)
Support by father		0.10**							0.07	0.06
		(0.04)							(0.04)	(0.04)
Support by mother			0.07						−0.03	−0.04
			(0.04)						(0.05)	(0.04)
Support by siblings				0.06					0.00	−0.00
				(0.04)					(0.04)	(0.04)
Support by friends					0.16***				0.07	0.06
					(0.04)				(0.04)	(0.04)
Support by team						0.22***			0.12*	0.11*
						(0.03)			(0.05)	(0.05)
Support by coach							0.21***		0.17***	0.15**
							(0.04)		(0.05)	(0.05)
Support by teacher								0.01	−0.15**	−0.16***
								(0.04)	(0.05)	(0.05)
Perceived competence										0.39
										(0.30)
Motives										0.60*
										(0.27)
Intercept	11.43*	11.23*	9.98*	10.39*	10.07*	9.30*	9.54*	11.40*	9.31*	7.95
	(4.47)	(4.44)	(4.55)	(4.52)	(4.40)	(4.28)	(4.32)	(4.48)	(4.30)	(4.34)
R-squared for between model	9.1×10^{-2}	8.9×10^{-2}	.11	9.9×10^{-2}	7.6×10^{-2}	.18	.15	8.7×10^{-2}	.24	.28
R-squared for within model	.13	.15	.14	.14	.17	.21	.2	.13	.25	.26

Table presents the regression coefficients and standard errors in brackets. The dummy variable 'school year' was used to model repeated measures; in the table, Year 3 represents the repeated measures.
Significance levels:
*$p < .05$.
**$p < .01$.
***$p < .001$.

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coaches ($B = 0.15$, $p < .001$), and PE teachers ($B = -0.16$, $p < .01$) continued to be significant predictors of adolescents' hours of participation in organized sports. Furthermore, motives ($B = 0.60$, $p < .05$) emerged as a significant predictor, while perceived competence ($B = 0.39$, $p = .197$) did not show statistical significance. The explained variance in this model (Between R-squared = 0.28) was slightly higher than in the previous model (Between R-squared = 0.24), suggesting only a marginal improvement in the model's predictive ability after adding the covariates.

In Models 5a-g and 6 (see Supplementary Table S1), we examined changes in the relationships between second and third year of secondary education by adding interaction terms between each source of social support and the school year of data collection. The models showed no significant changes over time in the relationships between the sources of social support and participation in organized sports. Furthermore, these models did not increase the explained variance compared to the previous models.

3.3 Types of social support

Table 5 presents the results of the multilevel linear fixed effects regression models for the types of social support. In Models 2a-g, we examined the relationships between the different types of social support and adolescents' hours of participation in organized sports. When added separately, all types of support except for modelling significantly predicted adolescents' hours of participation in organized sports. Specifically, adolescents who reported higher levels of emotional ($B = 0.41$, $p < .001$), esteem ($B = 0.41$, $p < .001$), informational ($B = 0.38$, $p < .001$), and instrumental support ($B = 0.85$, $p < .001$), and co-participation ($B = 0.52$, $p < .001$) spent more time in organized sports. The higher explained variance for the models including emotional (Between R-squared = 0.15) and instrumental support (Between R-squared = 0.15), compared to esteem (Between R-squared = 0.08), informational support (Between R-squared = 0.09), and co-participation (Between R-squared = 0.07), suggests that emotional and instrumental support are more robust predictors of adolescents' participation in organized sports compared to the other types of support.

In Model 3, where all types of social support were included simultaneously, esteem ($B = 0.28$, $p < .05$), and instrumental support ($B = 0.52$, $p < .05$), and co-participation ($B = 0.36$, $p < .001$) remained significant predictors of adolescents' hours of participation in organized sports. In contrast, emotional ($B = 0.10$, $p = 0.464$) and informational support ($B = -0.05$, $p = 0.716$) were no longer significant predictors while modelling emerged as a significant predictor in this model ($B = -0.37$, $p < .001$). Specifically, adolescents who reported higher levels of modelling spent less time in organized sports. Interestingly, the explained variance between individuals in this model was equal to that of the models including emotional and instrumental support alone (Between R-squared = 0.15). The similar explained variance suggests that the inclusion of additional types of support beyond emotional or instrumental support did not improve the model's ability to predict adolescents' participation in organized sports.

In Model 4, after adding the covariates perceived competence and motives, esteem ($B = 0.25$, $p < .05$), and instrumental support ($B = 0.43$, $p < .05$), co-participation ($B = 0.34$, $p < .01$), and modelling ($B = -0.37$, $p < .001$) continued to be significant predictors of adolescents' hours of participation in organized sports. Additionally, motives ($B = 0.65$, $p < .05$) was a significant predictor, whereas perceived competence ($B = 0.22$, $p = .468$) was not. The explained variance in this model (Between R-squared = 0.19) was slightly higher than in the previous model (Between R-squared = 0.15).

In Models 5a-g and 6 (see Supplementary Table S2), we examined changes in the relationships between second and third year of secondary education by adding interaction terms between each type of social support and the school year of data collection. The models showed no significant changes over time in the relationships between the types of social support and participation in organized sports. Furthermore, these models showed no improvement in the explained variance compared to the previous model.

3.4 Individual variability

Scatterplots were used to illustrate the relationships of the sources and types of social support with sports participation. Four representative scatterplots of these relationships are shown in Figures 1A–D, depicting coach support and instrumental support relative to hours spent in organized sports at both Year 2 and Year 3. On average, higher levels of coach and instrumental support were associated with more hours of sports participation (see Tables 4, 5). However, there was substantial variation between individuals. Some adolescents engage regularly in organized sports despite having low levels of social support, whereas others with low levels of support do no participate at all. Additionally, some adolescents participate rarely in organized sports despite high levels of social support, whereas others with high levels of social support participate regularly in organized sports. This variability indicates that the relationships between the sources and types of social support and sports participation are not uniform across individuals. Additional scatterplots illustrating these relationships can be found in the Supplementary Figures.

4 Discussion

Given the critical role of sports in promoting lifelong health and well-being, it is essential to understand the factors that influence adolescent sports participation, especially as it tends to decline during this period. To our knowledge, this study was the first to examine the association between different *sources* (i.e., father, mother, siblings, friends, teammates, coach, and PE teacher) and *types* (i.e., emotional, esteem, informational, instrumental, co-participation, modelling) of social support and

TABLE 5 Relationships between types of social support and organized sports participation.

	Model 1	Model 2a	Model 2b	Model 2c	Model 2d	Model 2e	Model 2f	Model 3f	Model 4
Age	−0.74*	−0.64*	−0.69*	−0.62	−0.49	−0.59	−0.73*	−0.59	−0.67*
	(0.32)	(0.31)	(0.31)	(0.32)	(0.31)	(0.31)	(0.32)	(0.31)	(0.31)
Boy	0.77**	0.81**	0.66*	0.76**	0.86**	0.77**	0.78**	0.65*	0.49
	(0.27)	(0.27)	(0.27)	(0.27)	(0.26)	(0.27)	(0.28)	(0.26)	(0.27)
Native	1.23**	0.95*	0.97*	1.10**	1.00*	1.17**	1.23**	0.82*	0.94*
	(0.41)	(0.40)	(0.40)	(0.40)	(0.40)	(0.40)	(0.41)	(0.39)	(0.39)
BMI	−0.05	−0.04	−0.04	−0.05	−0.06	−0.07	−0.05	−0.05	−0.06
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Sport (yes/no) in Year 1	2.30***	1.82***	1.71***	1.96***	1.85***	1.80***	2.30***	1.30**	1.09*
	(0.42)	(0.42)	(0.42)	(0.42)	(0.41)	(0.41)	(0.42)	(0.41)	(0.42)
Year 3	1.05*	0.88*	0.95*	0.93*	0.80	0.93*	1.04*	0.83*	0.91*
	(0.44)	(0.43)	(0.43)	(0.43)	(0.43)	(0.43)	(0.44)	(0.42)	(0.41)
Emotional support		0.41***						0.10	0.08
		(0.09)						(0.13)	(0.13)
Esteem support			0.41***					0.28*	0.25
			(0.08)					(0.13)	(0.13)
Informational support				0.38***				−0.05	−0.08
				(0.10)				(0.14)	(0.14)
Instrumental support					0.85***			0.52*	0.43*
					(0.15)			(0.21)	(0.21)
Co-participation						0.52***		0.36**	0.34**
						(0.10)		(0.12)	(0.12)
Modelling							0.02	−0.37***	−0.37***
							(0.09)	(0.10)	(0.10)
Perceived competence									0.22
									(0.31)
Motives									0.65*
									(0.27)
Intercept	11.43*	9.02*	9.87*	9.13*	7.19	9.05*	11.28*	8.29	7.52
	(4.47)	(4.40)	(4.36)	(4.44)	(4.39)	(4.36)	(4.52)	(4.29)	(4.36)
R-squared for between model	9.1×10^{-2}	.15	8.4×10^{-2}	9.2×10^{-2}	.15	7.3×10^{-2}	8.9×10^{-2}	.15	.19
R-squared for within model	.13	.17	.18	.16	.19	.19	.13	.24	.26

Table presents the regression coefficients and standard errors in brackets. The dummy variable 'school year' was used to model repeated measures; in the table, Year 3 represents the repeated measures.
Significance levels:
*$p < .05$.
**$p < .01$.
***$p < .001$.

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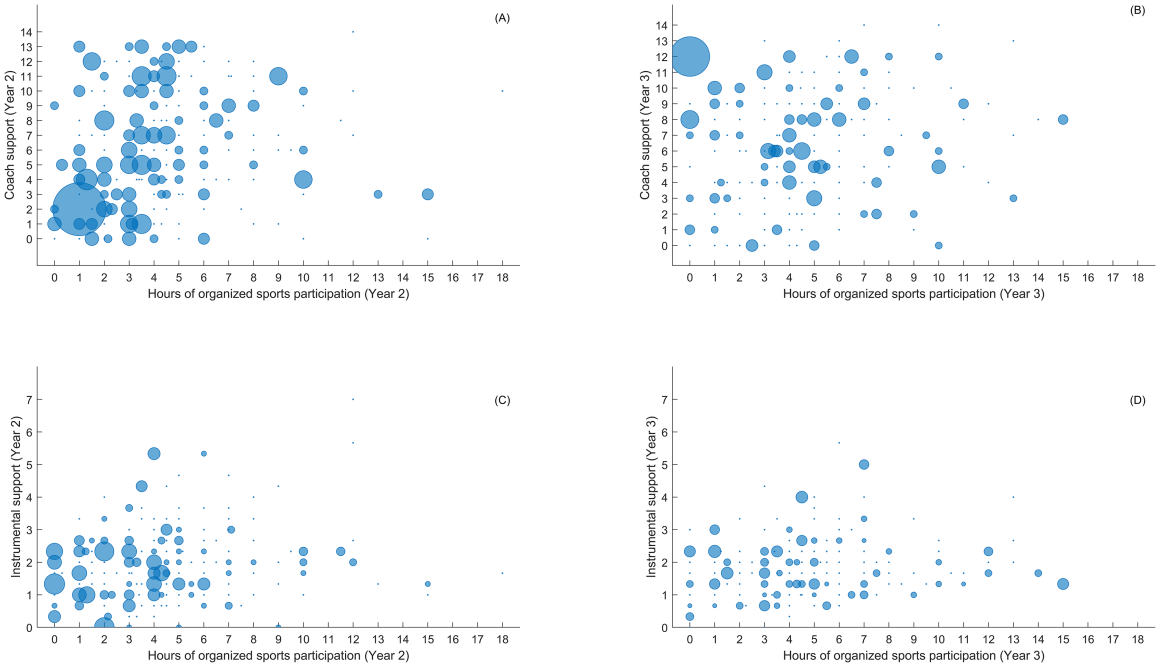

FIGURE 1
Individual variability in the relationship between sources and types of social support and hours of organized sports participation: **(A)** coach support at year 2, **(B)** coach support at year 3, **(C)** instrumental support at year 2, **(D)** instrumental support at year 3. The size of the circles in each panel reflects the number of participants, with the smallest circles representing 1 participant and the largest circles representing the maximum numbers of participants specific to each panel: 47, 35, 18, and 11 for panels A, B, C, and D, respectively.

adolescents' hours of participation in organized sports within a prospective study design. Our findings revealed significant relationships for various sources of social support and that social support from teammates and coaches consistently emerged as the strongest predictors of participation among adolescents in their second and third years of secondary education. Instrumental support also consistently predicted participation, while the relationships of the other types of support were smaller and less consistent. Additionally, we found that the relationships between the social support sources and types and sports participation remained stable over time between the second and third years of secondary education. Importantly, there was substantial individual variability, which indicates that the associations between the sources and types of social support and sports participation may not be uniform across all adolescents.

4.1 Sources of social support

Our results support previous research demonstrating the key role of teammates and coaches in adolescent sports participation (19, 21, 30, 48). Our findings also underscore the importance of additional sources of support (17). Specifically, although social support from parents, friends, siblings, and PE teachers appeared less significant, the combined impact of multiple sources was greater than the impact of each source individually. Notably, these relationships remained evident even after accounting for the covariates (i.e., motives and perceived competence). This highlights the need to consider multiple sources of social support to effectively promote organized sports participation.

Although earlier findings emphasized the positive influence of parental and peer support on adolescent sports participation (24), our results align with two studies indicating that teammates and coaches are more important than parents and friends during adolescence (19, 21). Specifically, the study of Chan et al. (21) indicated that while parents played a key role in childhood, the influence of teammates and coaches increased during adolescence. In a similar vein, the study by Gardner et al. (19) highlighted the central role of coaches and the less pronounced impact of parents and friends. Our study extends these insights by suggesting that the role of parents may be more general and less sport-specific, as they were reported as the primary sources of social support. Furthermore, we provide additional evidence that teammates, who are sometimes also friends, may play a more crucial role in sports participation compared to friends outside the sports environment. Overall, our findings suggest that sources within the sports environment—namely, teammates and coaches—play a more critical role in promoting sports participation among adolescents than those outside of this context.

Our study results further suggest a unique role for social support from PE teachers. Although PE teacher support alone was not significantly associated with organized sports participation, a negative relationship emerged when combined with other sources of support. Specifically, adolescents who spent

more time in organized sports reported lower levels of PE teacher support but higher levels of support from teammates and coaches. In contrast, individuals who spent less time in organized sports reported higher levels of PE teacher support and lower levels of teammate and coach support. These combined findings suggest that support from PE teachers may serve as a compensatory resource when support from teammates or coaches is lacking, which aligns with the idea that some supportive relationships can compensate for the absence of others (19). Moreover, our results suggest that PE teacher support might be more influential in stimulating physical activities outside of organized sports. This is consistent with research showing that PE teachers can play a more pronounced role in other forms of physical activity, such as non-organized sports, cycling, and walking (20, 31). Thus, while PE teacher support may be less critical for adolescents regularly participating in organized sports, it might play a significant role in encouraging physical activity beyond this context, particularly for individuals who are less engaged in organized sports. Nevertheless, PE teachers should be mindful of how their support influences adolescents who are already regularly participating, as they have a responsibility to provide support to all students, including those who are highly engaged in sports.

4.2 Types of social support

The positive relationships that our study revealed between emotional, esteem, informational, instrumental support, and co-participation with sports participation align with existing literature (18, 23, 24). Additionally, our study results support the idea that multiple types of social support play significant roles in encouraging sports participation (17, 18, 24, 30). Nevertheless, instrumental support emerged as the most crucial, both as an individual predictor and within the combined model, with a substantial explained variance. This underscores its strong and consistent relationship with organized sports participation (23, 24) and is perhaps not very surprising given that transport and financial support are essential components of organized sports. Unlike other types of physical activity, organized sports often require transportation to and from practices and games, as well as financial investments for equipment, uniforms, and participation fees. These requirements make instrumental support critical for sustained involvement in organized sports, highlighting why it had such a strong relationship with adolescents' participation.

The effects of the other types of social support were more equivocal and varied based on the presence of other support types. Emotional support was a relative strong predictor when considered individually but less influential when considered alongside other types of support. This suggests that the relationship of emotional support with sports participation might be overshadowed by other types of support. This contrasts with earlier research that found stronger relationships for emotional support compared to other types of support, including instrumental support (26). However, this previous research focused on general physical activity rather than organized sports. Studies specifically on organized sports pointed to a more significant role for instrumental support (23, 24). Thus, while emotional support is likely crucial for overall physical activity, instrumental support may be more important for organized sports.

For esteem support, informational support, co-participation, and modelling, we showed only minimal impact in the present study. However, modelling emerged as a noteworthy factor in adolescent sports participation. It was identified as significant in the combined model, with a negative relationship with sports participation. Adolescents who reported higher levels of modelling tended to spend less time in organized sports, whereas those with lower levels of modelling spent more time in organized sports. Together, these findings suggest that the influence of each type of support is both context-dependent and interconnected (17, 19). This underscores the complex nature of social support in shaping adolescents' sports participation, which might also explain previous inconsistencies regarding the relationships of these types of support (17, 26, 27, 49). Further research is warranted to clarify these interactions and better understand the relative importance of different types of social support for adolescent sports participation.

4.3 Individual variability

While regression analyses revealed multiple significant relationships, the scatterplots provided further insight into the complex and nuanced nature of these relationships. The substantial individual variability depicted by the scatterplots suggests that adolescents' organized sports participation is not uniformly related to their levels of social support. While some individuals engage extensively without support, others do not participate despite high levels of support. This underscores the importance to consider individual differences when interpreting the results and suggests that a one-size-fits-all approach to stimulating sports participation through social support may be insufficient. Understanding the complex interplay of various types of support on an individual level is crucial for developing more personalized and effective strategies to encourage sports engagement. Future research using mixed-methods approaches are needed to more fully capture the individual experiences and contexts that influence how social support affects sports participation among adolescents. This approach would lead to an even more comprehensive understanding of these relationships, identifying for whom social support is effective and for whom it is not, thereby informing more tailored sport participation programs.

4.4 Changes in the relationships over one year

Interestingly, the relationships of the sources and types of social support with organized sports participation remained stable over

the course of one year. This stability is notable given that adolescence is a period of significant individual (e.g., start of puberty) and environmental (e.g., new school, new peer groups) changes, which could potentially affect the relationship between social support and sports participation (50, 51). Evidence suggests that changes in social support can occur over periods of two years or more (32, 33), and these changes are associated with changes in physical activity levels (32). Our study builds on these findings by demonstrating that the strength of the relationship between social support and organized sports participation does not necessarily change over a shorter timeframe of one year. This suggests that while the amount of social support may vary, its impact on sports participation can remain stable. However, it is important to note that earlier studies examined longer durations, so our one-year study might have been insufficient to capture significant changes or may reflect a particularly stable period in adolescent development (33). To better understand how social support and organized sports participation interact, future research should consider tracking these factors over longer periods during adolescence.

4.5 Limitations

One limitation of the present study concerns the representativity of the sample. The high participation rate in organized sports among our participants, which ranged from 87%–88%, is considerably higher than the national average of 63% (8). This discrepancy may be partly due to the participating schools' emphasis on sports, which likely attracts students with higher engagement or motivation. Additionally, the sample included a low percentage of adolescents in pre-vocational secondary education (52), a group with generally lower sports participation rates (53). This limited representation may partly explain the higher rates of organized sports participation observed in our study. Future research should aim for a more representative sample, including more adolescents who do not participate in sports and/or are enrolled in pre-vocational secondary education.

Another limitation of our study involves the assessment of social support. We adapted the items related to emotional, esteem, informational, and instrumental support from previously validated questionnaires (28, 29). While these questionnaires effectively measure different types of social support, they do not distinguish between the sources of support. To address this, we included sources of social support but simplified the assessment by using binary items instead of frequency measures. This simplification aimed to reduce participant burden and minimize the time required for completing the assessment. However, this approach may have missed nuances in changes in social support and its relationship with sports participation, potentially impacting the depth of our results. Additionally, the use of single items to measure co-participation and modelling may have introduced limitations, as single-item measures often lack the depth and reliability of multi-item scales (see for example (54).

A third limitation of this study relates to the design and analysis of our data. We employed a longitudinal design to examine the relationships between the sources and types of social support and organized sports participation on two occasions over time. However, the relationships at both occasions were analyzed cross-sectionally, which precludes establishing causal relationships between the sources and types of social support and sports participation. Despite this limitation, the associations found in this study generally aligned with expected directions and underscored the relevance of different sources and types of social support, as well as the complex interactions between them. Further research using more robust longitudinal methodologies is warranted.

4.6 Future research

Our results revealed the complex role of social support in organized sports participation among adolescents. To better understand this complexity, future research should consider examining individual patterns more closely. This can be achieved by integrating both qualitative and quantitative approaches. Qualitative approaches can help identify the most significant combinations of sources and types of social support (17, 18, 26), which is crucial for the design of questionnaires that are both comprehensive and manageable. They are also crucial to identify which individuals would benefit from social support for sports participation and which do not. They enable researchers to explore the nuanced effects of non-modifiable factors like ethnicity and gender, as well as modifiable factors like motives and perceived competence. Complementing qualitative approaches, quantitative methods should prospectively track changes in social support and sports participation throughout adolescence. This comprehensive approach could guide interventions by targeting the most effective sources and types of social support tailored to individual patterns, thereby promoting sports participation among adolescents.

4.7 Practical implications

Based on our findings, we offer several practical recommendations for supporting adolescents in organized sports participation. These suggestions focus on the critical role of professionals in sports and PE settings. First, professionals in these environments should be mindful of individual differences among adolescents and tailor their approaches accordingly. To do so effectively, we advise that they engage directly and regularly with students during sports training, competitions, and PE lessons (55). Second, we highlight the essential responsibility of coaches and trainers, and suggest that they should be equipped with the pedagogical skills needed to foster a positive team culture and build strong relationships (56, 57). These practices can contribute to both effective team and coach support. Third, given the critical importance of instrumental support, it is crucial to assist adolescents whose parents are

unable or unwilling to provide this type of support. PE teachers can play a pivotal role for these adolescents as they interact with all students regularly through school and PE classes, positioning them uniquely to identify those lacking instrumental support. An important first step, therefore, is for teachers to gain a clear understanding of their students' involvement in sports. Once they identify those facing barriers due to insufficient instrumental support, teachers can connect them with available resources, such as financial assistance for sports fees. Additionally, PE teachers can collaborate with local municipalities and sports clubs to develop inclusive programs that address the financial and logistical barriers families often face. By adopting these practices, sports and PE professionals may help create supportive environments that foster long-term sports participation.

5 Conclusions

This study enhances our understanding of the role of social support in organized sports participation among adolescents. Our results highlight the importance of social support from multiple sources, with teammates and coaches emerging as particularly influential. Furthermore, instrumental support was identified as a crucial type of social support, while the role of other types of social support appeared more nuanced. Notably, the significance of specific sources and types of social support varies among individuals, which indicates that a one-size-fits-all approach may not be effective. It is therefore essential to promote social support from within the sports environment and to encourage instrumental support, while also recognizing the need for tailored approaches that address individual differences. Future research should explore the individual differences and the complex interactions among different sources and types of social support using mixed methods and prospective designs. Such research could inform interventions strategies that stimulate continuous participation and prevent dropout in youth sports.

Data availability statement

The original datasets presented in the study are publicly available. This data can be found here: https://doi.org/10.17026/SS/LA3KIZ.

Ethics statement

The studies involving humans were approved by Ethics Committee of the Faculty of Social Sciences at Radboud University (ECSW-2020-107). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

GS: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. FV: Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. SP: Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. MD: Conceptualization, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. BS: Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fspor.2025.1499693/full#supplementary-material

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The impact of social exclusion on experiential sports consumption: the chain mediating roles of loneliness and the need for social connection

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Introduction: With the advancement of the social economy, sports consumption has shifted from traditional material-based purchases to experiential sports consumption, emphasizing psychological engagement and emotional fulfillment. However, the psychological mechanisms behind experiential sports consumption remain underexplored, especially in the context of social exclusion.

Methods: This study is grounded in social exclusion theory, constructing a conceptual model where social exclusion is the independent variable, experiential sports consumption intention is the dependent variable, and loneliness and the need for social connection serve as mediators. A survey was conducted with 415 valid responses, and data were analyzed using structural equation modeling and the Bootstrap method to examine the relationships among the variables.

Results: The findings indicate that social exclusion significantly and positively predicts the intention to engage in experiential sports consumption. It also has a significant positive effect on loneliness and the need for social connection. However, loneliness does not mediate the relationship between social exclusion and experiential sports consumption intention, while the need for social connection does. Furthermore, a chain mediation effect exists between loneliness and the need for social connection in the relationship between social exclusion and experiential sports consumption intention.

Discussion: These results suggest that sports organizations and enterprises should design socially engaging activities that strengthen social connections and alleviate feelings of exclusion. This study enriches the theoretical understanding of social exclusion and its impact on experiential sports consumption, providing practical insights for enhancing social inclusion through sports.

KEYWORDS

social exclusion, experiential sports consumption, loneliness, need for social connection, sports consumption

1 Introduction

The fast-paced nature of modern society has intensified the prevalence of social exclusion (Pang et al., 2024). This phenomenon often leads to psychological imbalances and prompts individuals to seek relief from this discomfort through specific consumption behaviors (Mead et al., 2011). Against this backdrop, experiential sports consumption may serve as a significant lifestyle choice to mitigate the effects of social exclusion (Matte et al., 2024). Experiential sports consumption is a form of consumption in which

individuals directly participate in or engage in sports activities to achieve psychological involvement, emotional satisfaction, and social connection. For example, participating in fitness classes or sports events can help individuals alleviate psychological stress, improve social relationships, and generate lasting wellbeing (Andersen et al., 2019).

Compared to material sports consumption, experiential sports consumption is more unique and irreplaceable (Shank and Lyberger, 2014). It is also less likely to lead to regret among sports consumers (Decrop and Derbaix, 2010) and can provide them with higher and more enduring levels of wellbeing (Armbrecht and Andersson, 2020). The superiority of experiential sports consumption stems from the inherently social nature of sports activities (Yang et al., 2022). Previous research has extensively demonstrated that participation in sports activities can reduce the adverse effects of social exclusion (Dagkas, 2018; Herrmann, 2016), as well as the influence of social exclusion on conspicuous consumption (Lee and Shrum, 2012), green consumption (Guo et al., 2020), compensatory consumption (Rawat et al., 2022), and prosocial behaviors (Knowles and Gardner, 2008). However, the relationship between social exclusion and intention to consume sports remains inconclusive, particularly concerning the lack of in-depth exploration of its psychological mechanisms. For instance, studies have shown that experiential consumption behaviors, such as sports spectatorship, fitness and leisure activities, and sports tourism, can improve social relationships and serve as effective interventions to reduce feelings of social exclusion (Armbrecht and Andersson, 2020; Jiang et al., 2021; Sirgy et al., 2017), the psychological mechanisms and pathways through which social exclusion influences the intention to engage in experiential sports consumption remain unclear. This gap hinders a deeper understanding of its mechanisms and limits the application of related theories in practice.

The sports consumption behaviors triggered by social exclusion reflect individuals' coping strategies to alleviate the threat to their basic psychological needs (Shank and Lyberger, 2014). The Need-Threat Model suggests that social exclusion threatens individuals' basic psychological needs, compelling them to adopt behavioral strategies to alleviate the psychological discomfort caused by these threatened needs (Williams, 2009). For sports consumers, social exclusion may weaken interpersonal relationships, leading to feelings of loneliness (Wang et al., 2022) and prompting individuals to focus more on the need for social connection in sports consumption as a way to cope with this psychological threat (Cacioppo, 2008). Accordingly, based on the Need-Threat Model, this study constructs a relational model involving social exclusion, loneliness, the need for social connection, and experiential sports consumption. It aims to uncover the underlying mechanisms, extend the application of social exclusion theory in sports consumption, and provide empirical evidence and theoretical guidance for relevant practices.

2 Literature review

2.1 Experiential sports consumption

Based on differences in the purpose of sports consumption, sports consumption behaviors can be divided into two categories: material sports consumption and experiential sports consumption (Matte et al., 2024). Material sports consumption focuses on acquiring tangible sports goods like apparel or equipment, whereas experiential sports consumption emphasizes intangible experiences, such as watching events, fitness activities, or sports training (Baker et al., 2018). Current research generally defines experiential sports as a series of activities that use sports as a medium, involve participation in an experience as the primary form, and aim to promote physical and mental wellbeing.

Experiential sports consumption behaviors, such as watching sports competitions, are often positively associated with psychological states such as a sense of belonging (Jang et al., 2021), social interaction (Wann et al., 2011), self-concept (Bartsch et al., 2018), life satisfaction (Inoue et al., 2017), and wellbeing (Pawlowski et al., 2014). Experiential sports consumption's strong social attributes enhance social relationships by providing opportunities for self-expression and social identification (McDonald and Karg, 2014; Inoue et al., 2017). Even watching sports live streams via online digital platforms can offer viewers a social connection (Waycott et al., 2019), team identity (Yoshida et al., 2018), avenues for expressing opinions (Giglietto et al., 2016), and an escape from reality (Lin et al., 2016) through digital interaction. Under the framework of social identity theory, consumers can reinforce their identity while establishing deeper social connections through participation in symbolic sports activities. For example, in gym settings, consumers interact with others and the environment, enhancing emotional satisfaction and behavioral intentions (Sevilmis et al., 2024).

In terms of self-concept, personal characteristics can influence behavioral preferences. For instance, Baker et al. (2018) demonstrated that consumers' traits affect their satisfaction with sports activities and their likelihood of repeated participation in experiential sports consumption (Baker et al., 2018). Additionally, experiential sports consumption tends to create unique emotional experiences or memories, which, in turn, play a more significant role in shaping self-concept. For example, watching the Paralympic Games fosters empathy and compassion, encouraging prosocial attitudes toward individuals with disabilities (Bartsch et al., 2018).

Regarding wellbeing, existing research indicates that the lasting sense of happiness or satisfaction that sports consumers derive from experiential sports consumption (such as attending live games or participating in sports tourism) is significantly higher than that from material sports consumption (such as purchasing sports apparel or equipment; Armbrecht and Andersson, 2020; Sirgy et al., 2017; Tang and Wang, 2021). There are three main reasons for this phenomenon: (1) experiences are more capable than material wealth of shaping a person's identity and taste (Song et al., 2022); (2) compared to sports products, sports experiences are less likely to trigger negative emotions stemming from social comparison (Carter and Gilovich, 2010); (3) experiential sports consumption is more effective in fostering a sense of social connection (Kumar et al., 2024).

Despite extensive research on experiential sports consumption, the psychological mechanisms underpinning consumer intentions remain underexplored, particularly the roles of social exclusion, loneliness, and social connection.

2.2 Social exclusion

Social exclusion is the emotional state in which individuals feel ignored, rejected, or isolated by other individuals or social groups (Williams, 2009). According to the Need-Threat Model, social exclusion, as an unpleasant experience, threatens or undermines four basic psychological needs: the need for belonging, control, self-esteem, and a sense of meaning in life (Freedman et al., 2016; Williams, 2009). It also affects individuals' cognition, emotions, and behaviors in multiple ways (Mourey et al., 2017). Compared to self-determination theory, which emphasizes the role of individuals' positive needs in driving behavior, the Need-Threat Model focuses more on the impairment of psychological needs in adverse situations and their behavioral consequences, making it more suitable for studying the context of social exclusion.

To buffer against the need for threats caused by social exclusion, individuals typically adopt new behaviors or adjust existing ones to cope with the crisis of exclusion, and consumption behavior is one effective strategy for alleviating the effects of social exclusion (Mead et al., 2011). Research suggests that, compared to those not experiencing exclusion, socially excluded individuals are more willing to establish new connections with different social groups (Maner et al., 2007) and are more sensitive to the goal of gaining social acceptance and achieving a sense of belonging (DeWall et al., 2009). Consequently, they are more likely to follow others' opinions in their consumption behaviors, adopting choices that align with group preferences (Williams et al., 2000). They are also more inclined to select products with specific characteristics or symbolic meanings, such as a preference for conspicuous consumption (Lee and Shrum, 2012), green consumption (Guo et al., 2020), anthropomorphic products (Liu et al., 2022), unique products (Wan et al., 2014), and nostalgic products (Kim et al., 2023).

Based on the Need-Threat Model, numerous scholars have begun exploring how individuals respond to social exclusion by engaging in various behaviors to alleviate their threatened psychological needs (Williams, 2009). For example, in terms of brand choice, excluded individuals tend to select brands favored by groups that might accept them, thereby increasing their similarity to the group and re-establishing social connections and a sense of belonging (White and Argo, 2009). Interestingly, in cases where the desired brand is a luxury brand, socially excluded consumers' purchasing intention increases when sales staff exhibit exclusionary behavior (Ward and Dahl, 2014).

Regarding prosocial consumption behaviors, socially excluded individuals may engage in prosocial acts, such as helping others or donating to charity, to attract positive attention and gain others' approval (Knowles and Gardner, 2008), thereby restoring interpersonal belongingness (Lakin and Chartrand, 2003). However, socially excluded individuals whose efficacy needs are threatened may also exhibit negative behavioral responses, such as reducing donations, volunteering, or cooperation with others (Twenge et al., 2007).

In sports studies, it has been further pointed out that leisure sports activities, as a form of social interaction, may be disrupted when individuals experience exclusion or rejection from peers (Collins, 2004). Conversely, empirical studies have shown that sports can enhance peer interaction, improve social relationships, and reduce social exclusion (Herrmann, 2016). However, existing studies mainly focus on general sports participation, with limited exploration of how social exclusion drives experiential sports consumption by threatening basic psychological needs. This study aims to reveal the psychological mechanisms behind this process further.

2.3 Loneliness

Loneliness is a negative subjective emotional experience that arises when individuals feel their social or emotional relationships are unmet or fall short of expectations (Trucharte et al., 2023). Loneliness is prevalent across all age groups (Matthews et al., 2022), and individuals with varying levels of loneliness exhibit different behavioral and psychological responses toward social interactions and social needs (Berezan et al., 2020).

Loneliness is a prolonged emotional stressor, with various factors contributing to its onset. Some of the main perspectives are as follows: From a social psychology perspective, loneliness tends to arise when trusted interpersonal relationships, such as family, friendship, or romantic connections, fail to meet an individual's expected level of social interaction (Pittman and Reich, 2016). Hofman et al. (2022) highlighted that individuals with characteristics such as low income, low education, unemployment, single status, living alone, immigrant background, poor health, or chronic illness are more prone to experiencing higher levels of loneliness (Hofman et al., 2022). Andrew and Meeks (2018) pointed out that an individual's perceived sense of personal control significantly negatively impacts the intensity of their loneliness (Andrew and Meeks, 2018). Social comparison is another critical factor; upward social comparison (comparing oneself to those better off) tends to increase loneliness, while downward social comparison (comparing oneself to those worse off) can alleviate it (Arnold et al., 2021).

Most literature emphasizes that loneliness is an aversive psychological experience typically associated with adverse outcomes, such as weakened immune function (Pressman et al., 2005), a sense of loss of control (Stavrova et al., 2022), and diminished wellbeing (Becker et al., 2021). Loneliness has a complex impact with potential positive value. According to evolutionary theory, it heightens self-focus and threat sensitivity (Hofman et al., 2022). Under social exclusion, individuals show greater interest in forming new friendships, more positive impressions of others, and an increased willingness to share rewards (Maner et al., 2007). Moreover, individuals may adopt specific consumption behaviors to cope with loneliness. Research on online consumption has found that products with many positive reviews only appeal to non-lonely consumers. In contrast, such reviews might be counterproductive for consumers experiencing high levels of loneliness due to their lack of social connection (Wang et al., 2012).

Moreover, studies have shown that individuals with high levels of loneliness, due to a lack of real-life social connections, tend to seek symbolic connections through product consumption. For instance, they prefer second-hand products, which can establish a

symbolic link between the current and previous owners (Huang and Fishbach, 2021). In the realm of sports studies, it has been noted that sports activities can serve as effective interventions to improve wellbeing and alleviate loneliness. Attending live sports events, for example, can significantly enhance sports consumers' sense of wellbeing and reduce feelings of loneliness (Keyes et al., 2023). Furthermore, Oshimi et al. (2023) found that sports activities (including moderate- and high-intensity activities) and passive sports participation (such as watching sports events) indirectly reduce loneliness by enhancing individuals' eudaimonic wellbeing (Oshimi et al., 2023). However, existing research has yet to thoroughly examine the specific mechanisms of loneliness in sports consumption, mainly whether loneliness influences consumers' preferences and choices in sports consumption. This presents an important direction for future research.

2.4 Need for social connection

Social connection refers to an individual's subjective perception of the intimacy level in their interpersonal relationships (Maner et al., 2007), while the need for social connection reflects the desire to fulfill feelings of companionship, belonging, and connection through interactions with others or being part of a specific group (Vella-Brodrick et al., 2023). Individuals with a high need for social connection are likelier to engage in group activities, while those with a low need tend to avoid social opportunities (Lee et al., 2001).

The need for social connection is often directly influenced by an individual's subjective perceptions. When these perceptions are disrupted or diminished, individuals may experience a sense of social disconnection (Cacioppo, 2008). Specifically, social disconnection is closely linked to a range of psychological states, including social anxiety, low self-esteem, low agreeableness, and poor social skills. When individuals perceive social disconnection, they will likely experience a heightened need for social connection (Lim et al., 2016). Additionally, research has pointed out that social exclusion can significantly affect an individual's need for social connection. In such contexts, the basic psychological needs of excluded individuals, especially their need for social connection, may be substantially undermined.

Individuals may engage in compensatory behaviors to alleviate the distress caused by unmet social connection needs. For instance, they may actively seek out social connections, imagine essential relationships, or increase their attention to social cues in their environment. Moreover, individuals may turn to specific consumption behaviors for compensation. For example, they might purchase anthropomorphic brands or products and form connections with these human-like brands or items to satisfy their need for social connection (Chen et al., 2017). Individuals with a strong need for social connection also focus more on their role within a group and seek to maintain their ties to the community by engaging in actions beneficial to the group, such as green consumption (Do and Do, 2024).

Sports studies emphasize that sports consumption is typically associated with motives of pure entertainment (Hall and Zwarun, 2012). However, experiential sports consumption is often connected to deeper meanings, such as fostering connections between individuals (Rogers, 2018). This explains why many people consume sports even if they do not particularly enjoy it. For instance, although unfavorable game outcomes may cause negative emotions, many spectators still attend events because the experience provides an opportunity to connect with family or friends, helping to satisfy their need for social connection (Jang et al., 2017). Similarly, studies on sports event tourism highlight that these activities offer extensive social opportunities for participants, as they are often shared experiences that allow for broader social interaction during the event (Green and Jones, 2005), shifting participants' focus from competition to social engagement (Kaplanidou and Vogt, 2010).

In summary, existing literature underscores that consumers can fulfill their need for social connection through consumption choices. However, whether the need for social connection influences sports consumers' intention to engage in experiential sports consumption remains to be explored. Therefore, this study will further examine the mechanisms by which the need for social connection impacts the intention to engage in experiential sports consumption through empirical analysis.

3 Research hypotheses

3.1 Hypothesis on social exclusion and intention to engage in experiential sports consumption

Experiential sports consumption has strong social and interpersonal attributes. Its high level of social interaction and conversational value (Chanavat and Bodet, 2014) encourages individuals to share experiences (Yazici et al., 2017), making it more effective than material sports consumption in fostering social relationships, alleviating psychological crises caused by social exclusion, and enhancing subjective wellbeing (Gilovich and Gallo, 2020). For instance, experiential sports consumption behaviors such as sports tourism, spectating, and outdoor adventures are designed to encourage social connections and interpersonal interactions. Deepening these interactions helps increase interpersonal intimacy and foster positive social relationships for those who feel excluded.

Moreover, based on the theory of compensatory consumption behavior, individuals may engage in specific consumption behaviors to compensate for the psychological needs that have been threatened (Mandel et al., 2017). In the context of sports consumption, social exclusion may undermine self-concept, while participating in experiential sports can enhance self-identity, expand social networks, and restore social cohesion. In summary, experiential sports consumption can effectively foster social relationships, reduce psychological crises, and improve the wellbeing of those who experience exclusion. Thus, excluded individuals are more inclined to consume experiential sports to compensate for their threatened psychological needs. Based on this, the following hypothesis is proposed:

H1: Social exclusion has a significant positive effect on the intention to engage in experiential sports consumption.

3.2 The mediating role of loneliness

Loneliness is an individual's subjective perception of social isolation, typically triggered by having fewer social relationships than expected or lacking the desired level of intimacy in relationships (Gierveld and Van Tilburg, 2010). Existing studies have shown that failing to establish social connections can lead to a range of adverse psychological effects, such as loneliness, disappointment, and anxiety (Wolters et al., 2023). Wang et al. (2022) also pointed out that social exclusion easily triggers feelings of loneliness, as rejection by others disrupts an individual's expectations of interpersonal relationships, resulting in a psychological gap that intensifies feelings of loneliness (Wang et al., 2022).

Loneliness is both a direct result of social exclusion and a key driver of behavioral adjustments. It motivates individuals to escape isolation and seek social integration. Studies show that lonely consumers prefer socially oriented consumption to fulfill their interaction needs (Huang and Li, 2023). Experiential sports consumption is more effective in building positive social relationships than material sports consumption. This is because experiential sports consumption provides individuals with more opportunities to interact with others (Zhong and Mitchell, 2010) and enhances their wellbeing through these interactions (Oh et al., 2022), further reducing the harmful effects of loneliness. In summary, to mitigate the negative emotional experiences brought on by social exclusion (e.g., low self-esteem, loneliness), sports consumers may adjust their behavior and develop compensatory motivations (such as a greater intention to engage in experiential sports consumption; Adie et al., 2008) to regain healthy social relationships and achieve a more positive psychological state (Maner et al., 2007). Based on this, the following hypotheses are proposed:

H2-1: Social exclusion has a significant positive effect on loneliness.

H2-2: Loneliness has a significant positive effect on the intention to engage in experiential sports consumption.

H2-3: Loneliness mediates the relationship between social exclusion and the intention to consume experiential sports.

3.3 The mediating role of the need for social connection

According to the social monitoring system theory, social exclusion threatens individuals' sense of belonging, prompting them to search for cues that help them reintegrate (Pickett et al., 2004). When an individual experiences social exclusion, their sense of social connection is significantly threatened, leading to numerous adverse psychological effects. To satisfy their social needs (including self-esteem and a sense of belonging), individuals become more motivated to seek ways to establish closer ties with society (Mead et al., 2011). Research has found that when the need for social connection is unmet, individuals pay greater attention to social behaviors (Gardner et al., 2005) and are more willing to rebuild social relationships through socially-oriented consumption, thereby improving weak social connections.

In the context of sports consumption behavior, experiential sports consumption inherently possesses solid social attributes. Existing research indicates that watching sports events with friends provides enjoyable experiences and helps establish or maintain friendships and social connections, enhancing leisure quality (Zhong and Mitchell, 2010). Even when watching live sports events through social TV, the participatory experience fosters interaction, emotional exchange (Rejikumar et al., 2022), and content sharing, fulfilling the need for social connection. Additionally, a study on skiing and golf leisure activities found that consumers engage in these activities for inherent pleasure and to establish and maintain friendships and social connections, enhancing their social and leisure quality of life (Song et al., 2022). In summary, sports consumers who perceive social exclusion will likely experience a heightened need for social connection. They may engage in experiential sports consumption activities with vital social attributes to rebuild their social relationships. Based on this, the following hypotheses are proposed:

H3-1: Social exclusion has a significant positive effect on the need for social connection.

H3-2: The need for social connection has a significant positive effect on the intention to engage in experiential sports consumption.

H3-3: The need for social connection mediates the relationship between social exclusion and the intention to engage in experiential sports consumption.

3.4 The chain mediating role of loneliness and the need for social connection

When social exclusion occurs, individuals perceive their interactions or emotional connections with others as falling short of expectations, leading to feelings of loneliness (Wang et al., 2022). Loneliness is a subjective experience of lacking social connections, further triggering the desire to rebuild social relationships and enhancing the need for social connection (Satici et al., 2016). Loneliness not only serves as a direct result of social exclusion, but may also be an important driver of individual behavioral adjustment (Burholt et al., 2020). It provides a critical path to compensate for the psychological damage caused by social exclusion by deepening the individual's desire for social connection. According to self-determination theory, intrinsic needs drive all behavior and activity (Gilal et al., 2019). Individuals' needs shape their psychology and attitudes toward sports consumption services and directly influence their consumption processes and behaviors (Funk et al., 2012). For example, material needs reflect the value demands for the functional attributes of sports products. In contrast, the need for social connection reflects the value demands for the social qualities of sports and leisure activities (Jang et al., 2021).

Based on the theory of compensatory consumption behavior, lonely consumers driven by the desire for social connection may directly seek social interactions to alleviate their loneliness (Kim and Gal, 2014). Rippé et al. (2018) confirmed this, showing that consumers experiencing social and emotional loneliness actively seek social experiences, such as visiting brick-and-mortar

stores to communicate with sales staff (Rippé et al., 2018). Self-determination theory suggests that social exclusion drives loneliness and anxiety, prompting individuals to seek substitutes for unmet needs and fostering behaviors aimed at social support and connection. Experiential sports consumption is more likely than material consumption to provide opportunities for social interaction, creating a better sense of belonging and social connection (Keyes et al., 2023). For example, for older adults, participating in local sports team events can increase emotional support and fulfill their need for belonging, thereby improving their subjective wellbeing (Inoue et al., 2020). Similarly, e-sports enthusiasts' primary reason for participating in e-sports is to positively influence existing social relationships and foster and maintain interpersonal connections within online communities (Qian et al., 2022).

In summary, social exclusion may intensify loneliness and heighten the desire for social connection. This leads to the hypothesis that consumers will be more inclined to choose experiential sports consumption for social interaction and a sense of belonging. Based on this, the following hypotheses are proposed:

H4-1: Loneliness has a significant positive effect on the need for social connection.

H4-2: Loneliness and the need for social connection mediate the relationship between social exclusion and the intention to engage in experiential sports consumption.

In conclusion, this study develops a conceptual model of the impact of social exclusion, loneliness, and the intention to engage in experiential sports consumption. The relationships between these variables are illustrated in Figure 1.

4 Research design

4.1 Research subjects and sample

To further explore the impact of social exclusion on the intention to engage in experiential sports consumption, this study employed a survey method for data collection. To ensure the reliability and objectivity of the data, the survey emphasized that all data would be used solely for academic research purposes and that there were no right or wrong answers—respondents were encouraged to answer based on their experiences.

First, a pilot survey was conducted through an online questionnaire, with 100 questionnaires distributed and 97 returned. Of these, 89 were valid, resulting in an effective response rate of 91.75%. After statistical analysis, the reliability and validity of all scales used in the pilot survey were confirmed, allowing them to be used in the formal study.

For the formal survey, 200 paper questionnaires were distributed in person, and 300 questionnaires were distributed online, resulting in 500 questionnaires. A total of 486 responses were collected. Based on the criteria for identifying invalid questionnaires (such as excessively short response times, highly consistent answers, or missing answers), 71 invalid responses were excluded, leaving 415 valid questionnaires with an effective response rate of 85.39%. Descriptive statistics for the valid sample are provided in Table 1.

4.2 Research instruments

The scales used in this study were sourced from widely published and frequently utilized scales in major domestic and international journals. To ensure the scale's applicability to the sports consumption context, the research team used bidirectional translation to ensure semantic accuracy and refined the items through expert discussions, enhancing clarity and contextual relevance. The formal scale measured four key variables: social exclusion, loneliness, the need for social connection, and the intention to engage in experiential sports consumption. All items were rated on a 7-point Likert scale, where 1 indicated "strongly disagree" and 7 indicated "strongly agree."

4.2.1 Social exclusion

The measurement of social exclusion was adapted from previously developed social exclusion scales (Carter-Sowell, 2010), which include two dimensions: rejection and neglect. The scale comprises eight items, such as "During sports participation, I feel excluded by the people around me from their group." The scale uses a 7-point Likert scale, where 1 indicates "strongly disagree" and 7 indicates "strongly agree," with higher scores representing more significant levels of social exclusion. Confirmatory factor analysis

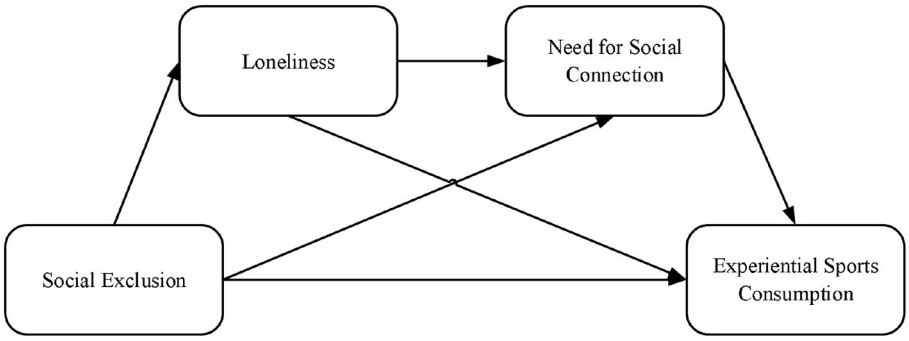

FIGURE 1
Conceptual model diagram.

TABLE 1 Descriptive statistics of the sample.

Statistical variable	Category	Frequency	Percentage (%)
Gender	Male	200	48.2
	Female	215	51.8
Age	Under 25 years	91	21.9
	25–35 years	114	27.5
	36–45 years	113	27.2
	Over 45 years	97	23.4
Education level	High school or below	72	17.3
	Associate degree	118	28.4
	Bachelor's degree	172	41.4
	Master's degree or above	53	12.8
Monthly income	3,000 or below	91	21.9
	3,001–5,000	113	27.2
	5,001–8,000	115	27.7
	Above 8,000	96	23.1
Monthly sports consumption expenditure	200 or below	103	24.8
	200–500	122	29.4
	500–1,000	115	27.7
	Above 1,000	75	18.1

showed that the standardized factor loadings for all items ranged between 0.790 and 0.831, indicating good structural validity for this scale. In this study, the Cronbach's α for this scale was 0.941.

4.2.2 Loneliness

The measurement of loneliness was based on the ULS-8 loneliness scale developed by Russell et al. (1980) and later adapted by Hays and Dimatteo (1987). The scale includes eight items, such as "I often feel like I lack companionship." A 7-point Likert scale was used, where 1 indicated "strongly disagree," and 7 indicated "strongly agree," with higher scores representing higher levels of loneliness. Confirmatory factor analysis showed that the standardized factor loadings for all items ranged from 0.747 to 0.832, indicating good structural validity. In this study, the Cronbach's α for this scale was 0.930.

4.2.3 Need for social connection

The measurement of the need for social connection was adapted from the research conducted by Han et al. (2015). The scale consists of four items, such as "I really want to engage in activities with others." A 7-point Likert scale was used, where 1 indicated "strongly disagree," and 7 indicated "strongly agree," with higher scores representing a more substantial need for social connection. Confirmatory factor analysis showed that the standardized factor loadings for all items ranged from 0.810 to 0.829, indicating good structural validity. In this study, the Cronbach's α for this scale was 0.891.

TABLE 2 Validation factor model fit.

Indicators	χ^2/df	RMR	GFI	AGFI	TLI	CFI	RMSEA
Results	1.101	0.086	0.949	0.938	0.996	0.996	0.016
Standards	<3	<0.1	>0.9	>0.9	>0.9	>0.9	<0.05
Situation	Fit	Fit	Fit	Fit	Fit	Fit	Fit

4.2.4 Intention to engage in experiential sports consumption

The measurement of the intention to engage in experiential sports consumption was adapted from the Experiential Buying Tendency Scale (EBTS) developed by Howell et al. (2012). The scale includes four items, such as "If I had enough money, I would prefer to spend it on sports experiences (e.g., sports tourism, attending sports events) rather than purchasing tangible sports products (e.g., sportswear)." The translated items were further refined through expert discussions to enhance their relevance to the context of sports consumption. A 7-point Likert scale was used, where 1 indicated "strongly disagree" and 7 indicated "strongly agree." Except for the reverse-scored fourth item, higher scores represented a stronger intention to engage in experiential sports consumption. Confirmatory factor analysis showed that the standardized factor loadings for all items ranged from 0.807 to 0.833, indicating good structural validity. In this study, the Cronbach's α for this scale was 0.893.

5 Results and analysis

5.1 Common method bias test

This study employed Harman's single-factor test to examine common method bias in the questionnaire data. This method integrates all questionnaire items for exploratory factor analysis to assess whether potential standard method bias affects the research results. The unrotated principal component analysis revealed four factors, with the first factor explaining 23.72% of the variance, well below the recommended threshold of 40%, indicating that the data in this study does not suffer from significant standard method bias.

5.2 Structural equation model testing

This study utilized AMOS 24.0 software to analyze the structural equation model. First, the model's goodness-of-fit was tested, and the results indicated a good fit, with specific values and reference standards shown in Table 2. Based on this, path analysis was conducted to evaluate the relationships between social exclusion, loneliness, the need for social connection, and the intention to engage in experiential sports consumption by examining the path coefficients between variables (see Table 3).

TABLE 3 Path analysis results.

Hypothesis	Path	Standardized path coefficient	*T*-value	*P*-value	Test result
H1	SE→IESC	0.246	4.550	$P < 0.001$	Supported
H2-1	SE→Lon	0.374	7.023	$P < 0.001$	Supported
H2-2	Lon→IESC	0.065	1.202	$P = 0.229$	Not supported
H3-1	SE→NSC	0.220	4.053	$P < 0.001$	Supported
H3-2	NSC→IESC	0.315	5.538	$P < 0.001$	Supported
H4-1	Lon→NSC	0.294	5.330	$P < 0.001$	Supported

SE, Social Exclusion; IESC, Intention to Engage in Experiential Sports Consumption; Lon, Loneliness; NSC, Need for Social Connection.

The main effects of this study are illustrated in Figure 2, where path analysis clearly demonstrates the significant relationships between social exclusion, loneliness, the need for social connection, and the intention to engage in experiential sports consumption. Specifically, social exclusion has a significant positive impact on the intention to engage in experiential sports consumption ($\gamma = 0.246$, $P < 0.001$), loneliness ($\gamma = 0.374$, $P < 0.001$), and the need for social connection ($\gamma = 0.220$, $P < 0.001$), confirming the validity of hypotheses H1, H2-1, and H3-1. This indicates that individuals with stronger feelings of social exclusion are more likely to engage in experiential sports consumption to alleviate negative emotions and seek psychological compensation through loneliness and the need for social connection. However, loneliness does not significantly affect the intention to engage in experiential sports consumption ($\gamma = 0.065$, $P > 0.05$), meaning hypothesis H2-2 is not supported. This suggests that while loneliness reflects an individual's lack of social connection, its direct impact on driving the intention to engage in experiential sports consumption is relatively limited. Additionally, the need for social connection significantly positively affects the intention to engage in experiential sports consumption ($\gamma = 0.315$, $P < 0.001$), supporting hypothesis H3-2. Finally, loneliness significantly impacts the need for social connection ($\gamma = 0.294$, $P < 0.001$), confirming hypothesis H4-1. This indicates that individuals with stronger feelings of loneliness are more likely to develop a need for social connection to alleviate their sense of psychological isolation.

5.3 Mediation effect test

To examine the mediating effects of loneliness and the need for social connection, this study employed the Bootstrap method, which is widely used in mediation analysis for its robustness and independence from the assumption of normal data distribution. Using AMOS 24.0 software, the study performed 5,000 resamples on 415 samples to ensure the estimates' stability and the confidence intervals' accuracy. In the Bootstrap analysis, a mediating effect is considered significant if the 95% confidence interval does not include 0. The results of the Bootstrap analysis for the mediation effect significance test are presented in Table 4.

As shown in Table 4, the 95% confidence interval for the effect of loneliness on the relationship between social exclusion and the intention to engage in experiential sports consumption includes 0, and the *P*-value is more significant than 0.05, indicating that the mediating effect is not substantial. Therefore, hypothesis H2-3 is not supported.

In contrast, the 95% confidence interval for the effect of the need for social connection on the relationship between social exclusion and the intention to engage in experiential sports consumption does not include 0, and the *P*-value is <0.001. This indicates that the mediating effect is significant, with a standardized effect value of 0.069, accounting for 18.45% of the total effect, thus supporting hypothesis H3-3.

Furthermore, the combined effect of loneliness and the need for social connection on the relationship between social exclusion and the intention to engage in experiential sports consumption also has a significant indirect effect, as the 95% confidence interval does not include 0 and the *P*-value is <0.001. The standardized effect value is 0.035, accounting for 9.36% of the total effect, indicating the presence of a chain mediation effect, thereby supporting hypothesis H4-2.

6 Discussion

6.1 The relationship between social exclusion and the intention to engage in experiential sports consumption

This study found a significant positive correlation between social exclusion and the intention to engage in experiential sports consumption. Individuals experiencing social exclusion are more likely to seek experiential sports to alleviate negative emotions and rebuild social connections. This finding aligns with previous research, which concluded that experiential sports consumption can provide individuals with satisfaction and positive feelings to counteract negative moods (Armbrecht and Andersson, 2020; Guo et al., 2024; Inoue et al., 2017). However, this study reveals how social exclusion drives individuals to adopt experiential sports consumption as a proactive psychological compensation strategy to rebuild social connections and enhance their sense of belonging and self-worth.

For individuals facing social exclusion, deriving a sense of identity and fulfillment through material sports consumption is more challenging. Instead, they are more inclined to choose experiential sports consumption to mitigate negative emotions and restore a sense of value. According to compensatory consumption theory, when the self-concept or self-efficacy of sports consumers is threatened, they tend to choose consumption behaviors that

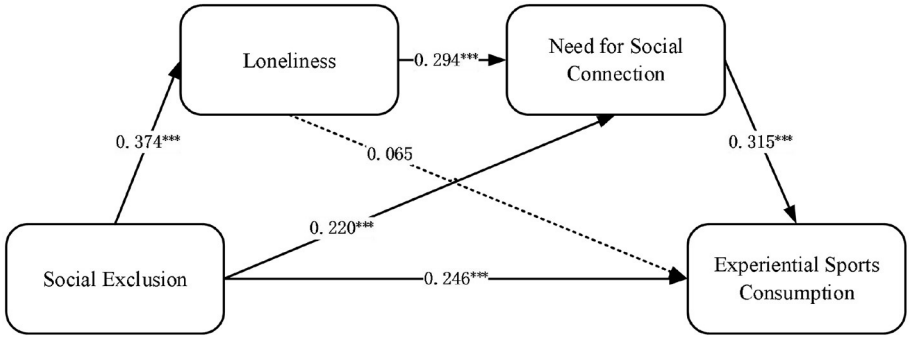

FIGURE 2
Conceptual model central path coefficient diagram. ***$P < 0.001$.

TABLE 4 Mediation effect test results.

Path	Effect value	SE	*P*-value	Bias-corrected 95% CI		Percentile 95% CI		Mediation percentage (%)
				Lower	Upper	Lower	Upper	
Total effect	0.374	0.070	$P < 0.001$	0.236	0.51	0.239	0.512	100
Direct effect	0.246	0.064	$P < 0.001$	0.131	0.382	0.13	0.38	65.78
Indirect effect	0.128	0.038	$P < 0.001$	0.062	0.212	0.058	0.207	34.22
SE→Lon→IESC	0.024	0.022	$P = 0.192$	−0.014	0.073	−0.017	0.069	6.42
SE→NSC→IESC	0.069	0.025	$P < 0.001$	0.029	0.132	0.026	0.125	18.45
SE→Lon→NSC→IESC	0.035	0.013	$P < 0.001$	0.016	0.068	0.014	0.063	9.36

SE, Social Exclusion; IESC, Intention to Engage in Experiential Sports Consumption; Lon, Loneliness; NSC, Need for Social Connection.

address the threat and restore their self-efficacy to compensate for psychological deficiencies (Rucker and Galinsky, 2008). Furthermore, Caprariello and Reis (2013) found that consumers are likelier to share experiences than material goods. Thus, individuals excluded from social interactions during sports participation tend to choose experiential sports consumption, which provides social value to compensate for interpersonal deficits.

6.2 The mediating role of loneliness

This study revealed the positive effect of social exclusion on loneliness among sports consumers, indicating that the higher the experience of social exclusion, the higher the corresponding level of loneliness. This result aligns with the predictions of the Need-Threat Model (Williams, 2009), indicating that social exclusion, as an experience of interpersonal disruption, intensifies individuals' sense of social disconnection, thereby increasing feelings of loneliness (Yue et al., 2022). However, contrary to expectations, loneliness does not significantly mediate the relationship between social exclusion and the intention to engage in experiential sports consumption. Nonetheless, loneliness plays a significant role in the mediation chain involving the need for social connection.

This outcome may be due to loneliness as a negative psychological experience, exhibiting a complex bidirectional influence on behavioral choices. On the one hand, they may develop a tendency to change their weak social state by trying to establish friendships, build harmonious relationships, and seek group acceptance (DeWall et al., 2009; Wang et al., 2012). On the other hand, loneliness may reinforce individuals' memories of past interpersonal failures, leading to negative evaluations of future social interactions and fostering a tendency for self-protection (Cacioppo and Hawkey, 2009; Lemay et al., 2024).

These two conflicting tendencies shape the psychological characteristics of lonely individuals and influence their behavioral choices in specific contexts. For example, research has found that lonely individuals are more likely to form attachments to inanimate objects to avoid potential social risks. This also helps explain the findings of this study: if lonely sports consumers adopt a defensive attitude toward others, they may take a passive approach when seeking support or connection (Anderson and Martin, 1995), which results in no direct relationship between loneliness and experiential sports consumption, which inherently involves social attributes. However, when their need to establish close interpersonal relationships becomes dominant—manifested as a heightened need for social connection—lonely sports consumers are more likely to significantly influence their intention to engage in experiential sports consumption. This finding enriches the research on the pathways of loneliness in consumption behavior. Further, it suggests that the effects of loneliness may have different manifestations depending on the context and psychological needs.

6.3 The mediating role of the need for social connection

This study found that the need for social connection mediates the relationship between social exclusion and the intention to

engage in experiential sports consumption. Specifically, social exclusion stimulates a desire for social connection, and the social interaction attributes of experiential sports consumption help individuals build positive relationships, alleviating negative emotions caused by exclusion. Consistent with previous studies, prior research has also highlighted that experiences of social exclusion can trigger a desire to reconnect with others (Maner et al., 2007), prompting individuals to adjust their behavior accordingly.

For example, studies on help-seeking behavior suggest that individuals experiencing social exclusion are more willing to seek help as rejection heightens their need for belonging (Molden et al., 2009). Such behavior helps them establish positive social connections, fulfilling their need for belonging (Addis and Mahalik, 2003). In the context of consumer behavior, research highlights that the social nature of experiential consumption fosters stronger social connections (Caprariello and Reis, 2013). In contrast, material purchases focus on individual accumulation, which may weaken social bonds (Kumar et al., 2024). Based on this theoretical perspective, this study combines social exclusion, social connection needs and experiential sport consumption to reveal further how the particular context of sport consumption can effectively fulfill individuals' social connection needs, and in the process extends the scope of application of previous studies.

6.4 The chain mediating role of loneliness and the need for social connection

This study found that loneliness and the need for social connection play a significant chain mediating role in the impact of social exclusion on the intention to engage in experiential sports consumption. This finding reveals the psychological mechanism by which social exclusion influences consumer behavior through loneliness and the need for social connection. Consistent with previous studies, social exclusion often threatens individuals' sense of belonging and social connection (Wesselmann et al., 2023), triggering a strong need to re-establish social ties (Lakin et al., 2008). This social motivation or need has been demonstrated to drive participation in sports consumption activities (Paek et al., 2021). For example, Kim et al. noted that interpersonal interaction with other consumers is one of the primary motivations for attending sports events (Kim et al., 2019). The present study expands on this and related research by revealing the specific role of the chain-mediated relationship between loneliness and the need for social connectedness in the context of sport consumption.

Moreover, previous research has emphasized that experiences of social isolation, including social exclusion, often intensify individuals' pursuit of materialism, reinforcing their sense of loneliness (Pieters, 2013). Materialism, as a value orientation, emphasizes the acquisition of material wealth (Dittmar and Isham, 2022; Richins and Dawson, 1992) and possessing material goods (Carter and Gilovich, 2010), and this value is usually tied to material purchases in consumer behavior (Pandelaere, 2016). However, less past research has explored how social exclusion affects experiential consumer behavior through the dual role of loneliness and the need for social connection.

The results of the chain mediation effect between loneliness and the need for social connection suggest that experiences of social exclusion amplify loneliness. The need for social connection helps activate the positive psychological need for interpersonal belonging in lonely individuals while suppressing the negative emotional tendency to avoid social risks, making them more inclined toward experiential sports consumption. Furthermore, the study indicates that loneliness cannot directly translate into an intention to engage in experiential sports consumption; it is only through the activation of the need for social connection that this transformation occurs. These insights suggest breaking the vicious cycle of loneliness and materialism, suggesting that fostering social connection can redirect lonely individuals from materialistic pursuits toward more socially enriching experiences.

7 Conclusion and outlook

7.1 Research conclusions

In summary, this study reaches the following conclusions: (1) Social exclusion significantly and positively predicts the intention to engage in experiential sports consumption. (2) Social exclusion has a significant positive impact on individuals' loneliness and need for social connection. (3) The direct effect of loneliness on the intention to engage in experiential sports consumption is not significant, nor is its mediating effect in the relationship between social exclusion and experiential sports consumption intention. (4) The need for social connection partially mediates the relationship between social exclusion and the intention to engage in experiential sports consumption. (5) A chain mediation effect exists, in which both loneliness and the need for social connection mediate the relationship between social exclusion and the intention to engage in experiential sports consumption.

7.2 Theoretical contributions

1. Broadening the scope of social exclusion research: Previous studies have primarily focused on the impact of social exclusion in areas such as conspicuous consumption (Lee and Shrum, 2012), impulsive buying (Mead et al., 2011), anthropomorphic consumption (Liu et al., 2022), green consumption (Guo et al., 2020), and status consumption (Walasek and Brown, 2016). This study integrates social exclusion with experiential sports consumption for the first time, showing that social exclusion influences consumption intentions through loneliness and the need for social connection. It enriches research on social exclusion and sports consumption while offering new strategies to address social exclusion.
2. This study innovatively reveals how loneliness indirectly influences experiential sports consumption through the need for social connection, clarifying their chain mediating role. The findings indicate that loneliness does not directly impact the intention to engage in experiential sports consumption but exerts an indirect effect through the need for social connection. This discovery deepens the understanding of the relationship between loneliness and consumer behavior and

extends the theoretical boundaries of social exclusion and experiential consumption.

3. Shifting the focus to antecedents of experiential sports consumption: While most prior research has focused on the outcome variables of experiential sports consumption, studies on its antecedents have been relatively scarce, with most focusing on socio-economic factors such as social class and financial status. This study explores the psychological antecedents of experiential sports consumption, expanding research in this area.

7.3 Recommendations

Research indicates that social exclusion significantly and positively predicts the intention to consume experiential sports. Based on this, relevant sports enterprises and organizations could consider incorporating elements into event design that attract marginalized groups, such as reducing participants' sense of social isolation through social interactions and team collaboration. Particularly in specific cultural contexts, such as regions with strong local cultures or relatively underdeveloped economies, sports activities' social and inclusive nature may enhance their appeal.

This study highlights loneliness as a critical emotional factor. Sports enterprises should focus on enhancing the emotional value of experiential products by addressing psychological aspects such as enriching experiences, fostering friendships, and promoting social interactions. More socially oriented events and interactive activities, such as parent-child programs and community sports events, could be designed. For specific groups like adolescents or the elderly, strengthening group connections can effectively increase participation.

The study also finds that the need for social connection partially mediates the relationship between social exclusion and the intention to engage in experiential sports consumption. Therefore, local governments and social organizations should collaborate to implement more personalized sports service programs, especially in areas with high population mobility or groups at high risk of exclusion. For instance, promoting participation in sports tourism, fitness and leisure activities, and sports spectating can enhance experiential sports consumption. Interregional sports interaction and exchange can strengthen social connections, helping groups overcome loneliness and increasing their engagement in experiential sports consumption.

7.4 Research limitations and future direction

This study has several limitations, which offer opportunities for further exploration in future research: (1) This study did not differentiate between different types of social exclusion (e.g., rejection or neglect). In contrast, existing research has shown that different types of social exclusion can have varying effects on individuals' emotions (Chow et al., 2008), cognition (White and Argo, 2009), and psychological needs (Mourey et al., 2017), leading to different behaviors. Future studies should explore whether other types of social exclusion influence the research conclusions in distinct ways. (2) The present study used self-report to measure social exclusion levels, which may have been influenced by the social approval effect, limiting external validity. Future research could validate the robustness of the results and enhance the practical guidance value by manipulating social exclusion situations in the laboratory or conducting field experiments to simulate real experiences (Lee and Shrum, 2012; Sinha and Lu, 2019). (3) This study focuses on the impact of social exclusion on experiential sports consumption from the perspective of social relationships. Future research could explore the roles of variables such as wellbeing and self-concept to refine the theoretical framework further. (4) This study did not address potential biases arising from sample selection, particularly the heterogeneous effects of social exclusion on different populations. Future research should further explore these issues.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and the institutional requirements.

Author contributions

CL: Data curation, Formal analysis, Writing – original draft, Writing – review & editing. WQ: Funding acquisition, Project administration, Writing – original draft, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2025.1532643/full#supplementary-material

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Does gender equality in sports matter? examining the socio-economic impact on public perceptions

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Introduction: Gender equality (GE) is increasingly becoming a key point on modern political agendas. While governments and civil societies strive to achieve this goal, we may be far from "perfect" equality between women and men. Sport is a good example of some of the inequalities that men and women face, such as pay, discrimination, and unequal opportunities.
Methods: The study uses data from the Special Eurobarometer 525 (April–May 2022) to understand attitudes towards GE in sports (ATGEQS). By applying Fuzzy-Hybrid TOPSIS approach, and other methods like Latent Profile Analysis and Multinomial Logistic Regression, I investigate how gender, age, income, education, political beliefs and nationality affect these attitudes.
Results and Discussion: The Nordic countries have the highest ATGEQS, while support for EU GE policies, left-wing views, and life satisfaction is positively related to favourable attitudes. The findings highlight the need for awareness and policies for sports participation to be created, with greater emphasis on disadvantaged groups.

KEYWORDS

gender equality attitudes, Fuzzy-Hybrid TOPSIS, LPA, Multinomial Logistic Regression (MLR) models, Eurobarometer

1 Introduction

Gender Equality (GE) has thus become central to European political agendas and has inspired several policies: the double gender preference in elections, as explained by Möschel (1); Scandinavian initiatives to integrate mothers into the labour market, by Kjeldstad (2); the recent Spanish app to involve men in sharing housework, according to Ministero de Igualdad (3). GE has been shaped by historical milestones, from the suffragette movement (4) to women's right to vote in the US (5) and the CEDAW convention defining GE and women's rights (6). Despite progress, achieving full GE remains a challenge. While more women hold leadership positions (7, 8), inequalities persist, particularly in wages (9), job opportunities (10), and maternal labour force inclusion (11).

Beyond economic concerns, gender inequality extends to social roles and sport. Studies show lower parental support for girls' participation in sport (12) and minimal media coverage of women's sport (13). However, successful pop-events such as Spain winning the 2023 Women's World Cup (14) signal progress. Figure 1a shows that there has been a lot more research published in the past decade, particularly from 2015, which suggests that more and more people in academia are interested in GE. Looking at the breakdown by subject area, we can see that there are a lot of studies in the social

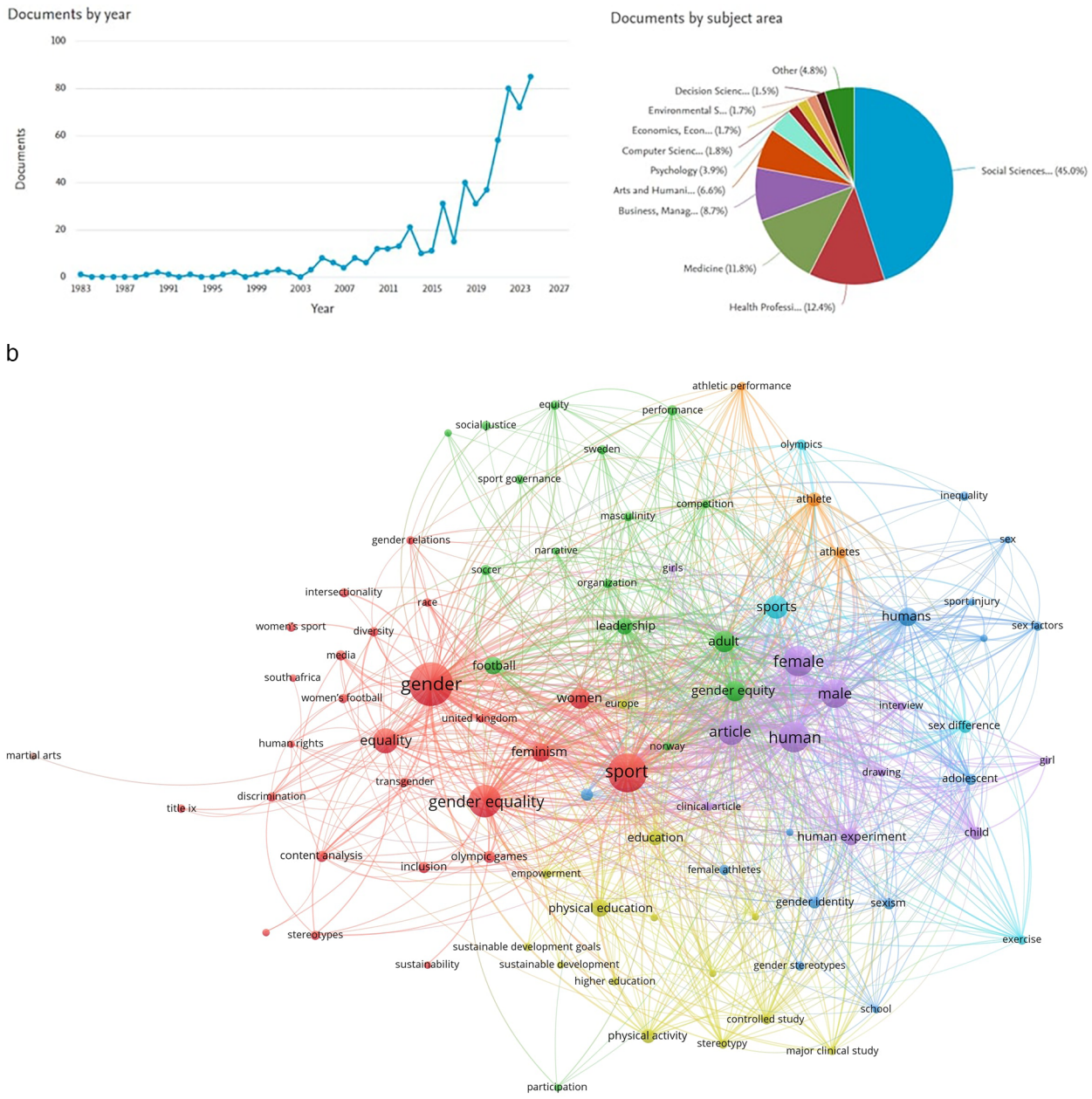

FIGURE 1
(a) Scopus search. (b) Topics on Scopus Search.

sciences, health professions and medicine, but not so many in quantitative analysis subjects like decision sciences or economics. This suggests a lack of research methods that focus on statistical analysis and data-driven approaches. Figure 1b shows the most important keywords and topics related to GE in sports. It is dominated by terms such as "gender equality", "human rights", and "discrimination". But there are hardly any keywords referring to quantitative methodology, such as "statistical analysis" or "quantitative research". This suggests that most studies rely on theoretical ideas rather than real-life, measurable approaches.

The study aims to fill this quantitative gap in the field of GE in sport and provide new insights into the influence of socio-economic factors through data provided by the Special Eurobarometer 525 (April–May 2022). First, Fuzzy-Hybrid TOPSIS is used to provide a Synthetic Indicator of the Europeans' Attitudes Towards Gender Equality in Sport (ATGEQS), then Latent Profile Analysis to cluster respondents based on these attitudes. Finally, Multinomial Logistic Regression is used to analyse the influence of socio-economic factors on the ATGEQS.

The remainder of the paper is structured as follows: Section 2 provides a brief theoretical background on GE in sport, Section 3

describes the data used, while Section 4 examines the methodologies employed. Section 5 analyses the main findings and Section 6 discusses the results. Finally, the paper concludes in Section 7 with final conclusions.

2 Gender equality in sports – a brief theoretical overview

In 1994, the Brighton Declaration became a landmark international framework for sport and gender equality, outlining a comprehensive plan that emphasised the full inclusion of women in all aspects of sport and physical activity. The Declaration builds on existing local, national and international regulations, but aims to set a higher standard by promoting global equity in sport. It marks a significant step in challenging gender norms in sport by supporting the representation and active participation of women at all levels (15). Eight years later, the Montreal Toolkit is a practical extension of this vision, providing resources specifically designed to support the role of women in sport through advocacy, leadership and organisational change. The toolkit focuses on cultural and institutional change in the sport sector, emphasising concrete steps to empower women and diversify sport leadership structures (16). Despite these initiatives, studies by Adriaanse and Claringbould (17) and Sheehy and Solvason (18) continue to emphasise the importance of monitoring women's progress in sport to bring about deeper structural change in decision-making processes. This observation is crucial as they highlight the need to include women in leadership as a catalyst for broader change in sport (12, 16–20).

Cultural gender norms are pervasive influences that shape perceptions of which sports are appropriate for women and often limit their participation and acceptance (21). Society tends to categorise sports as either male or female, based on traditional views of gender characteristics. "Masculine" sports, such as football, rugby and boxing, are associated with physical strength, aggression and competitiveness (22–24), while sports considered "feminine", such as gymnastics and figure skating, are associated with grace, aesthetics and agility (25). These cultural biases influence the acceptance and support of women in different sports, especially those labelled as "masculine" (26). Women involved in football, for example, face social disapproval and prejudice when challenging entrenched gender roles, and therefore the perception that intense contact sports are incompatible with femininity leads to stigmatisation (27). As a result, this social prejudice limits women's participation in certain sporting activities and reduces their recognition as serious athletes in sporting culture (28).

Family and societal expectations also have a significant impact on women's access to sport. Ince-Yenilmez (29) explains that cultural beliefs about gender roles are deeply rooted in families, which often act as gatekeepers to women's participation in sport. Parents may discourage their daughters from participating in sports such as weightlifting because they fear how these activities will affect their femininity and social status (30). Such social norms are particularly influential in more conservative areas, where traditional roles often prioritise domestic "duties" over personal ambitions in competitive sport (31).

Thus, GE in sport faces significant cultural and political challenges that perpetuate inequalities in opportunities, recognition and treatment of male and female athletes (32, 33). Cultural norms and stereotypes strongly influence the participation and perception of women in sport. In many societies, traditional beliefs reinforce the idea that sport is predominantly a male domain. In Ghana, for example, cultural expectations of femininity discourage women from participating in sport because it is seen as a predominantly male activity (34). Similarly, physical education in primary schools often reflects social gender norms, with boys more likely to be encouraged to participate in sports associated with masculinity, such as football, while girls are directed towards less physically demanding activities (35, 103).

Sport funding policies also tend to favour so-called "men's sports", limiting the resources available to women. According to Druckman and Sharrow (36), the historical underfunding of women's sport, coupled with inadequate political support, exacerbates this inequality. Policy decisions regarding the allocation of resources and support for "women's sport" continue to be heavily influenced by traditional views that favour men's sport on the assumption that it attracts more spectators and revenue. Thus, the intersection of cultural and political barriers is evident in the systemic exclusion of women from leadership roles in sports organisations, perpetuating male-dominated decision-making structures.

Another key aspect of gender inequality in sport is media coverage. Indeed, there is often a tendency to objectify female athletes, emphasising their physical appearance rather than their skills or competitive achievements (37). In this regard, Harmon (38) notes that media coverage of female athletes often emphasises attributes related to beauty and family roles, downplaying their athletic contributions. This objectification reinforces the stereotype that women must conform to traditional standards of femininity, discouraging younger generations from participating in sport and influencing public perceptions of female athletes (39). This bias limits sponsorship opportunities for women, as companies tend to invest in athletes who are publicly recognised for their achievements, a recognition often reserved for men in male-dominated sports. Furthermore, O'neill and Mulready (40) find that women's sports receive significantly less media coverage than men's sports, contributing to the invisibility of female athletes and reducing their potential for sponsorship and support. Where women's sport is included, it tends to focus on traditional narratives that reinforce gender stereotypes, rather than the skills and achievements of female athletes (41). This media exclusion not only affects the visibility of female athletes, but also contributes to a cycle of underrepresentation that affects the development of role models for young girls who aspire to participate in sport.

Although some countries, such as Spain and Canada, have introduced legislative frameworks to promote inclusivity, the effectiveness of these frameworks often depends on their practical implementation and public support. As in Salazar Benítez (42),

Spain has a clear legislative basis to support GE in line with international and EU directives, albeit still fragile. However, Pérez-Ugena (43) points out that enforcement in the sports sector is inconsistent, with many sports organisations failing to meet GE standards due to a lack of accountability mechanisms. Activists call for stronger regulatory measures, such as mandatory compliance requirements and penalties for non-compliance, for sports organisations to actively promote GE and address inequalities in areas such as funding and media coverage. On the other hand, other policies on gender inclusion in sport, such as in the case of Canada, reflect avant-garde intentions with commitments such as achieving GE by 2035 (44). However, as Harmon (38) notes, these policies often remain aspirational without being effectively implemented at the local level. Indeed, local sport organisations face challenges such as insufficient funding, limited awareness and cultural resistance that prevent policies from being translated into concrete actions. As a result, while frameworks exist to support women's participation in sport, the actual representation of women in these positions remains low, highlighting the need for more targeted efforts and resources to bridge the gap between policy and practice (45). The first hypothesis is therefore as follows, given that anthropological, cultural and political profiling is crucial to understanding GE in sport:

H_1 = *There are differences in Gender Equality Perception across European Countries.*

While social and cultural structures may influence individual attitudes toward GE in sport, these perceptions may also be significantly shaped by personal socio-economic factors. The interplay between socio-economic factors and GE in sport participation is multifaceted, with different dimensions shaping accessibility, governance, cultural acceptability and professional viability. For example, research has shown that gender quotas in sport governance structures help to increase women's representation in leadership positions, but their effectiveness depends on broader organisational and cultural changes (46). Similarly, socio-economic status (SES) is seen as a key determinant of access to sports facilities. For example, communities with higher SES have better infrastructure and therefore more opportunities for sports participation (47). The economic divide reinforces the impact of gender inequalities in access for sportswomen from low SES backgrounds. At the youth level, children from low-income families are less likely to specialise in sport at an early age, further limiting girls' opportunities to develop a sporting career (48). Thus, the second hypothesis is proposed as follows:

H_2 = *Socioeconomic factors play a fundamental role in shaping these attitudes.*

Despite the extensive academic focus on gender inequality in sport, this literature review reveals significant methodological gaps. Adriaanse and Schofield (46) identify a key gap in quantitative research on GE. While there are some qualitative findings suggesting that policies may act as a catalyst for change, without quantitative measures of their impact on participation rates and decision-making processes, the true effectiveness of these cannot be determined. Their study calls for more extensive quantitative research to determine how the quota system contributes to measurable variables that may change, such as the number of women in leadership positions and their ability to make and influence organisational policy. Building on this, the third hypothesis suggests that innovative methods, such as Fuzzy-Hybrid TOPSIS and Multinomial Logistic Regression Models (that will be detailed in Section 4), may reveal variations in GE perceptions across different cultural and national contexts. Thus, the second hypothesis is therefore structured as follows:

H_2 = *New methodological approaches in the field can provide consistent insights in GE in Sport.*

3 Data

The study analyses data from the Special Eurobarometer 525 "Sport and Physical Activity", conducted between April and May 2022 and published in September 2022. It is a survey commissioned by the European Commission's Directorate-General for Education, Youth, Sport and Culture (DG EAC) and carried out by the Kantar network through face-to-face and online interviews in the 27 countries of the European Union (EU). A total of 26,580 responses were collected, covering various social and demographic segmentations. As a part of the goals of the European Union Work Plan for Sport, DG EAC, this Eurobarometer tents to "*promoting good governance including the safeguarding of minors, taking account of the specificity of sport, combatting corruption and match fixing, and fighting doping*", explore "*the economic dimension of sport, in particular innovation in sport, and sport and the digital single market*", and to promote "*social inclusion, the role of coaches, education in and through sport, sport and health, sport and environment, sport and media and sport diplomacy*" (49, p. 4–5).

The sample is well represented across the 27 EU countries, falling within the 95% confidence interval for representativeness, as well as for other segmentation groups such as age and gender. Almost 60% of respondents are fairly satisfied with their lives, more than 50% are married and more than 42% of the sample never exercise. Most respondents have been studying for more than 16 years and only 7.48% are still studying, while almost 30% are already retired. In addition, almost 70% live in small towns or villages and 25.25% have some difficulty paying their bills. 21% of the sample are manual workers, while more than 25% are managers or other white-collar workers. The majority of respondents do not believe that GE is the European Parliament's (EP's) top priority in terms of values and policies, fighting discrimination and promoting diversity in society. See Table A1 for more details.

This special Eurobarometer fits the goal of the paper, as explore the role of Gender Equality in sport and physical activity by measuring Europeans' knowledge and attitudes towards Gender Equality in sport. Respondents are asked to give their opinion on the role of women as role models in sport, the extent to which women's sport is covered in the media and, finally, their personal

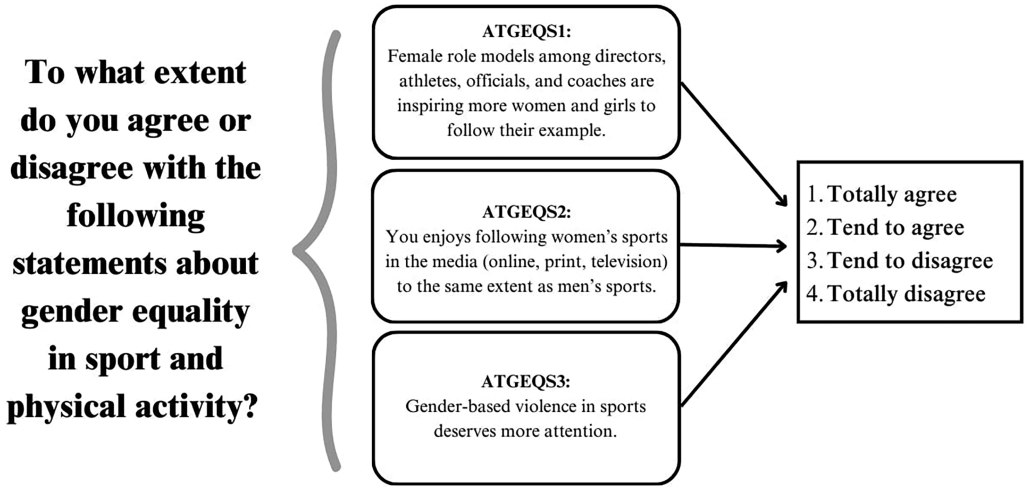

FIGURE 2
Items.

perception of gender violence in sport. In order to measure Europeans' attitudes towards gender equality in sport (ATGEQS), the study therefore considers these three different items. The survey uses a Likert scale from 1 (strongly agree) to 4 (strongly disagree) to record the level of agreement with these three statements (see Figure 2). However, to facilitate analysis of the items, the scale is inverted so that higher scores represent more "positive" attitudes.

4 Methodology

4.1 Fuzzy-Hybrid TOPSIS

Surveys are often a good tool for studying socio-economic phenomena, as they provide information on citizens' opinions on a specific issue (50). In the case of the study, the items selected for the analysis of the ATGEQS come from three different statements on a four-point Likert scale. This method of capturing opinion through scales is widely used by researchers when constructing a latent variable (LV) to analyse a socio-economic phenomenon, where each respondent indicates the "degree of agreement" with each statement (51). Methods for analysing this type of information, such as principal component analysis, factor analysis or structural equation models, are often used (52–54). However, these approaches have also been criticised by researchers who argue that their implementation results in the loss of a great deal of information and does not take into account the subjectivity of the answers given by respondents (55). For this reason, the study proposes an alternative approach based on mathematical deterministic methods, such as fuzzy logic, and multi-criteria decision making (MCDM) tools, such as the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), to provide a synthetic indicator (SI) capable of measuring Europeans' ATGEQS.

Zadeh (56) is the pioneer of Fuzzy Logic, as try to overcome the limitation of Boolean logic of true or false, implementing an approach of processing values able to allow an interval of possible truth values that can be processed in the same variable. Thus, this approach aims to solve problems when scientists analyse imprecise spectrum of data, providing tools to obtain a set of accurate conclusions (57). There are several approaches to manage the imprecision of the information provided by subjective interview responses, such as using *fuzzification* of the raw information in Triangular Fuzzy Numbers (TFNs) (58), which consists of converting all inputs (original data) into fuzzy membership functions that follow a 3-tuple of values $(a_1,\ a_2,\ a_3)$ of TFN as follows:

$$\mu_A(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1} & a_1 \leq x \leq a_2 \\ \dfrac{x - a_3}{a_3 - a_2} & a_2 \leq x \leq a_3 \\ 0 & otherwise \end{cases} \quad (1)$$

The 3-tuple of values $(a_1,\ a_2,\ a_3)$ of the TFN for each point of the inverted Likert scale is chosen according to previous studies (59) in the scientific literature (as detailed in Table 1). Overlapping TFNs are an effective tool for smoothing the jump between different fuzzy sets, allowing for gradual membership rather than hard boundaries (60). This reflects real-world scenarios where individual perceptionof two different scale

TABLE 1 Triangular fuzzy numbers.

Liker-scale (inverted)	Triangular fuzzy number
1 (Totally disagree)	(0, 0, 50)
2 (Tend to disagree)	(30, 50, 70)
3 (Tend to agree)	(50, 70, 90)
4 (Totally agree)	(70, 100, 100)

points, such as "tend to disagree" and "disagree", are often not the same across different sets of respondents (61).

Therefore, to analyse each segment of the population, the TFNs are aggregated by average using Fuzzy Set Logic Algebra. However, even though the data are now able to cope with the vagueness and uncertainty of the raw information, they are still difficult to analyse. Therefore, following Kaufmann and Gupta (62), the aggregated TFNs are *defuzzified* by giving more weight to the central values which, according to fuzzy theory, contain more truth. The defuzzified values are thus obtained as follows:

$$v_{\tilde{A}} = \frac{(a_1 + 2a_2 + a_3)}{4} \tag{2}$$

Following Kaya and Kahraman (63), once information is converted and defuzzified into crisp values ($v_{\tilde{A}}$), TOPSIS steps can be applied to obtain a synthetic indicator capable of measuring the Europeans' ATGEQS. First, Positive Ideal Solutions (PIS) and Negative Ideal Solutions (NIS) are calculated as the maximum and minimum values, respectively, across the segmentation group for each analysis item, as follows:

$$PIS_j = \{(maxV_{ij}),\ j = 1,\ 2,\ \ldots n\},\ i = 1, 2,\ \ldots,\ m \tag{3a}$$

$$NIS_j = \{(minV_{ij}),\ j = 1,\ 2,\ \ldots n\},\ i = 1, 2,\ \ldots,\ m \tag{3b}$$

where V_{ij} are the crisp values obtained by Equation (2), for each group ($i = 1, 2,\ \ldots,\ m$), and for each item ($j = 1,\ 2,\ \ldots, n$) (64).

As in Arman et al. (65), the distances between each crisp values and the two ideal solutions can now be calculated using the Euclidean method as follows:

$$D_i^+ = \sqrt{\sum_{j=1}^{J} (PIS_i - V_{ij})^2} \tag{4a}$$

$$D_i^- = \sqrt{\sum_{j=1}^{J} (NIS_i - V_{ij})^2} \tag{4b}$$

As the TOPSIS approach assumes that the best "solution", in the case of this study the most positive attitude, must be more similar to the PIS and less similar to the NIS (66). Thus, the synthetic indicator measuring the ATGEQS for each segment group of analysis is given by:

$$ATGEQS_i = \frac{D_i^-}{D_i^+ + D_i^-} \rightarrow [0, 1] \tag{5}$$

The logic behind this indicator is simple. The closer the ATEGQS values are to 1, the more positive the attitudes of Europeans towards GE in sport.

4.2 Latent profile analysis

Latent profile analysis (LPA) is a common tool used by quantitative researchers when they want to group, for example, respondents into different clusters based on similarity on a set of variables. It models categorical latent variables that identify defined subpopulations within a population in a defined set of variables (67). Thus, individuals are categorised according to their likelihood of belonging to one cluster or another, generating different profiles based on different characteristics, such as socio-economic.

Unlike other clustering techniques such as k-means or hierarchical clustering, LPA treats profile membership as an unobserved categorical variable. This variable indicates the probability that an individual belongs to a particular profile (68). LPA includes the classification of individuals into clusters based on estimated membership probabilities, the inclusion of different types of variables, and the use of demographics and covariates to describe profiles (69). Thus, this approach focuses on identifying and comparing patterns of variables, allowing the identification of individuals with similar variable patterns and the comparison of these patterns in relation to predictors and outcomes.

To obtain the optimal number of profiles, the algorithm compares results with different numbers of clusters (e.g., 1 cluster, 2 clusters, 3 clusters, etc.) using model selection criteria that penalise overly complex models (i.e., those with too many classes) to avoid overfitting. Following Spurk et al. (67), the study uses Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Entropy to evaluate the best number of profiles for analysis, as follows:

$$AIC = -2\log(L) + 2p \tag{6}$$

$$BIC = -2\log(L) + 2log(N) \tag{7}$$

$$Entropy = 1 - \frac{-\sum_{i=1}^{N}\sum_{c=1}^{C} P(C = c|X_i)log(P(C = c|X_i))}{Nlog(C)} \tag{8}$$

where N is the sample-size, p is the number of parameters in the model, L is the likelihood, C is the number of latent profiles, and $P(C = c|Xi)$ is the posterior probability that individual i belongs to profile c, given their observed data Xi. The optimal number of profiles is defined by lower values of AIC and BIC, while higher values of Entropy.

Once the number of best-fitting profiles has been determined, the probability that each individual i belongs to cluster c is calculated using Bayes' theorem as follows:

$$P(C = c|Xi) = \frac{\pi_c \cdot f(X_i|\mu_c, \sigma_c)}{\sum_{c=1}^{C} \pi_c \cdot f(Xi|\mu_c, \sigma_c)} \tag{9}$$

where π_c refers to the proportion of individuals in class c, and $f(X_i|\mu_c, \sigma_c)$ stands for the probability density function for the set of observed data X_i given the parameter in the profile c. This

creates a new variable (Profile) for further analysis. This variable indicates whether an individual belongs to one profile or another.

4.3 Multinomial logistic regression

One of the most commonly used methods in the social sciences to analyse the influence of one variable (or set of variables) on another variable is OLS, or when working with latent variables, it is common to use Structural Equation Models (SEM). However, the first method is not feasible in the study because it involves a categorical dependent variable and OLS assumes that the variable under study must be continuous. Also, according to previous research, the SEMs model is skipped because it falls into the loss of too much information (70).

For this reason, the study applies the Multinomial Logistic Regression (MLR) model to manage the categorical nature of the variable obtained by the LPA (profile). The MLR also has other advantages, such as the wide availability of its implementation in almost all statistical software, efficiency and speed in calculating and obtaining results and, finally, ease of interpretation (71).

Following Bansal et al. (72), let Y be the dependent variable, which in the case of the study is the "profile", with J categories (where $j = 1, 2, \ldots, J$), the probability that observation i belongs to category j is given by:

$$P(Y_i = j) = \frac{e^{X_i \beta_j}}{1 + \sum_{k=1}^{J-1} e^{X_i \beta_k}} \tag{10}$$

where X_i refers to the vector of independent variables (country, age, life satisfaction, education, gender, support for the EP on GE and left-right political self-positioning, among others) and β_j is the vector containing the coefficients for the j-th category.

Usually, when estimating the model, one category (e.g., $j = 1$) is taken as the reference, and this means that the probability of the reference category is evaluated by the probabilities of the other categories (73). Thus, to obtain the estimated coefficients, the MLR compares the log odds of being in category j relative to the reference category as follows:

$$ln\left(\frac{P(Y_i = j)}{P(Y_i = 1)}\right) = X_i \beta_j \tag{11}$$

Thus, each β_j indicates how the log odds of being in category j (relative to the reference category, $j = 1$) change for a one-unit increase in the corresponding predictor variable. If it is positive, it indicates an increased likelihood of being in category j relative to the reference, while if it is negative, it indicates a decreased likelihood of being in category j relative to the reference.

5 Results

This section provides the most highlighting insights, using novel quantitative methods in the field of GE in Sport. Firstly, results of applying the Fuzzy-Hybrid TOPSIS are illustrated to get a cross-national overview of the ATGEQS in the European Union (EU). Then, after having clustered individuals into different "profiles", Multinomial Logistic Regression (MLR) models are implemented to analyse the socioeconomic influence on ATGES.

5.1 Exploring gender equality attitudes in sport indicator

Figure 3 shows the synthetic indicator obtained to measure the ATGEQS (Equations 1–5). The differences between the countries analysed are easily visible, as the map provides an indicative colour legend of the ATGEQS indicator according to a range of values between 0.17, which would indicate the minimum value, and the maximum value (0.86) of the ATGEQS. An analysis of the "different" Europes (74) reveals important differences. The Mediterranean countries present a fairly solid and favourable structure in terms of the perception of GE in sport. Nevertheless, the countries that seem to have higher ATGEQS scores are the northern countries, especially Finland and Sweden.

In contrast, the Central European countries show signs of weakness in recognising the importance of GE in sport. In fact, these countries, led by Austria, have very low ATGEQS scores. This again highlights a regional difference between "different Europeans". Another significant result concerns the Eastern European countries, led by Poland and Hungary in terms of ATGEQS, while Romania is at the bottom of the ranking with lower scores.

Looking at the details of the differences and analysing all the socio-economic variables, it can be seen that the ideal solutions (PIS and NIS, as in Table 2, Equations 3a,b), formalised by the maximum and minimum values for each item, are occupied only by the country variable. Thanks to this analysis, it is possible to go deeper into the reason for a certain ATGEQS value, as it shows which item is considered more or less important when a nalysing the ATGEQS. Sweden has the highest ATGEQS, and this is mostly because of the role of women in sports management ATGEQS1. This is high-rated because of the country's progressive gender policy and excellent institutional support for equality (75). Finland also has a long history of inclusiveness, anchored in universal suffrage and policies with a gender equity focus (76). On the other hand, Austria, Romania, and the Czech Republic have lower scores because of traditional gender norms (77–79). A lack of interest in women's sports is a big reason why Austria got a low score for ATGEQS2. Romania doesn't put much importance on women in sports management, which is a sign of traditional gender norms. Meanwhile, the Czech Republic doesn't address gender violence in sports, showing a lack of commitment to these issues. Slovenia is focusing on media coverage of women's sports, and Malta is emphasising addressing gender violence.

5.2 Socioeconomic influences on ATGEQS

The use of the LPA technique makes it possible to group Eurobarometer respondents into different "profiles" on the basis

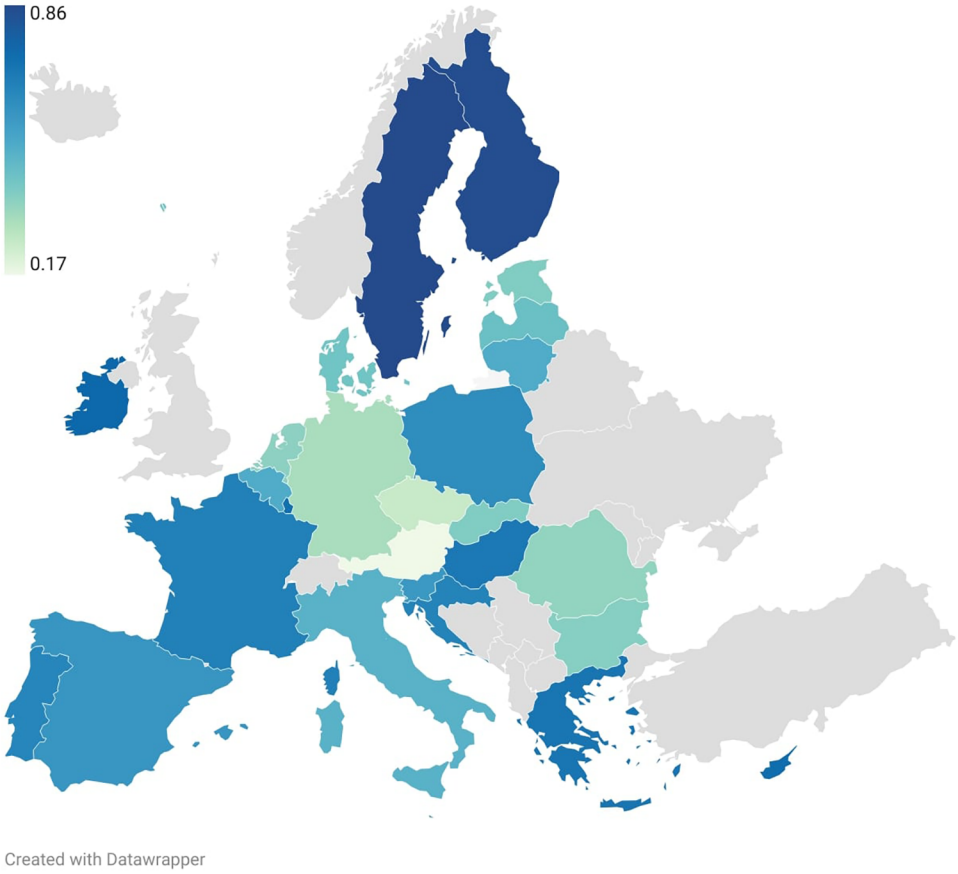

FIGURE 3
TOPSIS – ATGEQS.

of the latent variable and covariates. This method generates a new variable, called "profile", which indicates which profile an individual is most likely to be associated with. Table 3 gives an overview of the results of the AIC, BIC and Entropy tests (Equations 6–8), which provide important indications of the goodness of the model. According to the literature, lower values of AIC and BIC indicate a better fit of the model, while a higher entropy indicates a clearer classification (67). After careful analysis of different models with different numbers of clusters, the model with the lowest AIC and BIC values, together with a relatively high entropy, is the one that identifies three distinct profiles. Nevertheless, a critical point emerges: the third profile shows a certain weakness, with an entropy of 0.51, indicating less consistency in its definition compared to the other profiles.

TABLE 2 PIS and NIS.

Item	Group	PIS[a]	Group	NIS[b]
ATGEQS1	Sweden	84.47	Romania	66.93
ATGEQS2	Slovenia	72.82	Austria	52.70
ATGEQS3	Malta	80.83	Czech Republic	63.41

[a]Positive ideal solution.
[b]Negative ideal solution.

TABLE 3 LPA indicators.

Class	AIC	BIC	Entropy
1	−11,333	−11,317	1.00
2	−14,319	−14,286	0.96
3	−14,367	−14,318	0.51

Figure 4 shows the density distributions and the position of each profile (Equation 9). The results show three distinct profiles: Profile 1, characterised by the lowest values, Profile 2, representing the intermediate values, and Profile 3, associated with the highest values. Furthermore, the highest density is found in the intermediate profile. This result opens up interesting reflections on the dynamics and differences between the groups, suggesting a possible polarisation between those at the extreme ends of the spectrum analysed.

In addition, Tables 4, 5 show the results of the MLR model for Profile 3 (Equations 10, 11), which is characterised by high ATGEQS values, compared to Profile 1, which has lower values.

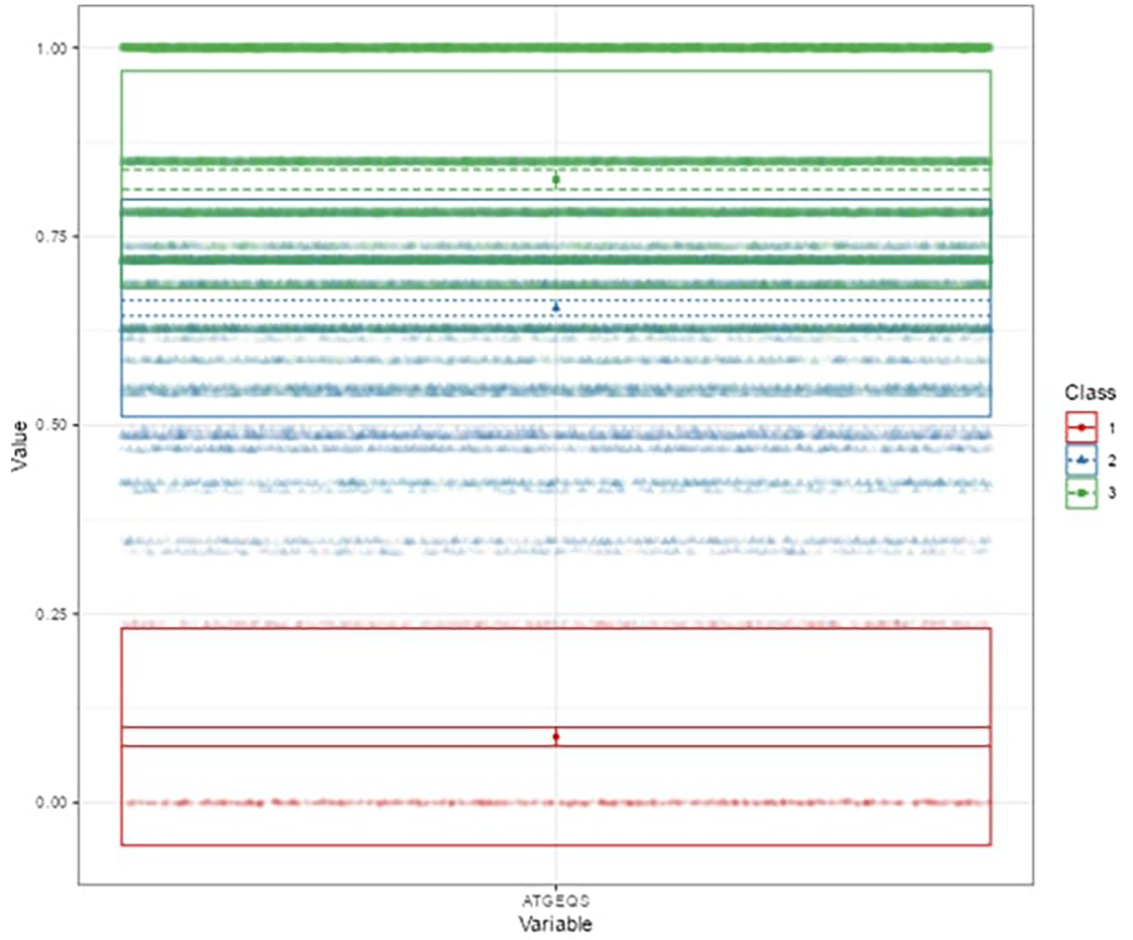

FIGURE 4
Latent profile analysis.

TABLE 4 Multinomial logistic regression – socioeconomics traits.

Predictor	Estimate	SE	*Z*	*p*
Left	0.39	0.11	3.72	<.001
Centre-right	−0.29	0.15	−1.96	0.05
SL - not very satisfied	−0.55	0.12	−4.62	<.001
SL - fairly satisfied	0.30	0.11	2.81	0.01
SL - very satisfied	0.50	0.12	4.04	<.001
Sport activity - regularly	1.86	0.94	1.99	0.05

SL, satisfaction of life.

TABLE 5 Multinomial logistic regression – gender equality traits.

Predictor	Estimate	SE	*Z*	*p*
Intercept	0.42	0.17	2.51	0.01
EP[a] gender equality (yes)	0.56	0.11	5.23	<.001
EP[a] no discrimination (yes)	0.29	0.11	2.69	0.01
EP[a] diversity (yes)	0.46	0.11	4.18	<.001
EP*a priority* GE/Disc./Incl. (yes)	0.52	0.12	4.47	<.001
EP[a] info GE/Disc./Incl. (no)	0.76	0.13	5.71	<.001
EP[a] info GE/Disc./Incl. (yes)	1.01	0.20	4.98	<.001
Support GE in sport org. – (yes)	1.23	0.40	3.08	0.00
Contact gender disc. In sport org (yes, management)	1.07	0.49	2.19	0.03

[a]EP, European parliament.

To facilitate the understanding of the results, only estimates with statistical significance (*p*-value less than 0.05) are reported. Among the socio-economic factors, political orientation emerges as a crucial predictor in the modelling of the ATGEQS. Respondents who identify themselves politically on the left are more likely to belong to the third profile, characterised by the highest ATGEQS, than to the first profile, while the opposite is true for centre-right voters. Another relevant predictor is life satisfaction: the higher the level of satisfaction, the higher the probability of belonging to the group with the most positive ATGEQS. Regular sporting activity also has a significant impact on ATGEQS scores, as those who participate in sport tend to have more positive attitudes towards GE in sport.

Finally, the section concludes with an in-depth analysis of the perception of GE and the importance of issues such as non-discrimination, inclusion and the promotion of diversity. The analysis examines whether these issues are perceived as social and political priorities, as well as within the awareness-raising

policies promoted by the European Parliament. As might be expected, those who support policies and the dissemination of information on these issues, and who see GE as *a priori*ty for the European Parliament, are more likely to fall into the third profile, reflecting generally more positive attitudes towards GE in sport. Another relevant finding concerns awareness of the existence of information points against gender discrimination in the workplace, as those who are aware of them are significantly more sensitive to the issue of GE in sport. This suggests that access to targeted information can play a key role in promoting positive ATGEQS.

6 Discussions

The results of this study indicate large regional and socio-political differences in attitudes towards gender equality in sport, confirming and extending previous research. The high ATGEQS scores in the Nordic countries, particularly Finland and Sweden, are indeed in line with the existing literature, which associates such attitudes with strong welfare policies, progressive gender norms and high levels of female representation in leadership positions (80–84). However, while these findings are consistent with previous research, a closer look reveals that high ATGEQS do not necessarily translate into equal funding in sport, media coverage and pay (104). The above findings also suggest that while women should theoretically be treated equally, women still lag far behind men in coaching and even administrative roles, based on research in countries such as the Nordic states (44).

Conversely, Austria, the Czech Republic and Romania had much lower ATGEQS scores, suggesting that resistance to gender equality in sport is much stronger in these countries. This would be consistent with studies that point to the importance of very strong traditional gender roles, a history of conservative religiosity and older socio-political structures in explaining very low regional support for progressive gender issues (85–87). However, some caution is needed: although religion and conservatism accounted for some of this opposition, the legacy of post-communist economic reform was also crucial. As previous research has shown, the economic upheavals that followed the transition to market economies deprioritised social reforms, including gender equality initiatives (105). This suggests that policy interventions should not only focus on ideological resistance but also address economic constraints that limit institutional support for gender equality in sport.

Religious influences on gender attitudes in sport remain a complex and under-researched area. According to Inglehart (88) and Tröhler (89), historical secularisation in the Nordic countries has favoured greater gender equality in public life, while Catholic and Orthodox traditions in Central and Eastern Europe still uphold patriarchal norms (90). However, recent research suggests that migration and multiculturalism may be reshaping gender dynamics in sport, as has recently been discussed in France (91, 92). Although migration brings new impulses to existing views on gender roles, it can also reignite cultural tensions between traditional values and inclusion policies in sport. The complex interplay of secularism, immigration and gender norms calls for more empirical research in light of ongoing political debates about multiculturalism and integration in European sports institutions.

This study also found a clear ideological divide in the ATGEQS, with left-wing respondents showing greater support for gender equality in sport than their right-wing counterparts. This finding follows wider political trends in which left-wing parties have more frequently aligned themselves with feminist movements, and rapid social change has been framed by conservative parties as an affront to cultural and national identity (93–95). However, such politicisation opens up a critical consideration of the direction in which the future of gender equality in sport may be heading. Although feminist-driven policies have been institutionalised in Western Europe, the rise of nationalism and religious ideologies in some parts of Eastern Europe following the collapse of communism has led to hostility towards many gender equality initiatives (96, 97).

These findings provide a more critical contrast to previous work in which political ideology influences, but is not the sole determinant of, attitudes towards gender equality in sport. Further development is needed on the ways in which economic priorities, media narratives and grassroots activism shape public perceptions. Recent political developments, such as the Spanish debate on the Trans Law, are another area where gender equality policy is increasingly at odds with sport policy itself (95). This divide calls for strategic engagement by political thinkers and sports organisations, so that gender equality in sport is not seen as a partisan issue, but as a core aspect of social justice.

The direct relationship between sports participation and support for GE in sport suggests that the more people are exposed to sporting environments, the more aware they become and the more likely they are to support GE. This finding is consistent with the #MeToo and #SeAcabó movements, which have raised public awareness of gender discrimination in sport (98–100). However, it is important to look critically at the limitations of these movements. While they have been successful in bringing gender inequalities to public attention, institutional responses remain uneven and in some cases performative (101).

Research has shown that awareness campaigns are not enough if they are not accompanied by effective policy enforcement mechanisms (102). For example, the existence of anti-discrimination reporting centres in sports organisations has been reported to be a very effective strategy against harassment and discrimination (101). However, most of them are underfunded and institutionally unbound, and therefore lack significant long-term impact. There is a political imperative to ensure that anti-discrimination and equal pay policies are in place in sport, which can be sustained beyond social movement action and media advocacy.

The findings suggest that both structural and socio-cultural factors are interrelated in achieving gender equality in sport. Increased funding for gender-equitable programmes in sport, with better access for more socio-economic groups, would increase participation. Targeting economic incentives such as scholarships and reduced training fees, may be necessary to address existing inequalities. Greater investment, also, in women's sports infrastructure and media presence could also help to reduce some of the historical inequalities. Conscious

public support, facilitated by awareness-raising events that focus on sporting achievement rather than overcoming gender tropes, can also help. Balanced media coverage and improved mechanisms for reporting discrimination and harassment would complement such a policy framework. However, the success of these policies depends on their rigorous enforcement and accountability at all levels of sport.

7 Conclusions

The article explores the geographical, social and political differences in Europe on the issue of GE in sport, analysing the countries of the European Union (EU). Using data from the Special Eurobarometer 525 (2022), the analysis adopts the Fuzzy-Hybrid TOPSIS approach to generate a synthetic indicator of attitudes towards gender equality in sport (ATGEQS). The study also identifies the main determinants of such attitudes using latent profile analysis and multinomial logistic regression.

The results underline remarkable geographical differences: the Nordic countries, led by Sweden and Finland, show positive ATGEQS scores, while Austria and Eastern European countries tend to resist progressive values and maintain a more traditional and conservative view of gender roles. Similarly, supporters of policies that promote gender equality within the EU are more likely to belong to the third profile, which is associated with positive attitudes towards gender equality in sport. Awareness of the existence of information points against gender discrimination in the workplace correlates with greater sensitivity to gender equality in sport, underlining the crucial role of targeted information. Politically, left-wing respondents are more likely to belong to the third profile, which has the highest ATGEQS scores, while centre-right respondents are more likely to belong to the first profile. Furthermore, a high level of life satisfaction increases the likelihood of belonging to the group with the highest ATGEQS scores.

Despite the innovative contribution of this study, both from a methodological and thematic point of view, it has some limitations. Firstly, its geographical perspective is limited to the EU, thus excluding neighbouring countries such as Albania, Ukraine, Turkey and others. In this respect, an extension to the continental level could provide a more complete picture of territorial, political and religious differences. Due to limited data availability, the analysis refers to one round in 2022, making the study static rather than dynamic. It would be interesting to include more recent data to assess how these attitudes have changed with the emerging recent geopolitical changes.

Data availability statement

The data used in this study are publicly available here: https://europa.eu/eurobarometer/surveys/detail/2668.

Author contributions

AI: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

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Appendix

TABLE A1 Descriptive statistics.

Variable	Group	*n*	%[a]	Variable	Group	*n*	%[a]
Country	Austria	1,005	3.78	EP policy info needed: GE	No	23,421	88.15
	Belgium	1,101	4.14		Yes	3,148	11.85
	Bulgaria	1,039	3.91	Sport activity	Regularly	1,876	7.06
	Croatia	1,008	3.79		With some regularity	8,300	31.24
	Cyprus	503	1.89		Seldom	5,205	19.59
	Czech Republic	1,073	4.04		Never	11,161	42.01
	Denmark	1,004	3.78	Support of GE in sport org.	Yes	4,060	15.28
	Estonia	1,030	3.88		No	2,873	10.81
	Finland	1,004	3.78	Know contact to speak to in sport org when Gend. Discr.	Yes, in management	3,449	12.98
	France	1,012	3.81		Yes, a single contact point	1,078	4.06
	Germany	1,511	5.70		No	2,818	10.61
	Greece	1,014	3.82	Left-right placement	(1-2) Left	2,151	8.10
	Hungary	1,025	3.86		(3-4)	4,879	18.36
	Ireland	1,011	3.81		(5-6) Centre	9,874	37.16
	Italy	1020	3.84		(7-8)	4,780	17.99
	Latvia	1,013	3.81		(9-10) Right	1,764	6.64
	Lithuania	1,002	3.77	Marital status	Married	13,773	51.84
	Luxembourg	502	1.89		Single living with a partner	2,690	10.12
	Malta	504	1.90		Single	5,306	19.97
	Poland	1,013	3.81		Divorced or separated	2,126	8.00
	Portugal	1005	3.78		Widow	2,537	9.55
	Romania	1,057	3.98		Other	1,10	0.41
	Slovakia	1,010	3.80	Gender	Man	12,331	46.41
	Slovenia	1,022	3.85		Woman	14,220	53.52
	Spain	1,006	3.79		Other	18	0.07
	Sweden	1,043	3.93	Occupation	Self-employed	1,925	7.25
	The Netherlands	1,032	3.88		Managers	3,144	11.83
Age	15-24	2,381	8.96		Other white collars	3,759	14.15
	25-34	3,332	12.54		Manual workers	5,590	21.04
	35-44	4,127	15.53		House persons	1,175	4.42
	45-54	4,481	16.87		Unemployed	1,093	4.11
	55-64	4,828	18.17		Retired	7,895	29.72
	65+	7,408	27.88		Students	1,988	7.48
Life Satisfaction	Very satisfied	6,363	23.95	Type of community	Rural area or village	8,823	33.21
	Fairly satisfied	15,789	59.43		Small/middle town	9,643	36.29
	Not very satisfied	3,650	13.74		Large town	8,100	30.49
	Not at all satisfied	735	2.77	Difficulties paying bills	Most of the time	1,994	7.50
EP values priority: GE	No	2,1545	81.09		From time to time	6,798	25.59
	Yes	5,024	18.91		Almost never/never	17,580	66.17
EP values priority: Fight Discrimination	No	23,333	87.82	Age education	15-	2,938	11.06
	Yes	3,236	12.18		16-19	11,085	41.72
EP values priority: Diversity in society	No	22,576	84.97		20+	9,723	36.6
	Yes	3,993	15.03		Still Studying	1,988	7.48
EP policy priorities: GE	No	23,139	87.09		No full-time education	181	0.68
	Yes	3,430	12.91				

[a]Some segment do not reach 100% because of missing values.

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Leisure constraints and the negotiation of structural relationships: a case study of scuba diving enthusiasts

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Background: Scuba diving has emerged as a popular recreational activity in China over the past two decades, yet academic research on this sport from the perspective of leisure studies remains limited. This study explores the relationship between leisure constraints and constraint negotiation among scuba diving enthusiasts, aiming to fill this research gap.
Method: This study employed a mixed-methods approach, combining in- depth interviews with 20 scuba diving enthusiasts and the Positive and Negative Affect Schedule (PANAS) for survey and analysis. The interviews focused on the participants' leisure motivations, the constraints encountered at different stages of their diving careers, and the negotiation strategies they employed.
Results: The findings revealed that scuba diving enthusiasts tend to use cognitive negotiation strategies when addressing personal and interpersonal constraints, while predominantly employing behavioral negotiation strategies when dealing with structural constraints. A structural relationship was identified between leisure constraints and constraint negotiation, indicating that the type of constraint influences the negotiation strategy employed.
Conclusions: This study provides empirical support for the structural relationship between leisure constraints and constraint negotiation, enriching the materials available for leisure research. Future research is recommended to expand the sample size and further explore the underlying mechanisms of this relationship, as well as to consider the authenticity and accuracy of respondents' self-reports.

KEYWORDS

SCUBA diving, leisure constraints, constraint negotiation, cognitive strategies, behavioral strategies

1 Introduction

1.1 Background

Scuba diving is a highly popular recreational activity in Western Europe and North America, regions with a strong foundation in marine sports. According to statistics, in the United States alone, 40 million individuals partake in diving activities worldwide annually. Among the 200 million Americans, 60 million hold scuba diving

certifications, representing 30% of the population. In France, with a population of only 40 million, there were already 2,000 diving clubs by the end of the 20th century. To date, formal diving clubs in Mainland China have only been established for a little over two decades. Despite the relatively late onset of recreational diving in China, the activity has experienced remarkable growth, with a rapid expansion in the number of participants (1). This trend demonstrates the immense potential and broad market demand for this sport. However, despite its global popularity, academic research on scuba diving from the perspective of leisure studies remains remarkably limited.

This paper first introduces the nature of scuba diving as a recreational activity. It then examines scuba diving through the lens of leisure constraints and constraint negotiation. Finally, through interviews with 20 amateur scuba diving enthusiasts, primary data are obtained and analyzed to derive a model of the structural relationship between leisure constraints and constraint negotiation.

1.2 Recreational diving evolution

Covering 70% of the Earth's surface, the ocean has long been a source of immense fascination and endless mystery for humanity. Since ancient times, driven by curiosity and a spirit of fearlessness, humans have continuously explored the unknown depths of the ocean. The most direct form of contact with the ocean is through diving. As early as 2,800 years ago, during the zenith of Mesopotamian culture, records indicate that diving activities were conducted for military purposes (2). In modern times, diving initially emerged as an activity undertaken by experienced professional divers to perform underwater surveys, salvage operations, repairs, and underwater engineering tasks. This type of diving, requiring specialized skills and training, is referred to as commercial diving or professional diving (3).

Subsequently, diving evolved to serve new purposes, transforming into a recreational activity focused on underwater sightseeing, with the goals of physical exercise, mental relaxation, and leisure enjoyment. This form of diving is known as recreational diving (4).

In recent years, advancements in diving equipment have propelled the rapid development of recreational diving. Consequently, the number of individuals engaging in and expressing interest in diving has increased significantly. In advanced countries such as Europe and the United States, recreational diving gained popularity as early as the 1950s. The development of recreational diving in China, however, is relatively recent (5). Prior to 1995, this field was virtually non-existent in China. The establishment of the China International Diving Club on March 18, 1995, marked the beginning of a rapid development phase for recreational diving in China. Over the past two decades, recreational diving in China has developed structured club organizations and stable participant groups, with studies in Hong Kong highlighting the role of clubs in promoting organized diving practices and behavioral norms (6).

Within the realm of recreational diving, there are three primary types of activities: snorkeling, free diving, and scuba diving. Among these, scuba diving refers to diving activities in which divers carry their own underwater breathing apparatus. In this study, the examination of recreational diving activities specifically focuses on scuba diving. All selected interviewees for this survey are divers participating in scuba diving activities.

1.3 Existing studies on diving activities

As a recreational sport, scuba diving initially emerged in relatively developed regions such as Western Europe and North America, and research on this activity also originated from these areas. Initially, the majority of researchers examined the environmental impacts of diving activities from an ecological perspective. For example, a nine-year study titled Sustainability of Scuba Diving Tourism on Coral Reefs of Saba was completed by Julie P. Hawkins, Callum M. Roberts, David Kooistra, Ken Buchan, and Susan White (7). Another study, Moderator and Mediator Effects of Scuba Diving Specialization on Marine-Based Environmental Knowledge-Behavior Contingency (2005), was conducted by Brijesh Thapa, Alan R. Graefe, and Louisa A. Meyer (8) through a survey of 370 scuba divers.

In addition to ecological perspectives, some scholars have examined recreational diving from a tourism standpoint. Ghazali Musa (9) published Sipadan: A SCUBA-diving paradise: An analysis of tourism impact, diver satisfaction and tourism management. Martin McCarthy (10) and colleagues conducted research on consumer satisfaction titled Customer Satisfaction and Scuba-diving: Some insights from the deep. Review studies in this area include Scuba Diving Tourism: Introduction to Special Issue by Ghazali Musa and Kay Dimmock (11), as well as Scuba Diving Tourism by Michael Lück (12).

Psychological perspectives have also been explored in the study of scuba diving. Kay Dimmock (13) published Finding Comfort in Adventure: Experiences of Recreational SCUBA Divers. Tah Fatt Ong (14) and colleagues examined the underwater behavior of recreational divers through attitude-behavior theories in their study titled An Examination of Recreational Divers' Underwater Behavior by Attitude-Behavior Theories. Stephanie Merchant (15) explored the sensory and bodily experiences of scuba diving in her work titled Negotiating Underwater Space: The Sensorium, the Body and the Practice of Scuba-diving.

In comparison, international researchers have conducted more specialized and segmented studies on scuba diving. In China, however, the popularity of recreational diving is still relatively low, resulting in limited domestic research. Studies from the perspective of leisure studies are particularly scarce. Initially, domestic research on diving in China primarily focused on the psychological and physiological aspects of professional divers. For example, a personality psychology survey of 189 diving trainees was conducted by Yu Qinghua, Yan Guohua, and Zhao Kunming (16). Xiao Chenghua, Li Shide, and Bai Lishan (17) investigated the physical and mental health of 70 divers. A psychological function test method for divers was proposed by Jing Yanlin and Gao Guizhen (18). Wang Jiali, Miao Luqing, Jiang Zhenglin, and Dai Jiajun (19) jointly developed a

preliminary scale for assessing the mental health dimensions of professional divers.

The second category of relatively more abundant literature consists of reviews on the history and current state of recreational diving in China. For instance, Su Xiong (20) published a study on recreational diving. Zhang Qiang, Chang Qing, and Yuan Hancheng (21) explored the historical significance of the initial stage of modern diving sports in China. Yuan Feng (22) conducted a bibliometric analysis of recreational diving research literature in China over the past decade.

1.4 Leisure constraints and negotiation

Leisure constraints refer to the factors that restrict or hinder the quality, duration, intensity, frequency, and other aspects of participation in leisure activities, thereby impeding the enjoyment of leisure (23).

Thus, the purpose of our research on leisure constraints is to "investigate the factors that limit the formation of leisure preferences or prevent people from participating in and enjoying leisure activities" (24). Typically, research on the negative factors that determine individual leisure choices—namely, leisure constraints—can help us explain the relationships between individuals' leisure attitudes, preferences, and ultimate leisure behaviors, and may even provide new insights into conclusions previously based on researchers' subjective perceptions.

Early theories of leisure constraints posited that constraints were static, meaning that leisure constraints were almost insurmountable limitations or obstacles to participation in leisure activities, i.e., with constraints—no participation, without constraints—participation. This paradigm and model led researchers to overlook the impact of leisure constraints on participants and the other outcomes beyond non-participation that these constraints might bring.

In the 1980s and 1990s, skepticism toward early leisure constraint research led to significant developments in constraint theory. First, the term "leisure barriers" was replaced by "leisure constraints". Subsequently, Crawford and Godbey introduced the most important concepts and models in leisure constraint theory research. In their 1987 article "Reconceptualizing Barriers to Family Leisure" published in Leisure Sciences, they made two major contributions: First, Crawford and Godbey (25) argued that constraints not only affect participation and non-participation but also influence preferences. In other words, a lack of interest in or awareness of an activity is also subject to or can be explained by constraints. Second, they expanded the range of factors that might influence behavior. That is to say, in addition to structural constraints, leisure constraints also include intrapersonal and interpersonal factors.While Crawford & Godbey's three-dimensional model of leisure constraints (intrapersonal, interpersonal, and structural) provides a useful theoretical framework, its application in the Chinese context requires careful consideration of cultural, economic, and social specificities. For instance, family dynamics in China often play a significant role in shaping individual leisure choices, while economic pressures and limited access to resources further distinguish the Chinese context from Western settings (26).The latter two, compared to the secondary structural factors, are more direct and more likely to influence leisure choices because they directly affect the formation of leisure preferences as individual internal factors and social factors, while structural factors influence participation before the actual engagement, after the formation of leisure preferences.

Since then, research on leisure constraints has continued to evolve. Scott (27) first introduced the concept of "negotiation" into leisure constraint theory in 1991. He pointed out that people often adopt a "negotiation" attitude towards leisure constraints, meaning that the presence or absence of constraints does not determine whether people participate in leisure. The decisive factor is the outcome of negotiation with the constraints, which usually involves adjustment rather than direct cancellation of participation. Shaw, Brawner, and Mcaleer (28) found that individuals with higher constraints participate in leisure activities more frequently than those with lower constraints, which is contrary to the intuitive view in the constraint-participation model.

Initially, constraint negotiation strategies were divided by Jackson (29) into two major categories: cognitive strategies (adjusting expectations, changing interests, etc.) and behavioral strategies (time management, financial management, skill learning, improving interpersonal relationships, etc.). By the early 21st century, Huber and Mannell established a four-factor model in the negotiation process from the perspective of the relationships among motivation, constraints, negotiation, and participation (see Figure 1), further refining the constraint-negotiation theory. The introduction of concepts from social cognitive psychology, such as self-efficacy, selective optimization with compensation theory, self-construction, and social identity, into the constraint-negotiation theory has been even more helpful in explaining the internal mechanisms of this process.

Subsequently, Walker and Virden (31), building upon the theories and models of numerous scholars, proposed a relatively comprehensive revised model of leisure constraints for outdoor recreation. Figure 2 integrates the entire process of leisure activities, incorporating mechanisms of preference, decision-making, constraints, negotiation, behavior, as well as the influence of macro- and micro-level factors. The significance of leisure constraint research in the field of leisure studies over the past two decades is profound. This is because research on leisure constraints is not merely concerned with whether individuals participate in certain leisure activities; rather, it involves multiple aspects, including leisure motivation, preference, and experience. Correspondingly, it holds implications for leisure services and the planning of leisure spaces.

2 Materials and method

The study examines the leisure constraints and negotiation strategies among scuba diving enthusiasts, analyzing the structural relationships between them through the collection and analysis of primary data. The research employs in-depth interviews as the primary method.

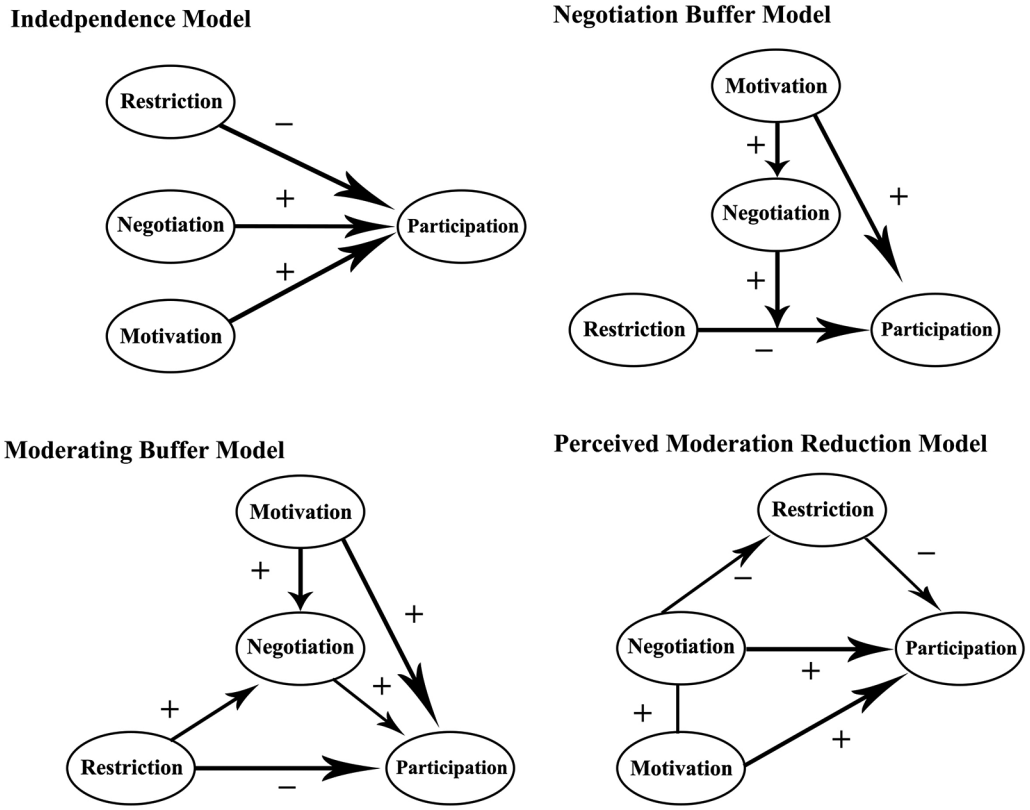

FIGURE 1
The competitive model of constraint negotiation process (30).

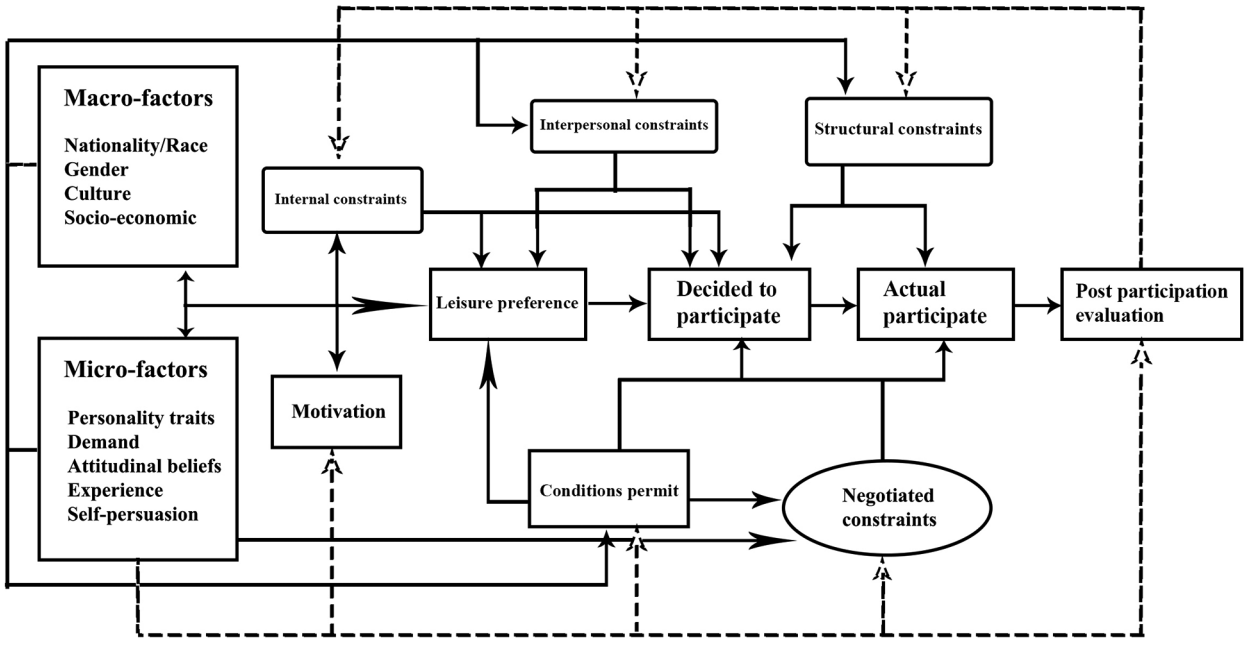

FIGURE 2
The outdoor recreation leisure constraints model (24).

2.1 Interview sample description

A total of 20 divers participated in the interviews, comprising 10 females and 10 males, with ages ranging from 25 to 52 years. All interviewees were non-professional divers, with diving experience varying from one to five years. Their occupations, income levels, and places of residence were diverse, although the majority were single and had high levels of education. The sample selection was representative. Detailed analysis is presented in Table 1.

2.2 Interview protocol

The interview focuses on the respondents' leisure motivations and preferences, the different leisure constraints encountered and negotiation strategies employed at the beginning, advancement, and peak stages of their recreational diving careers, as well as their levels of leisure participation and satisfaction. The specific questions are as follows:

(1) When did you start diving, and what motivated you to begin? (Motivation, formation of leisure preference)
(2) What barriers did you encounter when you first started recreational diving, and what were your achievements? What prompted you to take the certification exam for recreational diving? (Leisure constraints and negotiation strategies at the career onset)
(3) After obtaining the Open Water certification, why did you continue diving and pursue higher-level certifications? (Leisure constraints and negotiation strategies during career advancement)
(4) What is your current diving certification level? (e.g., AOW, Rescue Diver, Master Scuba Diver, Dive Master) How long did it take to achieve this level? What were the greatest gains and obstacles during this process? At which stage did diving bring you the most satisfaction? (Leisure constraints, negotiation strategies, leisure satisfaction, and participation)
(5) Have you considered further advancing your diving skills? What are the reasons for or against continuing to advance? (Leisure constraints and negotiation strategies at the career peak)

2.3 Positive and negative affect schedule (PANAS)

The study examines the subjective expectations prior to participation and the objective feelings following participation in diving activities among interviewees, focusing on intrapersonal and interpersonal constraints within the context of leisure constraints. The scale consists of 12 items, utilizing a 5-point Likert scale for scoring, where 1 indicates the weakest level of expectation or actual feeling, and 5 indicates the strongest.All statistical analyses for the PANAS scale, including reliability (Cronbach's alpha) and validity (factor analysis) assessments, were performed using the Statistical Package for the Social Sciences (SPSS), version 29.0 (IBM Corp., Armonk, NY, USA).

(1) Feeling happy and excited before participating in diving activities.

TABLE 1 Basic information of respondents.

Category	Gender	Age	Job	Working age	Marital status	Educational level	Monthly income (yuan)	Residence
F1	Female	30	Company staff	2 years	Married	Bachelor degree	Twenty thousand	Beijing
F2	Female	30	Online store owner	5 years	Unmarried	Bachelor degree	Thirty thousand	Dalian
F3	Female	28	Clerk	3 years	Unmarried	Bachelor degree	Ten thousand	Nanjing
F4	Female	37	Civil servant	4 years	Unmarried	Master's degree	More than Ten thousand	Wuhan
F5	Female	35	Hospital administrator	3 years	Unmarried	Bachelor degree	Eight thousand	Guiyang
F6	Female	40	Owner operator	5 years	Unmarried	Junior college diploma	Twenty thousand	Nanjing
F7	Female	29	Company staff	1 year	Unmarried	Junior college diploma	Twenty thousand	Hong Kong
F8	Female	32	Architect	2 years	Unmarried	Bachelor degree	Six thousand	Shenyang
F9	Female	25	Corporate treasurer	1 year	Unmarried	Bachelor degree	Five thousand	Dongguan
F10	Female	40	Tourism management personnel	1 year	Married	Bachelor degree	Forty thousand	Guangzhou
M1	Male	35	Employees of state-owned enterprises	3 years	Unmarried	Bachelor degree	Five thousand	Xi'an
M2	Male	30	Marketing manager	1 year	Unmarried	Bachelor degree	Fifteen thousand	Shanghai
M3	Male	39	Civil servant	5 years	Unmarried	Bachelor degree	Six thousand	Hangzhou
M4	Male	28	Foreign trade salesman	2 years	Unmarried	Bachelor degree	Forty thousand	Foshan
M5	Male	42	Engineer	5 years	Unmarried	Junior college diploma	More than fifty thousand	Shanghai
M6	Male	28	Graphic designer	2 years	Unmarried	Bachelor degree	Twelve thousand	Hangzhou
M7	Male	33	Aircraft commander	2 years	Married	Bachelor degree	More than thirty thousand	Chongqing
M8	Male	40	Company manager	2 years	Married	Bachelor degree	Twenty to thirty thousand	Guangzhou
M9	Male	52	Freelancer	3 years	Married	Junior college diploma	Ten thousand	Shanghai
M10	Male	35	Reporter	3 years	Unmarried	Bachelor degree	More than Ten thousand	Guangzhou

(2) Feeling nervous and anxious before participating in diving activities.
(3) Expecting to relieve stress and relax through diving activities.
(4) Expecting to feel more energetic and motivated through diving activities.
(5) Feeling proud to be a diver (due to skill improvement).
(6) Feeling pressured to be a diver (due to skill inadequacy or lack of support from friends and family).
(7) Feeling more inspired after participating in diving activities compared to before.
(8) Feeling guilty after participating in diving activities.
(9) Feeling more determined to continue engaging in diving activities after participation.
(10) Feeling timid or even depressed after participating in diving activities (due to perceived incompetence).
(11) Losing interest in continuing diving activities (due to fatigue, skill inadequacy, or lack of companions).
(12) Looking forward to continuing diving activities (expecting to make more friends).

To ensure the reliability of the PANAS scale used in this study, a Cronbach's alpha analysis was conducted. The results are presented in Table 2. The overall Cronbach's alpha coefficient for the scale was 0.769, indicating good internal consistency. Individual items showed varying levels of contribution to the overall reliability, with corrected item-total correlations (CITC) ranging from −0.226 to 0.736. The alpha coefficients if items were deleted ranged from 0.728 to 0.823, further supporting the scale's reliability.

To assess the validity of the PANAS scale, a factor analysis was conducted. The results are presented in Table 3. The factor loadings, communalities, and other relevant statistics are shown below. The Kaiser-Meyer-Olkin (KMO) value was 0.796, indicating sampling adequacy. Bartlett's test of sphericity was significant ($\chi^2 = 364.246$, $df = 66$, $p = 0.000$), supporting the factorability of the correlation matrix. Three factors were extracted, explaining a cumulative variance of 69.741% after rotation. The factor loadings indicated a clear factor structure, supporting the construct validity of the PANAS scale.

3 Results

During the interview process, participants predominantly discussed their experiences and perceptions of diving across several key dimensions: the initiation of their recreational diving careers, the constraints encountered during skill advancement and participation in diving activities, and the corresponding negotiation strategies. They also addressed the new social opportunities afforded by diving and the ways in which participation in diving activities enhanced their life satisfaction.

3.1 Diving enthusiasts: constraint negotiation to certification

Scuba diving, as a leisure activity, is distinct from other recreational pursuits. Notably, before becoming a certified scuba diver, individuals must undergo training and examination by a professional organization (32). Only after obtaining the relevant certification are they permitted to participate in organized scuba diving activities. Given the inherent risks and technical nature of this activity, specialized skills and knowledge are required. In the absence of such certification, individuals with an interest in diving may only engage in introductory diving experiences. For example, F3 mentioned, "*After my first introductory dive, I was completely hooked by the underwater world and couldn't wait to get certified*". F2 also mentioned, "*At first, it was hard to find diving buddies, but after joining a diving club, I met many like-minded people, which made the whole experience more enjoyable*". These experiences, lacking autonomy, professionalism, and technicality, are not classified as scuba diving activities in this study. The sample selected for this research consists exclusively of certified recreational divers who have obtained their scuba diving certification.

The Professional Association of Diving Instructors (PADI) is currently the most popular and largest global diving training organization. PADI has 25,000 instructors worldwide, issuing over 500,000 diving certifications annually. It also trains its own

TABLE 2 Cronbach's alpha analysis for PANAS scale.

Item	Corrected item-total correlation (CITC)	Alpha if item deleted	Cronbach's α
Feeling happy and excited before participating in diving activities	0.580	0.754	0.782
Feeling nervous and anxious before participating in diving activities.	0.182	0.791	
Expecting to relieve stress and relax through diving activities	0.488	0.760	
Expecting to feel more energetic and motivated through diving activities	0.667	0.738	
Feeling proud to be a diver (due to skill improvement)	0.736	0.728	
Feeling pressured to be a diver (due to skill inadequacy or lack of support from friends and family)	0.360	0.773	
Feeling more inspired after participating in diving activities compared to before	0.671	0.736	
Feeling guilty after participating in diving activities	0.214	0.783	
Feeling more determined to continue engaging in diving activities after participation	0.511	0.757	
Feeling timid or even depressed after participating in diving activities (due to perceived incompetence)	0.303	0.779	
Losing interest in continuing diving activities (due to fatigue, skill inadequacy, or lack of companions)	−0.226	0.823	
Looking forward to continuing diving activities (expecting to make more friends)	0.554	0.751	

The standardized Cronbach's alpha coefficient was 0.769.

TABLE 3 Factor analysis results for PANAS scale.

Item	Factor loading			Communality
	Factor 1	Factor 2	Factor 3	
Feeling happy and excited before participating in diving activities	0.774	−0.177	0.344	0.749
Feeling nervous and anxious before participating in diving activities.	−0.065	0.791	0.033	0.631
Expecting to relieve stress and relax through diving activities	0.744	−0.227	0.280	0.684
Expecting to feel more energetic and motivated through diving activities	0.884	0.082	−0.155	0.812
Feeling proud to be a diver (due to skill improvement)	0.834	0.215	−0.003	0.741
Feeling pressured to be a diver (due to skill inadequacy or lack of support from friends and family)	0.121	0.791	0.155	0.664
Feeling more inspired after participating in diving activities compared to before	0.814	0.175	−0.065	0.697
Feeling guilty after participating in diving activities	0.043	0.229	0.847	0.771
Feeling more determined to continue engaging in diving activities after participation	0.811	−0.150	−0.039	0.681
Feeling timid or even depressed after participating in diving activities (due to perceived incompetence)	0.047	0.799	0.085	0.648
Losing interest in continuing diving activities (due to fatigue, skill inadequacy, or lack of companions)	−0.524	0.471	0.455	0.704
Looking forward to continuing diving activities (expecting to make more friends)	0.761	0.066	−0.059	0.586
Eigenvalue (Before Rotation)	4.833	2.521	1.015	–
Variance Explained (%) (Before Rotation)	40.276%	21.008%	8.457%	–
Cumulative Variance Explained (%) (Before Rotation)	40.276%	61.284%	69.741%	–
Eigenvalue (After Rotation)	4.825	2.358	1.186	–
Variance Explained (%) (After Rotation)	40.211%	19.646%	9.884%	–
Cumulative Variance Explained (%) (After Rotation)	40.211%	59.857%	69.741%	–
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy	0.796			–
Bartlett's Test of Sphericity: χ^2	364.246			–
df	66			–
p	0.000			–

instructors and examiner instructors, and certifies dive shops and clubs where these instructors are based. All the instructors and divers known to the author, including the author's own certification, are issued by PADI.

3.1.1 Constraints and coping strategies for scuba diving enthusiasts

All interviewees began their narratives with how they developed an interest in diving. The majority were travel enthusiasts with experiences in international travel, particularly favoring island tourism. Among them, many who enjoyed swimming or had participated in snorkeling activities were exposed to the underwater world's breathtaking and novel scenery through various media. Alternatively, they had directly experienced the grandeur and allure of coral reefs and fish shoals during snorkeling. These experiences motivated them to engage in scuba diving through introductory dives organized by diving clubs, allowing them to more closely experience the ocean's wonders. After one or two introductory dives, interviewees gained a basic understanding of the rules and skills of scuba diving. Having experienced the joy of the activity, they all chose to pursue certification as recreational divers.

In deciding to undertake PADI diver training, each individual encountered certain leisure constraints, predominantly structural factors such as time and financial limitations, as well as interpersonal constraints, including family concerns and the lack of companions. At this stage, intrapersonal constraints were less prevalent, as most interviewees had already participated in introductory dives and had developed a preference and desire for this leisure activity. However, a few interviewees mentioned mild intrapersonal psychological constraints, such as uncertainty about their ability to succeed in the activity.

In the Chinese context, personal constraints such as lack of confidence or fear of safety risks are often exacerbated by societal attitudes toward high-risk activities, which are less normalized compared to Western countries (33). F6 mentioned the concerns of her family about diving activities: "*My family is not overly worried about the expenses I spend on diving. I pay for diving myself. They aren't too worried about me in this regard. However, if my parents don't support me, there is not much I can do. They think that obtaining certification and diving are not only very risky and may be life-threatening, but also useless, so they don't support me*".

During this phase, interviewees primarily employed behavioral strategies for constraint negotiation. Given their initial enthusiasm for diving, the negotiation approaches often involved promoting the activity to family or friends and joining clubs to find like-minded individuals, thereby improving social support.

3.1.2 Constraints and strategies for advancing in scuba diving

In PADI diving courses, the advanced programs specifically designed for non-professional divers are divided into several stages: Open Water Diver, Advanced Open Water Diver (AOW, with a depth limit of 30 meters and qualifications for night diving, boat diving, and open-water cavern diving), Rescue Diver, and Master Scuba Diver (the highest honor for recreational divers). For those aspiring to become professional instructors, there are the Diver Master and Open Water Scuba Instructor courses. These advanced courses are also pursued by amateur diving enthusiasts to elevate their diving skills to a higher level (34).

During the advanced stages of diving participation, the leisure constraints encountered by respondents differ from those experienced at the onset of learning scuba diving. At this stage, intrapersonal constraints become more pronounced. M1, a state-owned enterprise employee, says: "*I've gone diving more often, but I still worry it's not good for my boss to know I often go out for fun. So, on my personal social media, I block my leaders and colleagues. On some level, this is also a constraint for me*".As PADI courses progress in complexity, the stress associated with scuba diving activities becomes more evident, manifesting not only in time and financial pressures but also in significant psychological stress. For instance, enthusiasm for the activity may wane compared to the initial stages, with extensive training and examinations required for advancement diminishing the enjoyment of diving. In some cases, an unpleasant or unsafe diving experience may even lead to the consideration of discontinuing participation. Family opposition, a significant interpersonal constraint in China, often stems from cultural values emphasizing safety and stability, which may lead families to discourage participation in activities like scuba diving. F8 shared her view on family opposition: "*Family opposition often stems from safety concerns. For instance, when I plan to dive in faraway places, they think it's dangerous. But I usually explain to them that diving is actually a safe sport as long as I follow the rules*".

In this phase, scuba diving enthusiasts primarily employ cognitive strategies such as enhancing self-efficacy and identity, alongside behavioral strategies focused on improving social support, particularly seeking assistance from peer groups. As F8 stated, "*When I faced difficulties in advanced courses, I kept telling myself that I've come this far and I can do it. Joining a peer group also helped me a lot as we shared experiences and supported each other*". The limited availability of training resources was another challenge. M9 stated, "*In China, there are not many high-quality diving training resources. I had to travel to different cities several times to find suitable instructors, which was both time-consuming and costly*". Structural constraints in China are further compounded by the limited availability of affordable training resources and the high cost of diving equipment, which restrict access to the activity for many enthusiasts (35). F1 mentioned in a humorous way: "*Another thing is the cost. For example, an 8-day trip to the Galapagos costs over 70,000 yuan, which is my whole year's diving budget. I think it's not worth it. I'd better go to other places more times. I can't afford such a price now. I plan to dive there when I'm 60. It's not something I can afford now. I can go, but after spending all that money, I still feel a bit*".

3.2 Leisure constraints

The leisure constraint model employed in this study is categorized according to the three dimensions proposed by Crawford and Godbey: intrapersonal constraints, interpersonal constraints, and structural constraints. Based on the interview results, these constraints are summarized into 18 factors. The specific classification is shown in Figure 3.

3.3 Constraining negotiation strategies

The study's constraint negotiation strategy model is based on Jackson's cognitive and behavioral strategies, which, according to the interview data, may be summed up as 23 cognitive and 20 behavioral methods. The particular classification is displayed in Figures 4, 5.

3.4 Leisure constraints—consultative structural relationships

We may observe that there is a specific structural relationship between constraint and negotiation based on the related negotiation methods provided by the interviewees while discussing leisure limitations. While behavioral tactics are primarily employed when addressing structural limits, cognitive strategies are primarily employed when addressing interpersonal and personal constraints. While behavioral tactics were mostly employed to address structural constraints, cognitive strategies were primarily employed to address interpersonal and personal constraints. The particular classification is displayed in Figure 6.

4 Conclusions and recommendations

Based on interviews with scuba diving enthusiasts, this study examines the structural relationships between the three dimensions of leisure constraints—intrapersonal constraints (personal), interpersonal constraints (social), and structural constraints (environmental)—and the two strategies of constraint negotiation: cognitive strategies and behavioral strategies. The findings reveal distinct patterns in how enthusiasts address different types of constraints, highlighting the interplay between constraint dimensions and negotiation approaches.

4.1 The structural relationships between leisure constraints and constraint negotiation strategies

4.1.1 Intrapersonal and interpersonal constraints (constraints related to "People")

Constraints related to "people," such as lack of confidence, fear of safety risks, family opposition, or insufficient social support, are primarily addressed through cognitive strategies. These strategies involve altering psychological perceptions of the activity, modifying expectations, and enhancing self-efficacy. For example, enthusiasts may adjust their mindset by reframing diving as a means of personal growth or stress relief, or by emphasizing the social benefits of engaging with like-minded individuals. By strengthening their psychological and social identification with the role of a diver, enthusiasts develop greater motivation and confidence to continue participating in the activity. This

cognitive approach allows them to overcome internal barriers and maintain their enthusiasm for diving.

4.1.2 Structural constraints (constraints related to "Objects")

Constraints related to "objects", such as time limitations, financial pressures, or limited access to training opportunities, are predominantly addressed through behavioral strategies. These constraints are more objective in nature and can be tackled through specific actions. For instance, enthusiasts may manage their time by scheduling diving trips around work commitments, seek financial solutions through budgeting or part-time jobs, or join diving clubs to access shared resources and training programs. Behavioral strategies enable enthusiasts to systematically address external barriers, ensuring they can continue to participate in diving despite practical challenges.

4.1.3 Structural relationships between constraints and negotiation strategies

The study identifies a clear structural relationship between the type of constraint and the negotiation strategy employed. Cognitive strategies are predominantly used for intrapersonal and interpersonal constraints, while behavioral strategies are more effective for structural constraints. This relationship underscores the importance of understanding the nature of constraints when designing interventions or support systems for enthusiasts. For example, addressing psychological barriers through community-building initiatives or motivational workshops may be more effective than simply providing financial aid, while improving access to training facilities or flexible scheduling may better address structural limitations. As M1 suggested, "*If there were more affordable training facilities nearby, I would definitely participate more often*".

4.2 Structural relationships: a deeper analysis

The structural relationships between the three dimensions of leisure constraints and the two strategies of constraint negotiation can be further elaborated as follows:

4.2.1 Intrapersonal constraints and cognitive strategies

Intrapersonal constraints, such as lack of confidence or fear of safety risks, are deeply rooted in an individual's psychological state. For instance, regarding lack of confidence, F7 said, "*I was really nervous before my first dive, doubting whether I could handle it.*

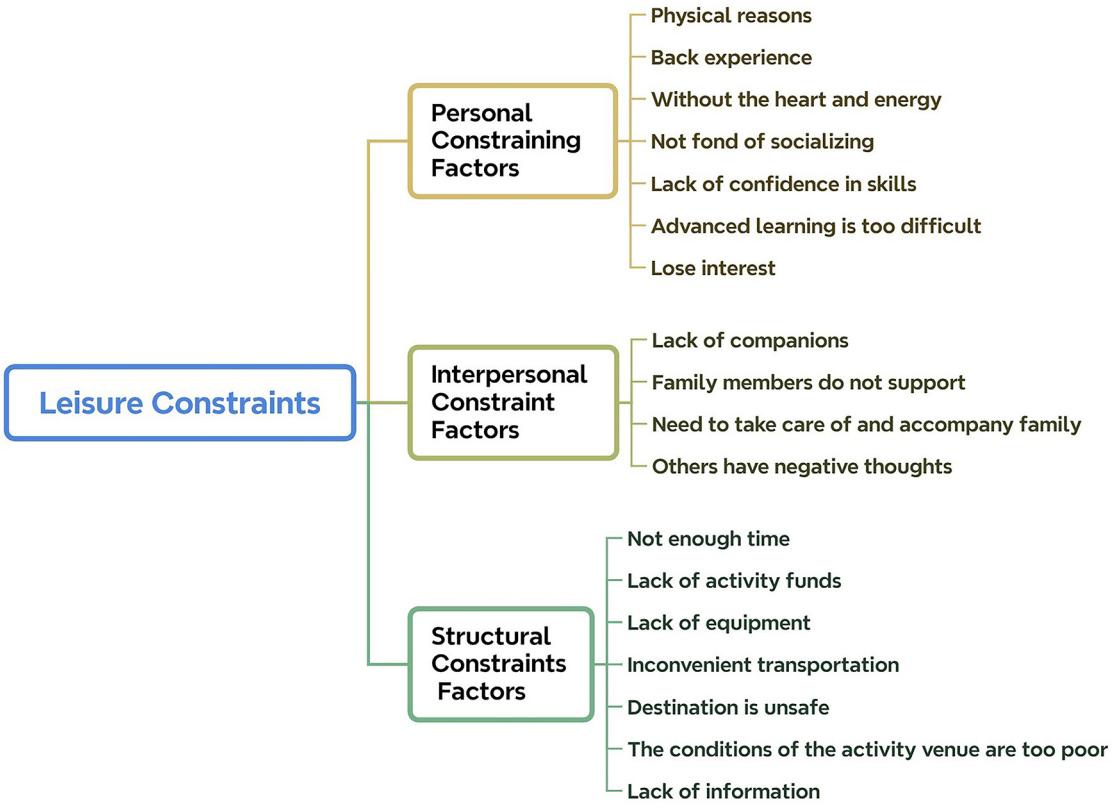

FIGURE 3
Leisure constraints model.

FIGURE 4
Cognitive strategies for constrained negotiation.

But after completing it successfully, my confidence boosted". Cognitive strategies, which involve adjusting perceptions and expectations, are particularly effective in addressing these constraints. By reframing diving as a positive and rewarding experience, enthusiasts can enhance their self-efficacy and reduce anxiety, thereby overcoming personal barriers.

4.2.2 Interpersonal constraints and cognitive strategies

Interpersonal constraints, such as family opposition or lack of social support, often stem from misunderstandings or miscommunications. Cognitive strategies, such as emphasizing the social and recreational benefits of diving, can help enthusiasts gain the support of family and friends. This approach not only addresses the immediate constraint but also strengthens social bonds and identity within the diving community.

4.2.3 Structural constraints and behavioral strategies

Structural constraints, such as time and financial limitations, are external and objective. Behavioral strategies, such as time management and financial planning, are practical and actionable solutions to these challenges. By systematically addressing these external barriers, enthusiasts can continue to participate in diving activities without being hindered by logistical issues.

5 Discussion

This study, based on interviews with scuba diving enthusiasts, confirms the structural relationship between leisure constraints and constraint negotiation. The findings align with existing theories, particularly Crawford and Godbey's leisure constraints model and Jackson's classification of constraint negotiation strategies. The study reveals that scuba diving enthusiasts predominantly use cognitive strategies to address personal and interpersonal constraints, while behavioral strategies are more effective for structural constraints. This supports the existing theoretical perspective on the relationship between constraint types and negotiation strategies.

Compared to Western contexts, family dynamics in China play a more pronounced role in shaping interpersonal

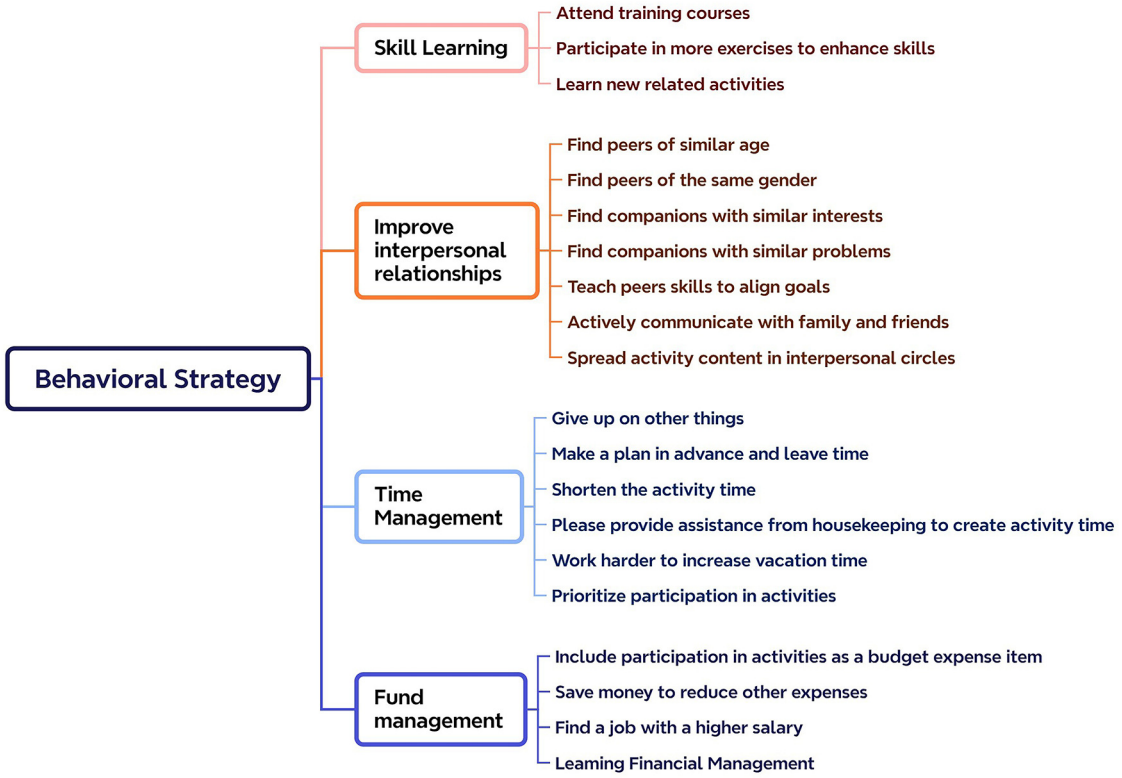

FIGURE 5
Strategies for constraining negotiation behavior.

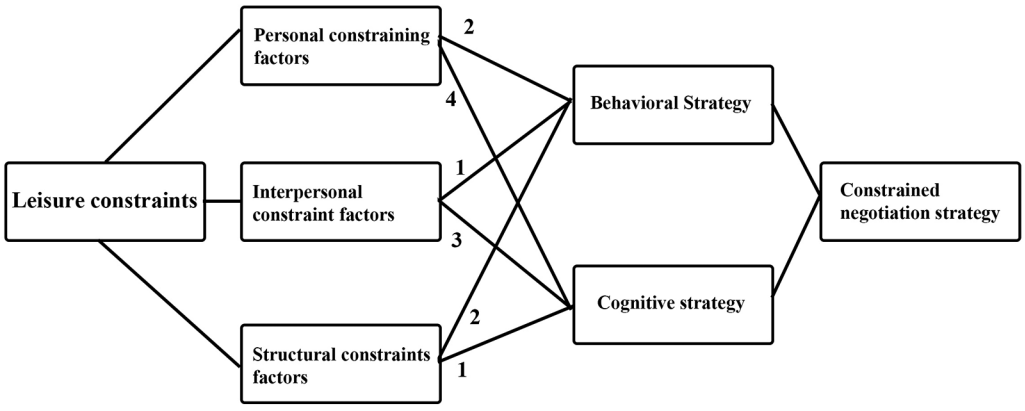

FIGURE 6
Constraint-consultation structural relationships.

constraints, with family opposition often stemming from cultural values emphasizing safety and stability. Additionally, structural constraints such as economic pressures and limited access to resources are more pronounced in China, reflecting the country's unique socio-economic landscape. These contextual differences highlight the importance of adapting theoretical frameworks to local cultural and economic conditions.

5.1 Contributions of the study

The contributions of this study are significant. First, it fills a research gap in the field of leisure studies in China, where research on scuba diving is relatively scarce. Through empirical research, this study provides new insights into understanding the leisure constraints and negotiation strategies of scuba diving

enthusiasts. Second, it enriches theoretical frameworks by validating and refining leisure constraints theory, particularly in terms of the structural relationship between constraint types and negotiation strategies. Third, the findings offer practical implications for diving clubs and related organizations, helping them better understand the constraints faced by scuba diving enthusiasts and design more effective support systems.

5.2 Limitations of the study

Despite these contributions, the study has several limitations. The sample size was small, with only 20 scuba diving enthusiasts interviewed, which may limit the generalizability of the results. Additionally, the sample selection was limited, as all respondents were non-professional divers, and most were single and highly educated, which may restrict the diversity of the results. The data collection methods were also limited, relying primarily on interviews without supplementary quantitative data, which may affect the comprehensiveness of the results. Furthermore, self-reported data may be biased, affecting the accuracy and authenticity of the data.

5.3 Recommendations for future research

Future research should address these limitations. Expanding the sample size to include a larger and more diverse group of scuba diving enthusiasts would enhance the generalizability and representativeness of the results. Using multiple data collection methods, such as combining surveys and interviews, could provide more comprehensive data. Exploring new analytical methods, such as structural equation modeling (SEM) or machine learning techniques, could deepen the analysis of the relationship between leisure constraints and negotiation strategies. Cross-cultural comparative studies could also explore differences in leisure constraints and negotiation strategies across different cultural contexts. Finally, validating self-reported data through objective measurement methods, such as behavioral observation or physiological measurement, could reduce bias and improve data accuracy.

In summary, this study validates the structural relationship between leisure constraints and negotiation strategies through interviews with scuba diving enthusiasts, providing new empirical support for leisure research. The findings offer valuable references for future research and practice, despite some limitations. Future research should further expand the sample size and methods to more comprehensively reveal the complex relationship between leisure constraints and negotiation strategies.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary Material.

Ethics statement

The participants provided their written informed consent to participate in this study.

Author contributions

JC: Writing – original draft, Writing – review & editing. ZY: Writing – original draft, Writing – review & editing. RN: Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Correction note

A correction has been made to this article. Details can be found at: 10.3389/fspor.2025.1664741.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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Correction: Leisure constraints and the negotiation of structural relationships: a case study of scuba diving enthusiasts

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Text correction

In the published article, there was an error in the abstract. Due to multiple submissions, the abstract for another article was mistakenly provided for this article.

The previous abstract was written as:

"**Background and aims:** College students' social media addiction is linked to psychological anxiety. This study explores the relationship mechanisms, particularly the mediating roles of self-efficacy and coping styles.

Methods: Data were collected from 615 college students using questionnaires. Structural equation modeling was employed to analyze the data an investigate both the direct and indirect effects of social media addiction on psychological anxiety through the lens of self-efficacy and coping styles.

Results: The results indicated a significant positive correlation between social media addiction and psychological anxiety. Specifically, social media addiction was found to not only directly increase psychological anxiety but also indirectly affect it through two pathways: (1) by reducing self-efficacy, which in turn heightened psychological anxiety, and (2) by influencing coping styles, wherein negative coping styles were positively related to psychological anxiety. Moreover, a chain mediation effect was observed where social media addiction led to decreased self-efficacy, subsequently shifting coping styles and ultimately exacerbating psychological anxiety.

Discussion and conclusions: These findings highlight the critical roles of self-efficacy and coping styles in the relationship between social media addiction and psychological anxiety among college students. They provide valuable insights for developing targeted

interventions to mitigate the adverse effects of social media addiction on mental health, emphasizing the importance of enhancing self-efficacy and promoting positive coping strategies. By addressing these factors, universities can better support students in maintaining healthy social media habits and reducing psychological anxiety."

The correct abstract appears below:

"**Background:** Scuba diving has emerged as a popular recreational activity in China over the past two decades, yet academic research on this sport from the perspective of leisure studies remains limited. This study explores the relationship between leisure constraints and constraint negotiation among scuba diving enthusiasts, aiming to fill this research gap.

Method: This study employed a mixed-methods approach, combining in- depth interviews with 20 scuba diving enthusiasts and the Positive and Negative Affect Schedule (PANAS) for survey and analysis. The interviews focused on the participants' leisure motivations, the constraints encountered at different stages of their diving careers, and the negotiation strategies they employed.

Results: The findings revealed that scuba diving enthusiasts tend to use cognitive negotiation strategies when addressing personal and interpersonal constraints, while predominantly employing behavioral negotiation strategies when dealing with structural constraints. A structural relationship was identified between leisure constraints and constraint negotiation, indicating that the type of constraint influences the negotiation strategy employed.

Conclusions: This study provides empirical support for the structural relationship between leisure constraints and constraint negotiation, enriching the materials available for leisure research. Future research is recommended to expand the sample size and further explore the underlying mechanisms of this relationship, as well as to consider the authenticity and accuracy of respondents' self-reports."

Affiliation correction

In the published article, there was a translation error in the institution's official English name for affiliation 2.

The affiliation was previously written as:

"Zhejiang Leisure Association, Zhejiang University Zijingang Campus, Hangzhou, Zhejiang, China"

The correct affiliation appears below:

"Zhejiang Leisure Association, Hangzhou, Zhejiang, China"

Affiliation correction

In the published article, there was an error in the ordering of affiliations 2 and 3.

The previous affiliations were ordered as:

2. "Zhejiang Leisure Association, Zhejiang University Zijingang Campus, Hangzhou, Zhejiang, China"

3. "Hangzhou International Urbanology Research Center & Zhejiang Urban Governance Studies Center, Hangzhou, Zhejiang, China"

The correct order of affiliations appears below:

2. "Hangzhou International Urbanology Research Center & Zhejiang Urban Governance Studies Center, Hangzhou, Zhejiang, China"

3. "Zhejiang Leisure Association, Hangzhou, Zhejiang, China"

The original article has been updated.

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The relationship between grit, resilience and physical activity: a systematic review

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Introduction: At present only about half of Americans meet the recommended physical activity (PA) guidelines. Theoretically personality traits, encompassed by grit and resilience, should be beneficial to overcome common barriers to PA participation. To systematically review synthesized literature regarding the relationship between grit, resilience, and PA outcomes.
Methods: The search methodology adhered to the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines. Study eligibility criteria included peer-reviewed studies with healthy adult participants, where a reported relationship between PA and either grit or resilience existed. Study quality was evaluated with the Appraisal Tool for Cross-Sectional Studies (AXIS) and a qualitative synthesis was performed.
Results: A total of 33 studies involving diverse participants (n = 37,370) across age, sex, culture, education, and PA outcomes met the inclusion criteria. The methodological quality of studies was rated as good on average. Most of the studies found positive relationships between grit, resilience, and PA outcomes, such as adherence, intensity, and performance in competitive settings.
Conclusion: Cumulatively, the findings suggest that personality traits of grit and resilience play a significant role in supporting PA engagement, with individuals exhibiting higher levels being more likely to participate in regular PA and achieve better performance outcomes. Given that most studies employed cross-sectional designs, future research is needed to elucidate whether a causal relationship exists between grit, resilience, and PA. These findings may have practical applications for designing interventions aimed at fostering these traits to enhance PA adherence and overall health.

Systematic Review Registration: https://www.crd.york.ac.uk/PROSPERO/view/CRD42022370061, identifier CRD42022370061.

KEYWORDS

physical activity, exercise adherence, health, grit, resilience, health promotion

1 Introduction

Physical activity (PA) plays an essential role in promoting overall health and well-being throughout the lifespan (1). PA is defined as any bodily movement that results in energy expenditure, which is an umbrella term for various activities including exercise and sport (2). Regular engagement in PA has been consistently linked to numerous

physical and mental health benefits, including reduced risk of chronic diseases, improved cardiovascular fitness, enhanced cognitive function, better mental health, and increased longevity (1). Despite the current PA guidelines, recommending at least 150 min of moderate to vigorous intensity per week (3), only half of Americans meet these guidelines (4).

Numerous studies conducted across diverse countries and communities have identified environmental barriers, such as neighborhood design and perceived safety, as significant influences on adults' PA levels (5–7). A common barrier is the lack of access to convenient facilities or designated spaces for exercise, whereas a well-designed built environment can serve as a strong facilitator of PA (8). Perceived neighborhood safety also plays a critical role in PA engagement. Individuals who live in areas with high levels of crime or who do not feel safe outdoors are less likely to engage in outdoor activities such as walking, jogging, or recreational play (7). Additionally, time constraints are consistently reported as a universal barrier across adult populations, limiting regular engagement in PA (5). These environmental barriers interact with individual-level determinants and contribute to disparities in PA across socioeconomic and geographic groups (6, 9). Among these individual-level factors, personality traits have received growing attention. Personality traits are defined as enduring patterns of thought, emotion, and behavior that remain relatively stable over time and across contexts (10). These traits influence how individuals perceive barriers, cope with setbacks, and sustain motivation, making them highly relevant to understanding PA behaviors (11). Accordingly, a growing body of evidence suggests that personality traits (12, 13) may positively influence PA participation (14–16).

One such personality trait, grit, which is defined as passion and perseverance towards long-term goals despite failures (17), may be beneficial for engaging in PA. The construct of grit, introduced in 2007 as a trait encompassing perseverance and consistency of long-term interests, has been found to be a robust predictor of accomplishments in challenging domains, often surpassing conventional measures of talent (17). Subsequent research indicates that individuals with higher levels of grit demonstrate success across diverse domains, including academics, sports, and professional settings (18, 19). Grit plays a vital role in sustaining effort, enabling individuals to navigate obstacles and setbacks that might otherwise impede the pursuit of their goals (20). Self-report measures, such as the 12-item Grit-O scale developed by Duckworth and colleagues (17), serves as a common tool in literature to gauge grit (20). This scale provides an overall grit score and sub-component scores for perseverance of effort and consistency of interest.

The perseverance of effort component of grit is highly correlated with conscientiousness (21), a personality trait where individuals invest in behaviors that allows for future successes (22). This "invest and accrue" model (Figure 1) employed by conscientious people also finds that conscientious individuals invest in their physical health by adopting healthy behaviors (22). These findings imply that gritty individuals, who are high on the perseverance aspect of grit, may also employ a similar "invest and accrue" model of health behavior, thus being more physically active compared to their less "gritty" counterparts. These individuals may be more likely to overcome obstacles such as time constraints, low self-confidence, competing priorities, and difficulty overcoming setbacks (5, 13, 23, 24). Consequently, higher grit may foster sustained engagement in PA, driven by the perceived benefits towards future health goals (19).

The second component of grit, consistency of interest, also emerges as a potential influencer of PA behaviors across the lifespan, as discerned from studies demonstrating that individuals reporting higher scores on this aspect tend to sustain similar interests for prolonged durations (25). This inclination suggests that those scoring higher on consistency of interest may exhibit sustained levels of PA over extended periods, potentially leading to higher fitness levels that facilitate engagement in more prolonged and intense exercise regimens, such as performing moderate to vigorous PA rather than light PA (26). Research investigating the interplay between grit and PA corroborates these observations, highlighting that both perseverance and consistency of interest are positively correlated with PA intensity (14, 27). Thus, given the detrimental health consequences associated with low levels of PA (e.g., obesity) and the plausible relationship between PA engagement and grit, researchers have increasingly examined the relationship between grit and PA measures (14, 16, 28, 29).

A construct closely related to grit is resilience (30). Although grit and resilience are often discussed together, sometimes used interchangeably in the literature (31) and have been combined in studies (32), they represent distinct psychological constructs with unique theoretical foundations and behavioral implications (25, 33). Grit is conceptualized as a personality trait reflecting sustained passion and perseverance toward long-term goals, characterized by continued effort despite failure, stagnation, or adversity (25). In contrast, resilience refers to a dynamic, context-dependent process of positive adaptation in the face of stress, adversity, or trauma (33). Resilient individuals demonstrate an ability to recover from setbacks and maintain psychological functioning, often adapting strategies and learning from challenging experiences (33). In other words, while both constructs involve persistence through difficulty, grit emphasizes unwavering goal-directed effort over time, whereas resilience centers on flexible coping and psychological recovery (34). This distinction underscores the need to examine grit and resilience as related but different contributors to behavior and motivation.

Despite their conceptual differences, grit and resilience may function in a complementary manner to support long-term goal attainment, such as sustained PA engagement. In theory grit provides the foundation for consistent, effortful pursuit of valued goals, even in the absence of immediate rewards or progress (25). Resilience, by contrast, facilitates adaptive functioning when disruptions or stressors threaten progress toward those goals (33). For example, in the context of PA, a gritty individual may persist with an exercise routine when faced with environmental barriers, during periods of low motivation or plateaus in performance, whereas a resilient individual may adapt the routine in response to injury or life stress, maintaining engagement through flexibility. *n* this way, resilience may enhance the sustainability of gritty behaviors by facilitating

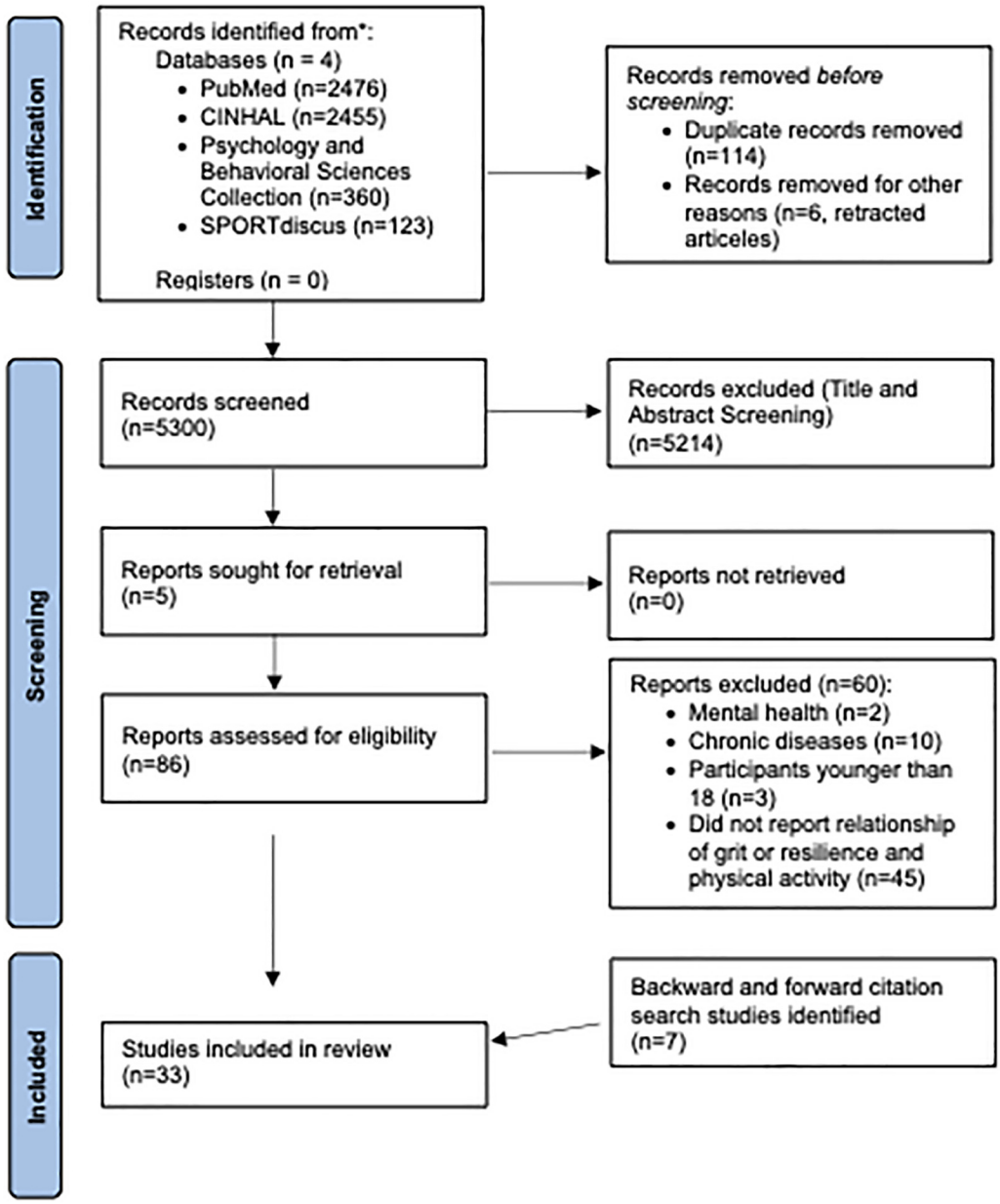

FIGURE 1
Conceptual "invest and accrue" model illustrating how the perseverance of effort component of grit can support sustained physical activity engagement. Gritty individuals are hypothesized to invest effort into physical activity behaviors despite short-term challenges, accruing health benefits over time that reinforce sustained motivation. PA, physical activity.

coping and recovery, while grit ensures directional consistency and persistence. Moreover, resilience may develop as an outcome of gritty behavior, as overcoming obstacles may strengthen adaptive capacities over time (35). Empirical research has demonstrated a moderate positive correlation between grit and resilience (36), with a stronger relationship between resiliency and the perseverance of effort component of grit (30, 37). However, resilience extends beyond perseverance, encompassing a broader range of coping strategies and adjustment processes (33). Therefore, when examining the association between grit and PA, resiliency should also be considered as it adds a dynamic and changeable process that is complementary to the more static grit personality trait (30, 32, 36, 37).

As with other personality traits, grit and resilience are not fixed and may change across the lifespan as a result of life experiences and contextual influences (38). For example, evidence suggests that grit varies across age (39, 40) and sex (39), with older individuals and women reporting significantly higher grit. Additionally, higher educational attainment has been positively associated with both grit (41) and PA participation (42). Beyond individual differences, grit and resilience are also influenced by cultural context (20, 43, 44). While these constructs are

frequently studied within Western, individualistic societies, their meanings and manifestations may differ in collectivist cultures. In individualist societies, grit typically reflects autonomous persistence toward self-determined goals and emphasizes consistency of personal interest (25). Resilience in these contexts is often framed as an internal capacity for emotional regulation and recovery (33). In contrast, collectivist cultures may emphasize perseverance of effort in support of communal or family-oriented goals, rather than consistent personal interests, and may foster resilience through relational networks and communal coping strategies (20, 43, 44). For instance, individuals in collectivist societies may demonstrate high levels of perseverance through a sense of duty, even if their personal goals shift, and may rely more heavily on social support as a key resilience mechanism (43). Similarly, resilience may be expressed through reliance on social support and group cohesion (45). The cultural distinctions highlight the need to interpret grit and resilience in context and may influence how these constructs relate to PA behaviors across diverse populations (43). Taken together, sociodemographic and cultural factors may moderate the association between grit, resilience, and PA.

The significance of grit and resiliency for promoting positive PA behaviors is supported by a growing body of literature (14, 16, 46). Given the health issues associated with insufficient PA across the adult lifespan, comprehending the potential interactions between "grit" and "resilience" in supporting PA outcomes holds considerable value. Hence, the purpose of the systematic review was to synthesize the findings from studies examining the relationship between grit and resilience with PA. Within the overarching objective of the review, relationships with aspects of PA, such as adherence, PA intensity and engagement in various PA domains across the adult lifespan, were more specific relationships of interest.

2 Methods

The systematic literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (47) and the systematic review was registered in the International Prospective Register of Systematic Reviews (PROSPERO; registration #: CRD42022370061).

2.1 Eligibility criteria

The database search was confined to studies published in the English language peer-reviewed journals that met the following inclusion criteria: (a) participants were least 18 years of age, (b) published in the last 30 years, (c) peer reviewed, (d) investigated the quantitative relationship between grit, or resilience, and a measure of PA, (e) English language or translated, and (f) full text. The exclusion criteria applied during the search were: (a) articles that reported case studies, (b) abstracts only, and (c) studies that involved subjects with chronic disease and diagnosed mental health conditions who would not be considered healthy adults. For the purposes of the review healthy adults was considered free of disease or conditions that could interfere with their ability to engage in physical activity or complete grit/resilience questionnaires.

2.2 Search strategy

To obtain relevant literature, databases were searched using search terms relevant to the topic in October 2023. The following Boolean search syntax was used: (grit OR perseverance OR resilience) AND (physical activity OR exercise OR fitness OR physical exercise OR sport). Search terms were decided based on keywords retrieved from the reference pages of relevant articles on the topic and pilot testing. The search terms were applied to the search strategy for four databases: PubMed (Medline), CINHAL, Sport Discus, and Psychology and Behavioral Sciences Collection. Filters were applied in each database search, if available. If the filters were not available, investigators performed manual screening of titles and abstracts. The eligibility criteria were applied to the full-text articles not excluded during the screening of titles and abstracts to select the final number of studies to be included in the literature review. The reference list of each included article was used to perform a backward search for any additional articles that potentially would fit the search criteria. Forward citation tracking of the studies meeting the inclusion criteria was also performed. To reduce the potential errors the search was conducted independently by 2 of the authors (A.H. and J.M.). Any discrepancies were resolved by the authors, then a third author (M.S.) if needed.

2.3 Risk of bias and study quality evaluation

The risk of bias and quality of each study was independently assessed by 2 of the authors (A.H. and J.M), and agreement was mutually determined for any observed discrepancies. Given that 30 of 32 studies used a cross-sectional design, the study quality was evaluated by use of the 20-point Appraisal Tool for Cross-Sectional Studies (AXIS), which has been shown to be a valid measure of the methodological quality of cross-sectional studies (48). The responses using the AXIS tool are "yes," "no," or "don't know," and a numerical value was assigned for each response. An answer of "yes" was assigned a value of 1, an answer of "no" and "don't know" was assigned a value of 0. Any responses that did not apply were given a response on N/A and was subtracted from the total of the 20-points. A total score was computed as the total score divided by the total number of possible points for each study and reported as a percentage. To interpret AXIS total scores, we categorized studies as high, moderate and low quality if they achieved ≥80%, 60%–79%, and <60% of total possible points (49). Importantly, although the search strategy and eligibility criteria did not address methodological design nearly all included studies were cross-sectional and the nature of cross-sectional studies limits conclusions on causality (50).

2.4 Data extraction and synthesis

From each included study, three researchers (A.H. and J.M.) independently extracted the following data: author names, title and year of publication, sample size, description of participants, survey instrument to assess grit and/or resilience, PA measures, statistical approaches, results, and key findings. A third reviewer (M.S.) then reviewed any inconsistencies and facilitated discussion to resolve discrepancies. All differences in data extraction were discussed and reconciled, with consensus achieved in all cases. Due to the overall heterogeneity of the methodology utilized in the included studies only a qualitative synthesis was performed. The synthesis of data was performed in several steps. First, the characteristics of included studies were aggregated by overall sample, country in which study was conducted, relevant socio-demographic factors (e.g., age, sex, education). Next, the specific grit and resilience instruments used in the included studies were summarized. In the last step, focused on the overall aims of the systematic review, the study findings related PA adherence, intensity, and domains were synthesized separately for grit and resilience.

3 Results

The PRISMA search diagram in Figure 2 details the results of the search. Full text screening was conducted on 86 publications, and 60 publications were excluded for the following reasons: participants reported mental health ($n = 2$), chronic disease ($n = 10$), did not report a relationship between grit and PA ($n = 45$), and included participants younger than 18 ($n = 3$). Forward ($n = 3$) and backward ($n = 4$) citation searches then yielded additional studies leading to a total of 33 included studies in the systemic search. However, one published manuscript (15) reported results of 4 separate studies: (1) US adults only; (2) military, veterans, and civilians; (3) college students; (4) performing artists, while another study reported data on two studies (51). Since each study had unique results, in this manuscript the studies from Flinchbaugh et al. (51) and Martin et al. (15) are reported as separate studies [e.g., Martin et al. (15)-study 1, Martin et al. (15)-study 2, etc.]. Unless otherwise noted, all percentages reported in this study are reported as a percentage of 37 total studies [31 separate manuscripts + 2 studies extracted from Flinchbaugh et al. (51) and 4 studies extracted from Martin et al. (15)].

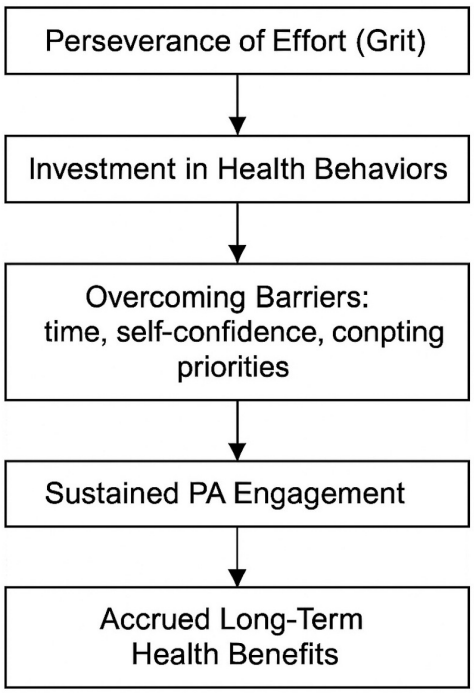

FIGURE 2
Search flow diagram.

3.1 Methodological quality

The average quality score of the studies was 81.2 (±7.5)% with the minimum and maximum scores being 65% and 100%, respectively (Table 1). A majority ($n = 28/37$) studies were classified as being of high methodological quality. Items 13 and 14 were N/A and most of the articles scored low on items 3 and 7. Item 3 pertained to size justification reporting and ~70% of the studies ($n = 23/33$) did not report a size justification or what methods were used to determine the sample size, thus resulting in a score of 0. Items 7, 13 and 14 on the AXIS tool are related to assessing and reporting non-responders and, in 60% of the included studies ($n = 20/33$), item 7 was not addressed and only 1 study addressed items 13 and 14 (Table 1). As previously mentioned, the inherent limitation of cross-sectional studies is inability to draw causality from the findings (50), which bears consideration when interpreting the methodological quality of the studies.

3.2 Study characteristics

The characteristics of the included study reports are summarized in Table 2. An important characteristic of the body of literature is related to the year of publication. Despite the search range including the past 30 years, the earliest study was published in 2014 (57) with ~88% of the studies being published in the last 5 years (Table 2).

The participants of the studies represented a diverse population in terms of socio-demographic factors known to influence grit and resiliency (e.g., age, gender, socio-cultural, age). There were a total of 37,370 participants (18,614 Male; 16,883 Female) in the included studies with 4 distinct subject populations consisting of students ($n = 13,657$; 7,347 Male; 6,310 Female), healthy adult populations ($n = 12,382$; 3,217 Male; 7,342 Female), athletes ($n = 5,113$; 3,896 Male; 1,167 Female), military populations ($n = 7,743$; 6,364 Male; 1,379 Female) and older adults (defined as 60 + years; $n = 979$; 550 Male; 429 Female). All included both males and females, however one study did not report the sex of the participants (54).

TABLE 1 Quality appraisal of included studies using appraisal tool for cross-sectional studies (AXIS).

Author(s)	Items																				Total Points	%
	Introduction	Methods										Results					Discussion		Other			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
Studies using only a grit instrument ($n = 11$)																						
Allee et al. (52)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**15**	75%
Benedict et al. (53)	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Cazayoux and DeBeliso (54)	1	1	0	1	0	0	0	1	1	1	1	0	0	0	1	1	1	1	1	1	**13**	65%
Daniels et al. (55)	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**18**	90%
Flinchbaugh et al. (51)	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**18**	90%
Kelly et al. (56)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	1	1	**15**	75%
Martin et al. (28)	1	1	1	1	0	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Martin et al. (15)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Nothnagle and Knoester (38)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	**15**	83%
Reed (57)	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	**17**	85%
Shamshirian et al. (58)	1	1	0	1	0	0	0	1	1	1	1	1	0	0	1	1	1	1	0	0	**12**	60%
Totosy de Zepetnek et al. (16)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Studies using only a resilience instrument ($n = 18$)																						
Blanco-García et al. (59)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Carriedo et al. (60)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Chow and Cho (61)	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**18**	90%
Harman et al. (62)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Li et al. (63)	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Lines et al. (64)	1	1	0	1	0	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1	**13**	65%
Martínez-Moreno et al. (46)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**15**	75%
Martínez-Moreno et al. (65)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Ozkara et al. (66)	1	1	0	1	1	1	0	1	1	0	0	1	0	0	1	1	1	0	1	1	**13**	65%
Peyer et al. (67)	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**18**	90%
Roebuck et al. (68)	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
San Román-Mata et al. (69)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**15**	75%
Seçer and Çakmak Yıldızhan (70)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	0	0	1	**14**	70%
Thogersen-Ntoumani et al. (71)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
To et al. (72)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Wermelinger Ávila et al. (73)	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%
Xu et al. (74)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Yu and Ye (75)	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Studies using a grit and resilience instrument ($n = 3$)																						
Atkinson and Martin (76)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	95%
Dunston et al. (14)	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**17**	85%
Schaefer et al. (77)	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	**16**	80%

Note: Bold values indicate the total score on the 20 point scale of the appraisal tool for cross-sectional studies (AXIS).

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TABLE 2 Characteristics of included studies.

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
(A) Studies using only a grit instrument ($n = 11$)								
Allee et al. (52)	North America/ United States	First-semester university students *n*: 431 Sex: m = 169, f = 262 Age: 19.3 ± 2.4 years	Cohort-type observational study, cross-sectional	12-item Grit Scale	Daily Step Count via wearable (Fitbit)	Bivariate correlation Multiple regression *DV = Grit* *IV's = Step count, Age, Sex*	Grit was not associated with daily step count in the bivariate analysis ($r = 0.11$, $p = 0.062$). After controlling for age and sex, the relationships between grit and daily step count were significant ($\beta = 509.28$, $p = 0.0496$).	In university students, only after controlling for sex and age, steps per day was significantly associated with grit.
Benedict et al. (53)	North America/ United States	US Army ranger school candidates *n*: 670 Sex: m = 614, f = 19 Age: 25.3 ± 4.2 years	Cross-Sectional	8-item Grit Scale	Self-reported months of strength training, minutes per week of strength training, and days per week of rucking to train for ranger school.	Bivariate correlation	Grit was associated with minutes per week of strength training ($r = 0.09$, $p < 0.05$), and days per week ruck marching ($r = 0.08$, $p < 0.05$) but not months of strength training ($r = 0.07$, $p > 0.05$).	In US Army ranger school candidates, greater levels of grit were found to have a weak, positive relationship with some, but not all physical training leading up to ranger school.
Cazayoux and DeBeliso (54)	North America/ United States	CrossFit athletes, n:50; Advanced*, $n = 23$, Novice, $n = 27$. Sex: not reported Age: not reported **Advanced was defined as competing at the CrossFit games. Novice performed CrossFit workouts recreationally at a local gym.*	Cross-sectional	12-item Grit Scale	Performance achievement in CrossFit	t-tests *DV = Grit, persistence of effort, consistency of interest* *IV = Dichotomous variable for CrossFit performance level (Novice vs. Advanced)*	Advanced CrossFit athletes were found to have great total grit ($p = 0.03$, $d = 0.57$) and consistency of interest subscale ($p = 0.02$, $d = 0.59$) scores; however, no difference in persistence of effort was found ($p = 0.13$, $d = 0.38$)	The findings support the importance of grit in athletic achievement within the sport of CrossFit.
Daniels et al. (55)	North America/ United States	Undergraduate university students *n*: 875 Sex: m = 500, f = 375, Age: 20.0 ± 2.5 years	Cross-Sectional	8-item Grit Scale	International Physical Activity Questionnaire (31-item)	Multiple regression DVs: *Grit, perseverance of effort, consistency of interest* *IVs: Total MET-min/week; Vigorous MET min/week; Moderate MET-min/week; Walking MET-min/week; Work MET-min/week; Active transport MET-min/week; Domestic MET-min/week; Leisure MET-min/week* **For each of the 3 DV and 8 IV, multiple regression models were created that controlled for sex and age.*	Grit was positively and significantly associated with total *MET-min*/week ($\beta = 1{,}009.99$, $p < 0.001$), *Vigorous MET min/week* ($\beta = 470.09$, < 0.001), *Moderate MET-min/week* ($\beta = 306.94$, $p = 0.001$), walking *MET-min/week* ($\beta = 232.96$, $p = 0.018$). domestic *MET-min/week* ($\beta = 192.14$, $p = 0.007$) *and leisure MET-min/week* ($\beta = 555.42$, $p < 0.001$). Consistency of interest was positively and significantly associated with total *MET-min*/week ($\beta = 307.81$, $p = 0.047$) and Vigorous	In US university students, grit and perseverance positively correlated with various PA intensities and domains. Specifically, consistency of interest showed a positive association with total PA and VPA, while the perseverance of effort component exhibited a stronger influence on PA outcomes than consistency of interest.

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
							MET-min/week ($\beta = 169.40$, $p = 0.019$). Perseverance of effort was significantly associated with total *MET-min/week* ($\beta = 756.95$, $p < 0.001$), Vigorous *MET-min/week* ($\beta = 318.87$, $p < 0.001$), Moderate *MET-min/week* ($\beta = 194.91$, $p = 0.025$), walking *MET-min/week* ($\beta = 243.17$, $p = 0.006$), active transport *MET-min/week* ($\beta = 132.44$, $p = 0.033$), domestic *MET-min/week* ($\beta = 160.92$, $p = 0.012$), and leisure *MET-min/week* ($\beta = 428.32$, $p < 0.001$).	
Flinchbaugh et al. (51) Study 1	North America/ United States	Working Adults $n = 207$ Sex: m = 91, f = 116 Age: 44.7 ± 13.2 years	Cross-Sectional	12-Item Grit Scale	Weekly volume of PA	Structural Equation Modeling (SEM) *Weekly physical activity volume (observed) predicting consistency of interest (latent) and perseverance of effort (latent)*	Physical activity was negatively associated with consistency of interest ($\beta = -0.14$, $p < 0.05$) and not associated with perseverance of effort. The SEM demonstrated good fit indices [$\chi^2(46) = 89.77$, $p = 0.00$; RMSEA = 0.07, 90% CI = [.05 to.09]; CFI = 0.97; TLI = 0.96]	In physically active working adults, the subscales of grit were not found to have a positive relationship with weekly PA.
Flinchbaugh et al. (51) Study 2	North America/ United States	Competitive cyclists $n = 119$ Sex: m = 61, f = 58 Age: 43.2 ± 10.8 years	Cross-Sectional	12-Item Grit Scale	Weekly cycling training volume	Structural Equation Modeling (SEM) *Weekly training volume (observed) predicting consistency of interest (latent) and perseverance of effort (latent)*	Weekly training volume was positively associated with consistency of interest ($\beta = 0.27$, $p < 0.05$) and with perseverance of effort ($\beta = 0.25$, $p < 0.05$). The SEM demonstrated good fit indices [$\chi^2(94) = 148.52$, $p = 0.00$; RMSEA = 0.08, 90% CI = [.05 to.10]; CFI = 0.91; TLI = 0.88]	In competitive cyclists, who were also working, the subscales of grit were found to have a positive relationship with weekly cycling training volume.

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Kelly et al. (56)	North America/ United States	United States Military Academy Cadets Total $n = 2,558$ m = 2,188, f = 370 Class 1 n: 1,310 entered and 1,046 graduated Sex: 14% female Age: 19 years (Mean)	Cross-Sectional	12-Item Grit Scale	Physical Program Score (PPS)	Bivariate correlation	PPS was positively associated with total grit ($r = 0.09$, $p < 0.01$), consistency of interest ($r = 0.06$, $p < 0.01$), and consistency of effort ($r = 0.10$, $p < 0.01$).	Grit total score and subscales were found to have a positive relationship with a composite measure of physical performance (academic, fitness testing and competitive sports activity) in West Point cadets.
Martin et al. (28)	North America/ United States	University Students $n = 125$ Sex: m = 61, f = 64 Age: 19.4 ± 0.9 years (all between 18 and 22 years)	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Stepwise multiple linear regression *DV: Grit* *Model 1 IVs: VPA, MPA, LPA* *Model 2 IVs: model 1 + sitting time* *Model 3 IVs: model 2 + sleep quality* *Model 4 IVs: model 3 + dietary behaviors.* **Gender, employment, and population density were controlled for in all models.*	Grit was positively associated with VPA in model 1 ($\beta = 0.254$, $p < 0.05$) and 2 ($\beta = 0.245$, $p < 0.05$). None of the other PA variables were significantly associated with grit in any of the models.	In US university students during the COVID-19 pandemic, grit and VPA were found to have a positive relationship; however, when sleep and dietary behaviors were accounted for the relationship was no longer significant. The final regression model indicated that grit was positively associated with better sleep quality and dietary behaviors but not with any measure of PA.
Martin et al. (15) Study 1	North America/ United States	Adults $n = 1,388$ Sex: m = 393, f = 995 Age: 33.9 ± 13.9 years	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Multiple regression *DV = Grit* *IV's = MVPA, LPA, Sitting time, dietary behaviors* **Age and gender were controlled for*	Grit was positively associated with MVPA ($\beta = 0.093$, $p < 0.05$).	In several samples of US adults during the COVID-19 pandemic, grit was associated with MVPA in populations who did not currently, or previously, have occupational requirements to be physically active.
Martin et al. (15) Study 2	North America/ United States	Active-duty military $n = 253$ Sex: m = 166, f = 87 Age: 33.4 ± 7.3 years Veterans $n = 169$ Sex: m = 110, f = 59 Age: 42.6 ± 9.9 years Civilians $n = 388$ Sex: m = 104, f = 284 Age: 39.2 ± 12.1 years	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Multiple regression *DV = Grit* *IV's = MVPA, LPA, Sitting time, dietary behaviors* **Age and gender were controlled for. Separate linear regression models were created for active-duty military, veterans, and civilians.*	Grit was positively and significantly associated with MVPA in civilians ($\beta = 0.252$, $p < 0.001$) but not associated in active-duty members of the military ($\beta = -0.097$, $p > 0.05$) or veterans $\beta = 0.147$, $p > 0.05$).	

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Martin et al. (15) Study 3	North America/ United States	University Students $n = 144$ Sex: m = 66, f = 78 Age: 19.5 ± 0.9 years	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Multiple regression *DV = Grit* *IV's = MVPA, LPA, Sitting time, dietary behaviors* **Age and gender were controlled for*	Grit was positively associated with MVPA ($\beta = 0.185$, $p < 0.05$).	
Martin et al. (15) Study 4	North America/ United States	Performing Artists $n = 77$ Sex: m = 16, f = 61 Age: 36.1 ± 12.7 years	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Multiple regression *DV = Grit* *IV's = MVPA, LPA, Sitting time, dietary behaviors* **Age and gender were controlled for*	Grit was not associated with MVPA ($\beta = -0.21$, $p > 0.05$).	
Nothnagle and Knoester (38)	North America/ United States	Adults $n = 3{,}931$ Sex: m = 1,022, f = 2,909 Age: 21–65 years	Cross-sectional	8-item Grit Scale	2018–2019 National Sports and Society Survey on sports participation during childhood and adulthood survey	Multiple regression *DV = Grit* *IV's = Participation in sport as a child, Continual childhood sport participation, Regular participation in sport as an adult during the past year.* **Age and gender were controlled for*	Grit was positively associated with childhood sport participation ($\beta = 0.06$, $p < 0.05$), continual childhood sport participation ($\beta = 0.21$, $p < 0.001$), and regular participation in sport during the past year as an adult ($\beta = 0.11$, $p < 0.001$).	Greater levels of grit were observed in adults who regularly participate in sport and those who continually participated in sport as a child.
Reed (57)	North America/ United States	University students, faculty, and staff $n = 1{,}171$ Sex: m = 406, f = 755 Age: 34.6 ± 14.0 years	Cross-Sectional	8-item Grit Scale	Self-reported exercise behavior scores calculated as: Exercise Behavior = (months × LPA) + (months × MPA) + (months × VPA). *Months were how many months participants had been exercising at each intensity 1 or more times per week for more than 15 min.*	Bivariate correlation Multiple regression *DV = Exercise behavior* *IV's = Grit* **Age and gender were controlled for* t-tests *DV: Grit* *IV: Exercise behavior as dichotomous variable (exercisers vs. non-exercisers)*	Bivariate correlation analysis found that grit was positively associated with exercise score ($r = 0.18$, $p < 0.001$). Multiple regression analysis found that exercise behavior was positively associated with grit ($\beta = 14.50$, $p = 0.035$). Participants who engaged in exercise (=989) had greater grit ($p < 0.001$, $d = 0.34$) than those who do not engage in exercise ($n = 172$).	In healthy adults, attending school and working at a university, several statistical approaches all indicated that greater levels of grit were found in those individuals who engaged in more PA.
Shamshirian et al. (58)	Asia/Iran	Elite level wrestlers $n = 117$ Sex: m = 117, f = 0 Age: 22.0 ± 4.5 years Non-wrestler controls $n = 102$ Sex: m = 56, f = 46 Age: 25.5 ± 3.9 years	Cross-sectional	8-item Grit Scale	Participation in elite level athletics (wrestling) vs. control group of similar age and culture university students.	t-test *DV: Grit* *IV: Wrestler vs. University student*	The mean (SD) of grit scores were 4.09 (0.59) and 3.45 (0.63) for wrestlers and university students, respectively. Wrestlers had significantly greater grit ($p < 0.001$) than university students.	High level Iranian wrestlers more passion and grit than the control group of Iranian university students.

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Totosy de Zepetnek et al. (16)	North America/ United States	Adults *n* = 888 m: 237, f = 651 Age: 34.8 ± 14.0 years	Cross-sectional	8-item Grit Scale	International Physical Activity Questionnaire Short Form	Multiple regression *DV = Grit* *IV's = VPA, MPA, LPA* **Age and gender were controlled for* *ANCOVA* *DV = Grit* *IV: PA (4 levels: 0 min/ week, < 150 min/week, 150 to <300 min/week, 300 + min/week), Covariates: sex, education, employment/student status and any chronic disease*	The regression model indicated grit was positively associated with VPA ($\beta = 0.077$, $p < 0.001$ but not MPA ($p > 0.05$) or LPA ($p > 0.05$). Participants reporting 300 + minutes/week of PA had significantly greater grit than participants reporting 0 min/week, < 150 min/week or 150 to <300 min/week of PA.	In U.S. adults during the COVID-19 pandemic the study found a positive correlation between Grit and high-intensity physical activity (e.g., VPA). Additionally, individuals who participated in high volumes of physical activity (300 + min/week) exhibited significantly greater levels of grit compared to those classified in other categories of weekly physical activity volume, ranging from inactive to meeting the 150 min/ week guidelines.
(B) Studies using only a resilience instrument (*n* = 18)								
Blanco-García et al. (59)	Europe/Spain	Competitive athletes *n* = 1,047 Sex: m = 589, f = 458 Age: m, 24.4 ± 6.0 years; f, 24.1 ± 5.8 years Sports represented: Basketball *n* = 165 Handball *n* = 165 Volleyball *n* = 158 Athletics *n* = 242 Judo *n* = 317	Cross-sectional	Brief Resilience Scale	Participation in sport	*ANCOVA 1* *DV = Resilience* *IV: Sport (5 levels: basketball, athletics, handball, volleyball, judo)* *ANCOVA 2* *DV = Resilience* *IV: sport category (3 levels: team, individual, and combat)* *ANCOVA 3* *DV = Resilience* *IV: Sport type (2 levels: team and non-team)* **Age was the covariate in all analyses*	There were no significant differences in resilience between individuals based on sport played or sport category.	In young Spanish adults participating in competitive sport, the study found that the specific sport or type of sport did not exert any discernible impact on resilience levels among participants.

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Carriedo et al. (60)	Europe/Spain	Adults *n* = 1,795 Sex: m = 656, f = 1,150 Age: 40.5 ± 15.7 years	Cross-Sectional	Connor-Davidson Resilience Scale **Focused on locus of control, self-efficacy, and optimism sub-components of resilience instead of overall resilience.*	International Physical Activity Questionnaire Short Form	Bivariate correlation Multiple regression Model 1 *DV = Locus of control* *IVs = VPA, MPA, LPA* Model 2 *DV = Self-efficacy* *IVs = VPA, MPA, LPA* Model 3 *DV = Optimism* *IVs = VPA, MPA, LPA* **Controlled for age and gender in models*	Bivariate correlations indicated that 1) VPA was positively correlated with locus of control ($r = 0.09$, $p < 0.01$), self-efficacy ($r = 0.09$, $p < 0.01$) and optimism ($r = 0.08$, $p < 0.01$); MPA was positively correlated with locus of control ($r = 0.08$, $p < 0.01$), self-efficacy ($r = 0.07$, $p < 0.01$) and optimism ($r = 0.06$, $p < 0.01$); and LPA was positively associated with locus of control ($r = 0.05$, $p < 0.05$). The regression models indicated that (1) locus of control was positively associated with VPA ($\beta = 0.040$, $p < 0.01$) and LPA ($\beta = 0.031$, $p < 0.05$); (2) self-efficacy was positively associated with VPA ($\beta = 0.028$, $p < 0.05$) and (3) optimism was negatively associated with VPA ($\beta = -0.008$, $p < 0.05$) and MPA ($\beta = -0.344$, $p < 0.001$) but positively associated with LPA ($\beta = 0.004$, $p < 0.05$).	In Spanish adults during the COVID-19 pandemic, VPA was the only PA intensity level associated with all 3 components of resilience examined in the multiple regression models. There was a positive relationship between locus of control and self-efficacy components of resilience with VPA; however, when demographic factors were accounted for there was a negative relationship between the optimism component of resilience and VPA.
Chow and Choi (61)	Asia/China	University students *n* = 416 Sex: m = 167, f = 249 Age: Not reported	Cross-Sectional	Brief Resilience Scale	Godin-Shephard Leisure Time Physical Activity Questionnaire	Bivariate correlation	The correlation between PA and resilience was not significant.	In Chinese university students attending school in Hong Kong the study did not find a significant relationship between resilience and PA.

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Harman et al. (62)	Europe/ Primarily France (73%) and United Kingdom (11%)	Endurance sport athletes $n = 3,551$ Sex: m = 2,975, f = 576 Age: 44.1 ± 9.8 years *Note: Participants self-reported their athletic level as amateur, competitive amateur, or semi-professional/ professional athlete.*	Cross-sectional	Connor-Davidson Resilience Scale	Self-Reported Weekly PA and Competitive Level	Bivariate correlation (Spearman's) Multiple regression *DV = Perceived barriers to training during the COVID-19 pandemic lockdown* *IV = training volume*	Athletic level was positively associated with resilience ($rs = 0.11$, $p < 0.001$). Perceived barriers to training were associated with resilience ($\beta = 0.003$, $p < 0.05$) such that greater resilience led to fewer perceived barriers.	During the COVID-19 lockdown European endurance athletes with greater resilience perceived fewer barriers to training. Resilience had a positive relationship with achieving greater success (e.g., amateur, competitive amateur, professional) in endurance sport within the sample.
Li et al. (63)	Asia/China	University students $n = 1,214$ Sex: m = 506, f = 708 Age: 20.0 ± 1.7 years	Cross-sectional	Connor-Davidson Resilience Scale	Physical Exercise Questionnaire with dimensions for exercise adherence and commitment	Bivariate correlation Structural Equation Modeling (SEM) *Physical exercise (observed) predicting resilience (observed)*	Physical exercise was positively associated with resilience ($r = 0.47$, $p < 0.001$). Resilience was positively associated with resilience ($\beta = 0.51$, $p < 0.01$). The SEM demonstrated good fit indices [$\chi^2(46) = 4.698$; CFI = 0.993; GFI = 0.988; AGFI = 0.970, NFI = 0.991; IFI = 0.993; RMSEA = 0.055].	In Chinese university students physical exercise was positively related to resilience during the COVID-19 lockdown.
Lines et al. (64)	Oceania/ Australia	University students $n = 52$ Sex: m = 11, f = 41 Age: 21.9 ± 4.6 years	Longitudinal Design with 3 measurement periods over 6 days. Each measurement period was separated by 8. Weeks. Time point 1 occurred in the middle of a semester, time point 2 during the study week prior to finals and time point 3 during the first week of the next semester.	Brief Resilience Scale	Actigraphy via 24-hour Triaxial Accelerometry to record LPA, MPA and VPA.	Bivariate correlations at each time point.	There was a positive association between VPA and resilience at time point 1 ($r = 0.31$, $p < 0.01$) but non-significant associations at time points 2 and 3. There was a positive association between MPA and resilience at time point 1 ($r = 0.33$, $p < 0.01$) and time point 2 ($r = 0.13$, $p < 0.05$) but a non-significant association at time point 3. There was a positive association between LPA and resilience at time point 1 ($r = 0.26$, $p < 0.01$) and time point 2 ($r = 0.18$, $p < 0.01$) but a non-significant association at time point 3.	In a cohort of Australian university students relationships between VPA, MPA and LPA with resilience differed at various points in the semester.

(*Continued*)

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Martínez-Moreno et al. (46)	Europe/Spain	Older Adults $n = 381$ Sex: m = 210, f = 171 Age: 68.1 ± 8.6 years	Cross-sectional	Connor-Davidson Resilience Scale	Participants self-reported PA behaviors regarding engaging in PA (yes or no) and for those who were physically active how many days per week they engaged in PA.	t-test *DV: Resilience* *IV: Engaging or not in PA*	Resilience scores were higher in those who engaged in PA ($p < 0.001$).	Older Spanish adults who engaged in PA had higher scores in resilience than those who did not.
Martínez-Moreno et al. (65)	Europe/Spain	Older Adults, $n = 381$ Sex: m = 191, f = 190 Age: 68.8 ± 8.7 years	Cross-sectional	Connor-Davidson Resilience Scale	Participants self-reported PA behaviors regarding engaging in PA (yes or no) and for those who were physically active how many days per week they engaged in PA.	Bivariate Correlation t-test *DV: Resilience* *IV: Engaging or not in PA*	Resilience scores were higher in those who engaged in PA ($p = 0.016$). There was no association between resilience and the number of days per week they engaged in PA.	Older Spanish adults who engaged in PA had higher scores in resilience than those who did not. However, there was no significant relationship between resilience and the number of days per week PA was performed. .
Ozkara et al. (66)	Europe/ Turkey	University Students $n = 331$ Sex: m = 197, f = 134 Age: Not reported	Cross-Sectional	Brief Resilience Scale	Childhood and Adolescence Physical Activity Levels Questionnaire and Childhood	Bivariate Correlation Univariate Regression *DV: Resilience* *IV: PA*	PA was positively associated with resilience based on bivariate correlation ($r = 0.598$, $p < 0.001$) and univariate regression ($\beta = 0.598$, $p = 0.016$) analyses.	In Turkish university students, who were preservice physical education teachers, resilience was positively associated with PA.
Peyer et al. (67)	North America/ United States	University Students $n = 300$ Sex: m = 74, f = 226 Age: Not reported	Cross-Sectional	Brief Resilience Scale	International Physical Activity Questionnaire	Bivariate Correlation 2-way ANOVA *DV: Resilience* *IV1: Meeting PA Guidelines (2 levels: Yes, No)* *IV2: Gender (2 levels: Yes, No)*	Resilience was positively correlated with days per week of strength training ($r = 0.18$, $p < 0.01$) and minutes per week of strength training ($r = 0.15$, $p = 0.03$) in females. Resilience was positively correlated with days per week of moderate exercise ($r = 0.40$, $p < 0.01$), days per week of strength training ($r = 0.26$, $p = 0.03$), minutes per week of moderate exercise ($r = 0.33$, $p < 0.01$), and minutes per week of walking ($r = 0.27$, $p = 0.02$) in males. There was a significant main effect of Gender (male > female resilience) and interaction of Meeting PA Guidelines × Gender in the 2-way ANOVA model with males meeting PA guidelines reporting the greatest resilience and females not meeting PA guidelines reporting the least resilience.	In United States university students during the COVID-19 pandemic, resiliency was related to frequency and minutes per week of strength training in females. Resiliency was also related to moderate exercise frequency and minutes per week, frequency of strength training per week, and minutes of walking per week in males. Males meeting PA guidelines reporting the greatest resilience and females not meeting PA guidelines reporting the least resilience.

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Roebuck et al. (68)	Oceania/ Australia	Ultra-runners $n = 20$ Sex: m = 9, f = 11 Age: 42.6 ± 7.9 years Controls $n = 20$ Sex: m = 9, f = 11 Age: 40.2 ± 8.5 years	Cross-Sectional	Connor-Davidson Resilience Scale	Self-reported exercise behaviors	t-tests *DVs: Resilience, time spent running per week, total distance run per week, weekly strength training frequency, weekly stretching frequency* *IV: Ultra-runners vs. non-running controls.*	Ultra-runners had significantly higher resilience scores than the control group ($p = 0.014$, $d = 0.81$). In a week, ultra-runners reported more time spent running ($p < 0.001$), total distance run ($p < 0.001$), frequencies of strength ($p = 0.002$), and stretch training ($p = 0.046$) than non-running controls.	Compared to controls, ultra-runners had significantly higher resilience, spent significantly more time running, covered more distance running, and had higher frequency of strength training and stretching per week.
San Román-Mata et al. (69)	Europe/Spain	University Students $n = 1,095$ Sex: m = 351, f = 744 Age: 21.4 ± 4.6 years	Cross-sectional	Connor-Davidson Resilience Scale	Ad-Hoc Questionnaire based on WHO physical activity recommendations.	t-tests *DVs: Resilience and subcomponents* *IV: Meeting PA Guidelines (2 levels: Yes, No).*	Those who meet the minimum PA guidelines have greater overall resilience ($p < 0.01$ m $d = 0.22$) and greater scores in the resilience subcomponents of locus of control and commitment ($p < 0.01$, $d = 0.25$), self-efficacy and resistance to discomfort ($p < 0.01$, $d = 0.24$), and optimism and adaption to stressful situations ($p < 0.01$, $d = 0.28$).	University students in Spain who met the minimum recommended level of PA per week reported greater total resilience compared to those who did not meet the PA recommendations.
Seçer and Çakmak Yıldızhan (70)	Europe & Asia/Turkey	University students $n = 1,734$ Sex: m = 725, f = 1,009 Age: Mean not reported; 16.7% were 17–19 years; 46.7% were 20–21 years and 36.6% were 22 + years	Cross-sectional	Psychological Resilience Scale	International Physical Activity Questionnaire Short Form	Bivariate Correlation Univariate Regression *DV: Resilience* *IV: PA (MET-min/week)*	Bivariate correlations indicated a positive correlation between PA and total resilience ($r = 0.17$, $p < 0.01$) and sub-dimensions of resilience of self-commitment ($r = 0.14$, $p < 0.01$), challenge ($r = 0.13$, $p < 0.01$) and locus of control ($r = 0.12$, $p < 0.01$). PA was a significant predictor of resilience ($\beta = 0.176$, $p < 0.01$).	In a sample of university students attending school in Turkey, there was a positive relationship between PA, total resilience, and resilience subcomponents. PA was a significant predictor of resilience.
Thogersen-Ntoumani et al. (71)	Europe/ United Kingdom	Older manual workers $n = 217$ Sex: m = 149, f = 68 Age: 57.1 ± 5.6; range, 50–77 years	Cross-sectional	The Brief Resilience Scale	Baecke Questionnaire	Bivariate Correlation	The correlations between resilience with work, leisure, and sport/exercise PA were not statistically significant ($p > 0.05$).	In older manual workers in the UK there was no association between resilience with work, leisure, or sports/exercise domains of PA.

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
To et al. (72)	Oceania/ Australia	Adults Timepoint 1 Survey $n = 638$ Sex: m = 199, f = 436 Age: 52.5 ± 14.3 years Timepoint 2 Survey $n = 843$ Sex: m = 269, f = 573 Age: 53.2 ± 14.1 years Timepoint 3 Survey $n = 545$ Sex; m = 161, f = 382 Age: 53.8 ± 13.9 years	Longitudinal and Cross-sectional across 3 time points. Time point 1 occurred in April 2020, time point 2 occurred in August 2020 and time point 3 occurred in December 2020.	Brief Resilience Scale	Active Australia Survey (LPA, MPA, VPA over past 7 days)	Longitudinal data: Linear mixed models Cross-sectional data: Linear models *DV: Resilience* *IV: Meeting PA Guidelines (2 levels: Yes, No).* **Controlled for age, gender, years of education, household income, marital status, chronic disease, depression, anxiety, and stress levels in models.*	Meeting MVPA guidelines resulted in higher resilience in the longitudinal (aDif = 0.07, $p < 0.05$, 95% CI = 0.01, 0.13) and cross-sectional samples (aDif = 0.15, $p < 0.001$, 95% CI = 0.08, 0.21). *Note: aDif stands for adjusted differences between meeting vs. not meeting MVPA guidelines in models adjusted for covariates.*	In Australian adults during the COVID-19 pandemic, the findings of the study indicate that participants that obtained at least 150 MVPA minutes per week had higher resilience scores.
Wermelinger Ávila et al. (73)	South America/ Brazil	Older adults $n = 180$ Sex: m = 25, f = 155 Age: 69.6 ± 6.3 years	Longitudinal across 4 years with 3 time points. Time point 1 was 2015, time point 2 and 3 were 2- and 4-year follow ups, respectively.	Wagnild and Young's Psychological Resilience Scale	International Physical Activity Questionnaire *Participants were classified as "regularly" active (e.g., meeting MVPA guidelines for all 3 time points) and 'intermittently' active (e.g., those not meeting MVPA guidelines in at least 1 time point.*	2 × 3 Repeated Measures ANCOVA *DV: Resilience* *IV1: PA (2 levels: Regularly Active, Intermittently Active)* *IV2: Time (3 timepoints: baseline, 2-year follow-up, 4-year follow-up)* **Age was included as a covariate.*	There was a significant main effect for PA ($F = 5.143$, $p = .025$, $\eta^2 = 0.029$) with higher levels of resilience in participants who were regularly active. There was no main effect of time ($F = 0.222$, $p = 0.801$, $\eta^2 = 0.001$), or interaction effect of PA × Time ($F = 0.319$, $p = 0.727$, $\eta^2 = 0.002$).	Older Brazilian adults who maintained regular PA were more resilient than those who did not maintain regular PA across a 4-year time period.
Xu et al. (74)	Asia/China	University students $n = 2{,}375$ Sex: m = 1,110, f = 1,265 Age: 20.3 ± 2.0 years	Cross-sectional	Connor-Davidson Resilience Scale	International Physical Activity Questionnaire Short Form	Bivariate Correlation Multiple regression *DV = Resilience* *IV = PA* **Controlled for age, gender, grade, major, residence and whether an only child in model* Mediation analysis (Haye's PROCESS macro) *PA (observed) predicting resilience (observed)*	PA was positively correlated with resilience ($r = 0.159$, $p < 0.01$). The regression analysis indicated a positive association of resilience with PA ($\beta = 0.151$, $p < 0.001$). PA had a direct mediating effect on resilience ($\beta = 0.051$, 95% CI = 0.021–0.081, $p < 0.001$).	In Chinese university students PA was found to have a positive relationship with resilience.
Yu and Ye (75)	Asia/China	University students $n = 352$ Sex: m = 131, f = 221 Age: 20.8 ± 2.2 years	Cross-Sectional	Connor-Davidson Resilience Scale	International Physical Activity Questionnaire—Short Form **Minimum and adequate levels of PA where definitions are provided in notes below.*	Logistic regression *DVs = Minimum MPA, Minimum VPA, Minimum MVPA, Adequate MPA, Adequate VPA, Adequate MVPA* *IV = Resilience* **Controlled for age, gender, and BMI in model.* **For each DV a separate model was computed.*	Resilience was a significant predictor of obtaining minimum MPA ($\beta = -0.041$, OR = 0.960, $p < 0.05$), minimum MVPA ($\beta = 0.024$, OR = 1.024, $p < 0.05$), and adequate MVPA ($\beta = 0.023$, OR = 1.023, $p < 0.05$).	In Chinese university students, greater levels of resilience were associated with attaining minimum MVPA and adequate MVPA guidelines but decreased the odds of attaining minimum MPA guidelines. Notably, only 43.5% of the sample reported meeting minimum MVPA guidelines.

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
(C) Studies using a grit and resilience instrument ($n = 3$)								
Atkinson and Martin (76)	North America/ United States	Wheelchair rugby athletes $n = 87$ Sex: m = 80, f = 7 Age: 35.9 ± 9.3 years	Cross-sectional	8-item Grit Scale Connor-Davidson Resilience Scale	16-item Athlete Engagement Questionnaire	Bivariate Correlation Multiple regression *DV = Sport engagement* *IVs = Grit, Resilience*	Grit was positively correlated with sport engagement ($r = 0.33$, $p < 0.05$) and resilience ($r = 0.46$, $p < 0.05$). Sport engagement was positively associated with grit ($\beta = 0.21$, $p < 0.05$) and resilience ($\beta = 0.23$, $p < 0.05$).	In wheelchair rugby athletes, greater grit and resilience had a positive relationship with sport engagement.
Dunston et al. (14)	North America/ United States	University students $n = 244$ Sex: m = 79, f = 165 Age: 21.1 ± 2.9 years	Cross-sectional	8-item Grit Scale Connor-Davidson Resilience Scale	International Physical Activity Questionnaire Short Form	Bivariate Correlation Multiple regression and mediation analyses *DVs = Resilience, Consistency of interest, Perseverance of effort* *IVs = VPA* **Controlled for sex, year in school and GPA in models.* 1-way ANCOVAs DVs = *Resilience, Consistency of interest, Perseverance of effort* IVs: Tertiles of MPA and VPA **Controlled for sex, year in school and GPA in models.* ***Tertiles of VPA and MPA were 1) 0 to < 75 min/week, 2) 75 + to <300 min/week, and 3) 300 + min/week.*	VPA was positively correlated with resilience ($r = 0.16$, $p = 0.01$), perseverance of effort ($r = 0.20$, $p = 0.002$), but negatively correlated with consistency of interest ($r = -0.22$, $p = 0.002$). MPA was positively correlated with perseverance of effort ($r = 0.17$, $p = 0.007$) and negatively correlated with consistency of interest ($r = -0.15$, $p = 0.02$). MPA and resilience were not found to be correlated nor was time spent walking or sitting. Regression analyses found that VPA was positively associated with resilience ($\beta = 0.17$, $p = 0.01$) and perseverance of effort ($\beta = 0.18$, $p = 0.004$) but negatively associated with consistency of interest ($\beta = -0.22$, $p = 0.001$), independent of demographic variables. 1-way ANCOVAs found differences in consistency of interest ($p = 0.04$, tertile 3 > tertile 1), perseverance of effort ($p = 0.02$, tertile 3 > tertile 1), and resilience ($p = 0.007$, tertile 2 > tertile 1) across tertiles. There were no differences across tertiles for MPA.	In US university students, the overall findings indicated that VPA showed positive associations with resilience and perseverance of effort but exhibited a negative association with consistency of interest. Higher levels of VPA were correlated with increased scores in grit and resilience, while MPA did not demonstrate similar significant relationships.

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TABLE 2 Continued

Authors, Year	Continent/ Country	Participants	Study Design	Grit/Resilience Instrument	PA Measure(s)	Statistical Analysis	Results	Key Findings
Schaefer et al. (77)	North America/ United States	United States Military Academy Cadets $n = 4,299$ Sex: m = 3,396, f = 903 Age: Did not report	Cross-Sectional	8-item Grit Scale Dispositional Resilience Scale	Scores from Military Movement Course (MMC) aggregate and individual events (tumbling, high bar, trampoline, obstacle, strength, vault, rope climb).	Multivariate multiple regression DVs: Aggregate and Individual MMC event scores IVs; Grit, Resilience, Optimism *Controlled for race, gender, NCAA athlete status, interactions, graduation year, and GPA.	Grit was a significant predictor of aggregate MMC score ($p < 0.001$, $\eta^2 = 0.001$) and the strength event ($p = 0.016$, $\eta^2 = 0.003$). Resilience was a significant predictor of aggregate MMC score ($p = 0.002$, $\eta^2 = 0.006$), tumbling ($p = 0.045$, $\eta^2 = 0.002$), high bar ($p < 0.001$, $\eta^2 = 0.003$), obstacle ($p < 0.001$, $\eta^2 = 0.004$), strength ($p = 0.016$, $\eta^2 = 0.002$), vault ($p = 0.016$, $\eta^2 = 0.002$), and rope climb ($p < 0.001$, $\eta^2 = 0.004$).	In US military academy cadets, grit and resilience significantly predicted aggregate MMC event score. However, in terms of individual MMC events, grit was only significantly related to a strength event whereas resilience was significantly related to all events of the MMC except the trampoline.

AGFI, adjusted goodness-of-fit index; ANCOVA, analysis of covariance; APFT, Army Physical Fitness Test; BMI, body mass index; CFI, comparative fit index; CI, confidence interval; DV, dependent variable; ES, effect size; f, female; GFI, goodness-of-fit index; GPA, grade point average IFI, incremental fit index; IV, independent variable; LPA, light physical activity; m, male; MET, metabolic equivalent; MMC, military movement course; MPA, moderate physical activity; MVPA, moderate to vigorous physical activity; NFI, normal fit index; OR, odds ratio; PA, physical activity; PPS, Physical Program Score; RMSEA, root mean square error approximation SEM, structural equation model; US, United States; VPA, vigorous physical activity; WHO, world health organization.

*Minimum and adequate PA levels of Yu and Ye (75): Minimum MPA: 150 + min/week of MPA and 0 min/week of VPA; Minimum VPA: 75 + min/week of VPA and 0 min/week of MPA; Minimum MVPA: 150 + min/week of VPA combined with MPA; Adequate MPA: 300 + min/week of MPA and 0 min/week of VPA; Adequate VPA: 150 + min/week of VPA and 0 min/week of MPA; Adequate MVPA: 300 + min/week of VPA combined with MPA.

While some studies included exclusively young adults ($n = 17$) (14, 15, 28, 52, 55, 56, 58, 63, 64, 67, 69, 70, 74, 75, 77–79), middle-aged adults ($n = 2$) (62, 76), or older adults ($n = 3$) (46, 65, 71), other studies ($n = 4$) included adults across the age span (15, 16, 51, 72), including 3 of 4 studies in Martin et al. (15) (studies 1, 2, & 4).

The educational backgrounds of participants in the included studies varied, with college students being the focus of a subset ($n = 13/37$ or 35%) of the studies (14, 15, 28, 52, 56, 58, 63, 64, 69, 70, 74, 77–79), whereas $n = 19/37$ (~51%) of the studies did not report educational level of participants. Only one study (16) reported and controlled for education in their analysis.

The included studies were conducted in 7 different countries including the United States ($n = 20/37$) (14–16, 28, 38, 51, 52, 53, 54, 55, 56, 57, 67, 76, 77, 80, 81), Spain ($n = 4/37$) (46, 69, 59), Australia ($n = 3/37$) (64, 68, 72), China ($n = 3/37$) (63, 74, 75), United Kingdom ($n = 2/37$) (62, 71), Iran ($n = 2/37$) (58, 79), and Turkey ($n = 1/37$) (70).

Less than half (~45%) of the included studies used only a grit ($n = 15/37$) while ~57% used a resilience ($n = 21/37$) only survey instrument, and three studies used both grit and resilience survey instruments (Table 2) (14, 76, 77). Grit survey instruments included the 8-item Grit-Short Scale ($n = 13$) (14–16, 28, 38, 53, 55, 57, 58, 76, 77) and the 12-point Grit Scale ($n = 5$) (51, 52, 54, 56). Resilience survey instruments included the 10-item Connor-Davidson Resilience Scale (CD-RISC-10; $n = 11$) (14, 46, 60, 62, 63, 65, 68, 69, 74–76), the Brief Resilience Scale (BRS; $n = 6$) (59, 61, 66, 67, 71, 72), the Psychological Resilience Scale ($n = 1$) (70), the Wagnild & Youngs Psychological Resilience Scale ($n = 1$) (73), the Dispositional Resilience Scale (55), and the Psychological Capital Questionnaire ($n = 1$) (64).

3.3 Physical activity adherence

Approximately 83% ($n = 30/37$) of included studies reported a positive association between grit and/or resilience and PA outcomes (Table 2). All extracted studies employed two main analytical approaches: group comparisons or examining relationships between grit or resilience and PA outcomes. Of the studies that performed group comparisons ($n = 11$), 9 reported that participants who engaged in higher levels of PA reported higher levels of grit ($n = 4$) (14, 16, 52, 57) or resilience ($n = 5$) (14, 46, 65, 68, 73) compared to those not engaging in PA. However, Martin et al. (28) reported no significant differences in grit between individuals who met PA guidelines compared to those who did not, while Blanco-Garcia et al. (59) reported no significant difference in resilience between different sport types or levels. Studies ($n = 10$) reported that grit ($n = 5$) (16, 54, 55, 58, 76) and resilience ($n = 5$) (62, 69, 71, 72, 76) were lower for those engaging in lower levels of PA, but still physically active.

Furthermore, 69% of all studies used multivariate regression, or bivariate correlation analyses, while two studies (Flinchbaugh et al., study 1 and 2) (51) used structural equation modeling (SEM). Of these studies, 18 identified a positive relationship between various aspects of PA engagement and grit ($n = 10$) (14–16, 27, 52, 53,

55, 78) or resilience ($n = 8$) (14, 60, 63, 66, 67, 70, 74, 80). This positive relationship was reported in 14 of 16 studies among college students (14, 15, 52, 55, 57, 58, 61, 63, 64, 66, 67, 69, 70, 74, 75). For example, Dunston et al. (14) found that in a sample of US college students, vigorous PA was positively correlated with resilience and perseverance of effort. Moreover, those who met vigorous PA recommendations had higher grit and resilience scores than those not meeting the recommendations (14). The only study that did not report a positive association between grit and PA was Martin et al. (28), which reported a significant relationship between VPA and grit in a non-significant model. Chow and Choi (61) reported no significant relationship between resilience and physical activity.

Multiple studies investigated the impact of grit ($n = 6$) (15, 16, 28) and resilience ($n = 4$) (62, 63, 67, 72) on adherence to PA during the COVID-19 pandemic, which presented new challenges such as gym closures and physical distancing measures that hindered many individuals from maintaining their PA levels. Greater levels of resilience (63, 67) and grit (15, 16) were reported to be positively associated with PA levels in college students (15, 63, 67) and US Adults (15, 16) during the COVID-19 pandemic. Similarly, Australian adults who reported meeting PA guidelines had greater levels of resilience than those who did not meet PA guidelines (72). Moreover, elite endurance athletes, who exhibited higher levels of resilience than amateur athletes, perceived fewer barriers in continuing their training during the pandemic (62). Interestingly, one study found a positive relationship between grit and PA in US college students during the COVID-19 pandemic, however, when dietary and sleep behavior predictors were added to the stepwise regression model, PA was no longer associated with grit (28). In 2 of 4 studies reported in Martin et al. (studies 2 and 4) (15), the authors report that for individuals who have jobs that require them to be physically active, there is no significant association between PA and grit.

3.4 Physical activity intensity

A subset of the studies reported on the association between physical activity intensity and grit ($n = 7$) (15, 16, 28, 55) or resilience ($n = 5$) (60, 64, 67, 72, 75), with one study reporting an association between both grit, resilience and PA (14). Of these 13 studies (14–16, 55, 60, 64, 67, 72, 75), 5 reported a positive association between grit, resilience to high levels of PA intensity, specifically vigorous activity (14, 16, 55, 60, 64), while Dunston et al. (28) reported no significant association between VPA and grit when accounting for diet and sleep behavior.

Results for moderate to light PA were conflicting. Dunston et al. (14) report a significant association between vigorous PA, resilience, grit perseverance of effort, and grit consistency of interest. However, moderate PA was correlated with grit perseverance of effort and grit consistency of interest only, while walking time, was not associated with either aspect of grit or resilience (28). These findings are contradictory to those presented by Daniels et al. (55), who report a significant association between grit, as well as the two sub-constructs of grit and VPA, MPA, and walking in a sample of college students. While Dunston et al. (14) reported a significant negative association between grit consistency of interest and VPA and MPA, Daniels et al. (55) report a significant positive association between these outcomes. Further, Lines et al. (64) and Peyer et al. (67) report contradictory findings in that resilience is associated with LPA (64) and MPA (64, 67) in their sample of university students, while Dunston et al. (14) report no significant association between resilience and LPA or MPA.

Conversely, in adults during the COVID-19 pandemic, Totosy de Zepetnek et al. (16), report a significant association between grit and VPA, but with MPA or LPA, while Carriedo and colleagues (60) reported similar results for all components of resilience and VPA, but not MPA or LPA. For studies that combined VPA and MPA and examined MVPA (15, 72) or combined VPA, MPA and LPA to report an overall PA outcome (74) find that MVPA is positively associated with grit (15) and resilience (72), while overall PA is also positively associated with resilience (74).

When examining levels of athletic competitions, athletes competing at higher levels within a sport report higher levels of grit (54, 58) and resilience (62, 68). However, these findings contradict those of Blanco-Garcia et al. (59) who report no differences in resilience among athletes at various levels of play within a sport.

3.5 Domains of physical activity

Grit and resilience were assessed across various domains of PA, including recreational activities (55, 62, 76), team and individual sports (54, 58, 59, 62, 78, 79), as well as within military settings (53, 56, 77). Of the 6 studies that assessed levels of competition grit and resilience, five reported that athletes at higher levels of competition reported higher levels of grit (54, 58, 78, 79) and resilience (62) compared to their lower-level (54, 62, 78, 79) or non-athlete peers (58). Shamshirian et al. (58) found that wrestlers showed greater levels of grit compared to a control group of students, although no differences in grit were found between international and national level wrestlers. Furthermore, elite CrossFit athletes scored significantly higher on the 12-item grit scale compared to novice CrossFit athletes (54). In contrast, Blanco-Garcia et al. (59) reported no significant differences in resilience between sport levels or sports category in a study of 1,047 competitive Spanish athletes. However, Blanco-Garcia et al. (59) had no comparator group, as all athletes in their study were participating at a competitive level in Spain and levels were selected based on whether they compete on the national team or not. Another interesting finding was that amongst wheelchair rugby athletes, those with higher levels of grit were the most engaged with their sport (76).

In populations of members of the military, grit and resilience are positively associated with various measures of military fitness tasks when assessed in cadets (53, 56) or during Ranger Training (77); however, grit is not associated with physical activity levels in individuals who are not in training (15). Grit was positively

associated with military cadet performance on their physical program score (56), an outcome that assesses instructional coursework, fitness testing and participation in competitive sports and on the strength portions of cadets' fitness tests (77), while resilience is associated with all aspects of cadets' fitness tests. Grit is also positively associated with push-ups and the number of days that Ranger Trainees participate in resistance training and rucking (77).

3.6 Socio-Demographic factors

3.6.1 Age

A majority ($n = 29/37$) studies consistently demonstrated positive associations between both grit and resilience with PA across different life stages. Specifically, the research showed a beneficial influence of grit (14, 15, 52, 58, 79, 81) or resilience (14, 63, 67, 69, 70, 74, 75) on PA in young (14, 52, 55, 58, 63, 67, 69, 70, 74, 75, 79) and older adults (46, 65, 73, 71, 80) as well as adults across the lifespan (15, 16, 38, 51, 60, 62, 68, 72, 76). The one exception was Thogersen–Ntoumani et al. (71), who found **no** association between resilience and any PA domain in older UK manual workers. Thus, aside from this outlier, age was not found to systematically alter the positive grit/resilience relationship with PA.

3.6.2 Sex

All studies included both sexes, however, sex differences in the grit, resilience and physical activity outcomes were not an aim of most studies. Peyer and colleagues (67) reported that resilience had a stronger association with PA levels in males than females. Additionally, of the 25 studies that performed regression analyses, 16 studies accounted for sex in their models (14–16, 28, 38, 52, 55, 57, 60, 72, 74, 75, 77). Of these studies, some found an influence of sex (52, 57) or difference between sexes (55, 59, 60, 67), while other studies reported no sex differences (28, 62, 70) on variables of interest (e.g., grit, resilience, PA measures). Thus, the evidence on sex as a moderator is mixed and does not point to a consistent influence of sex on the grit/resilience relationship with PA.

3.6.3 Education

Education level was rarely reported. Over half of studies did not specify participant education, and most samples (e.g., university students, military cadets) implied at least secondary/college education (Table 2). Only one study explicitly controlled for education (16). Totosy de Zepetnek et al. (16) found that higher that higher levels of education and vigorous PA were associated with greater levels of grit. With no other study including education as a moderator its influence on the grit/resilience relationship with PA remains relatively unknown.

3.6.4 Socio-Cultural

The 37 studies were conducted across multiple regions and most were in Western countries (e.g., USA, Spain, UK, France) but there were others in Asia (e.g., China, Iran, Turkey), Australia, and Brazil (Table 2). Despite this socio-cultural diversity, results were remarkably consistent across contexts. For example, U.S., Spanish, Chinese, and other samples all showed that more-active participants reported higher grit or resilience. In one Brazilian longitudinal study (73), older adults who remained regularly active over four years had significantly higher resilience than intermittently active peers. These cross-cultural findings suggest the grit/resilience relationship with PA is robust across settings, although no study formally tested culture or ethnicity as moderators (Table 3).

4 Discussion

This systematic review synthesized the current knowledge from studies examining the relationship between grit, resilience, and PA. The overall body of research suggests that both grit and resilience positively influence physical activity engagement, intensity of physical performed, and gritty or resilient individuals are more likely to engage in high level competition. While most of the literature was moderate-to-high quality, many of the studies were cross-sectional in nature, which inherently limits extrapolating causality (50). The three studies that used longitudinal designs reported that individuals who were gritty and/or resilient were more physically active across most of the time points when data was collected (64, 72, 73). However, grit and resilience are constructs that may take years to modify, thus interventional trials may not be feasible. Further, evidence suggests that greater levels of fitness, an outcome of regular engagement in PA, may make individuals more resilient to nonphysical stressors (82). This highlights difficulty in addressing the directionality of the relationship between the grit, resilience, and PA. Potential solutions to this challenge may be to use interventions meant to increase PA to determine whether those resulted in an increase in grit or resilience, or to use interventions such as growth mindset that have been known to increase grit (83) to determine whether increased grit resulted in an increase in PA participation. Another challenge with the studies presented in this systematic review is that most of the studies used self-reported measures of PA, such as the IPAQ, which previous work suggests has inherent self-report bias (84). However, the present review presents compelling evidence that individuals who are gritty and/or resilient are more likely to engage in PA, specifically higher intensity PA, and may be more likely to participate at higher levels in their sports.

An important theme to emerge is that the findings indicated that regardless of age, sex, culture or education level, grit and resilience support a variety of PA outcomes. Not only were there positive associations between grit, resilience, and PA participation and adherence, but group comparisons in studies also consistently reported that individuals engaging in higher levels of PA demonstrated greater levels of grit or resilience compared to those not engaging in PA or those with lower PA levels. Leading a physically active lifestyle necessitates consistent effort and determination to overcome barriers (5), which can change as one ages (85–88). Grit represents the ability to adhere to and persevere in the pursuit of long-term goals (20, 29), which is

essential for maintaining PA engagement over an extended period. Concomitantly, resilience emerges as an asset for overcoming setbacks and navigating barriers to engage in PA, throughout the lifespan (5).

While we are unaware of evidence that may explain why individuals who are gritty or resilient are more likely to participate in PA, we hypothesize that these individuals may be more likely to set goals and stick to these goals despite setbacks. In other contexts, the personality traits embodied in grit and resilience have been found advantageous. The ability to overcome adversity and setbacks regarding health, such as injuries, acute or chronic illness, is beneficial for improved PA-related outcomes (89), recovery time (90, 91), and overall quality life (92). For example, Traino and colleagues reported in college students diagnosed with a chronic medical conditions those with higher levels of grit were less likely to be discouraged by setbacks and may be more likely to adhere to treatment plans, engage in necessary rehabilitation activities, and follow medical plans (93). Another potential explanation may be that since grit and resilience, which are both part of the conscientiousness family of traits (21), individuals who are gritty/resilient are more likely to adopt behaviors that that they view as long-term investments in one's health (22).

A second important theme from the literature was the association with grit and resilience with higher intensity (e.g., vigorous) PA considering that health benefits tend to be the greatest with higher intensity levels of PA (1, 94, 95). There are several plausible explanations as to why grit and resilience are associated with participation in higher intensity PA. Higher intensity exercise is often more challenging, requiring adaptability and a willingness to face discomfort (96). Resilient individuals thrive in challenging environments, viewing them as opportunities for growth and improvement (97), and they may view performing high intensity physical activity as an opportunity to grow and improve. Individuals with grit and resilience may possess an understanding of the long-term health benefits associated with higher intensity PA. As such, these individuals may prioritize their health goals, recognizing that engaging in more intense PA is linked to improved cardiovascular health, metabolic benefits, and overall well-being. Considering that grit is associated with conscientiousness (21) these findings may be an extension of the "invest and accrue" model (22) to PA where gritty and resilient individuals choose to invest in physical health by engaging in higher intensity PA for future health benefits.

The results pertaining to higher intensity PA can also be understood through established motivational frameworks. According to Self-Determination Theory, sustained engagement in demanding behaviors such as vigorous PA is driven by autonomous motivation, which is motivation stemming from intrinsic enjoyment or the perceived personal value of the activity (98). Individuals with higher levels of grit may be more likely to internalize PA as integral to their identity or long-term goals, thereby exercising for reasons aligned with intrinsic or identified regulation. This interpretation is supported by recent evidence indicating that grit is positively associated with self-efficacy and autonomous motivation for exercise, both of which predict an individual's readiness to initiate and maintain PA (99). In essence, gritty individuals may perceive high-intensity exercise as personally meaningful or rewarding, enabling them to persist despite physical discomfort. Achievement Goal Theory offers a complementary perspective, suggesting that individuals high in grit and resilience are more likely to adopt mastery-oriented goals, focused on personal growth and sustained effort, rather than ego-oriented goals that emphasize outperforming others (100). A mastery orientation has been linked to greater intrinsic motivation and long-term persistence in sport settings (101), which leads to another theme identified in the reviewed studies.

The third theme that emerged was the role of grit and resilience in facilitating higher levels of success within sport and military environments. However, due to study design it is unclear whether reaching these levels of success in sports and military results in increased grit or whether grit is responsible for helping these individuals reach these higher levels. Literature suggests that the attributes of grit, such as perseverance, passion, and sustained effort, are vital for success in competitive arenas (19, 20). Individuals with higher levels of grit are goal-driven, enabling them to persist in the face of challenges and setbacks (102). Moreover, grit fosters a growth mindset, instilling the belief that abilities and performance can be developed through effort and practice (103). This mindset encourages individuals to embrace challenges, seek feedback, and continuously learn and enhance their skills (104). Furthermore, the perseverance aspect of grit may drive athletes to invest dedicated time and effort into deliberate practice, which is essential for skill development and mastery (105). Resilience supports overcoming obstacles which may result in an increased commitment to their training (106). However, it is conceivable that by participating in higher levels of sports and military training individuals may have increased their resilience and/or grit over time. A study from our review suggests that individuals who participated in childhood sport, and continued childhood sport participation were grittier (38). The cross-sectional nature of that study could suggest that either gritty individuals were the ones who continued to participate in sports or that continued sport participation during childhood resulted in higher levels of grit as adults when the participants of that study completed the grit survey.

4.1 Limitations

Several limitations related to the search and the methodology of included studies should be considered. Regarding the search process, the review included studies examining sport performance and competition levels. It is important to clarify that these domains were included as proxies for physical activity in certain populations. Sport performance and competition levels often require sustained physical engagement and training that align with or exceed recommended levels of moderate-to-vigorous physical activity. These contexts were considered relevant to this review as they provide insight into PA behaviors

TABLE 3 Summary of socio-demographic factors and Key findings.

Study	Trait Assessed	Population Age Group	Sex	Education	Culture/ Region	PA Outcome(s)	Key Finding
(A) Significant relationships between grit and/or resilience and physical activity outcomes							
Allee et al. (52)	Grit	Young adult (university students)	Both	Not reported	USA	Daily step count	Grit not related to steps until adjusted for age/sex
Benedict et al. (53)	Grit	Adult (military)	Both	Not reported	USA	Weekly strength training frequency; ruck march frequency	Grit showed weak positive correlations with weekly strength training and ruck-march days
Cazayoux & DeBeliso (54)	Grit	Adult	Both	Not reported	USA	CrossFit performance level	Advanced CrossFitters had higher total grit and consistency than novices.
Daniels et al. (55)	Grit	Young adult (university students)	Both	Not reported	USA	MET-min/week	Grit positively predicted total, vigorous, moderate, walking, domestic, and leisure PA.
Flinchbaugh et al. (51) Study 2	Grit	Adult (cyclist athletes)	Both	Not reported	USA	Weekly training volume	Greater weekly training volume was positively related to grit subscales.
Kelly et al. (56)	Grit	Young adult (military)	Both	Not reported	USA	Physical Program Score	Higher total grit and subscales correlated with better physical performance.
Martin et al. (28)	Grit	Young adult	Both	Not reported	USA	MET-min/week	Grit positively associated with vigorous PA.
Martin et al. (15) Study 1	Grit	Adult	Both	Not reported	USA	MVPA	Grit positively predicted MVPA in U.S. adults.
Martin et al. (15) Study 2	Grit	Adult (civilians)	Both	Not reported	USA	MVPA	MVPA predicted higher grit in non-military US adults.
Martin et al. (15) Study 3	Grit	Young adult (university students)	Both	Not reported	USA	MVPA	Grit positively predicted MVPA in university students.
Nothnagle & Knoester (38)	Grit	Adult	Both	Not reported	USA	Childhood/adult sport participation	Grit higher in adults with continual childhood/adult sports participation.
Reed (57)	Grit	Adult (university students and adults)	Both	Not reported	USA	Exercise behavior	Individuals who exercised had higher grit and exercise behavior positively predicted grit.
Shamshirian et al. (58)	Grit	Young adult (athletes and university students)	Male only	Not applicable	Iran	Athletic status	Elite wrestlers scored higher on grit than student controls.
Totosy de Zepetnek et al. (16)	Grit	Adult	Both	Controlled for education	USA	VPA/MPA/LPA	Grit positively related to VPA and participants with ≥300 min/wk PA had higher grit.
Carriedo et al. (60)	Resilience	Adult	Both	Not reported	Spain	VPA/MPA/LPA	VPA/MPA were positively correlated with locus of control, self-efficacy, and optimism resilience subscales.
Harman et al. (62)	Resilience	Adult	Both	Not reported	France/UK	Weekly training volume; athletic level	Higher resilience was associated with higher athletic level and fewer perceived training barriers.
Li et al. (63)	Resilience	Young adult	Both	Not reported	China	Exercise adherence	Exercise behavior was strongly correlated with resilience.
Lines et al. (64)	Resilience	Young adult (university students)	Both	Not reported	Australia	LPA/MPA/VPA	VPA, MPA, and LPA showed positive correlations with resilience at various time points.
Martínez-Moreno et al. (46)	Resilience	Older adult	Both	Not reported	Spain	PA engagement	Older adults who exercised had significantly higher resilience than inactive peers.
Martínez-Moreno et al. (65)	Resilience	Older adult	Both	Not reported	Spain	PA engagement	Physically active older adults had higher resilience.
Ozkara et al. (66)	Resilience	Young adult (university students)	Both	Not reported	Turkey	Childhood PA level	Childhood PA level positively predicted adult resilience.
Peyer et al. (67)	Resilience	Young adult (university students)	Both	Not reported	USA	Strength training & moderate exercise frequency	Resilience was positively related to strength training (both sexes) and to moderate exercise in men; men meeting guidelines had highest resilience.

(*Continued*)

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TABLE 3 Continued

Study	Trait Assessed	Population Age Group	Sex	Education	Culture/ Region	PA Outcome(s)	Key Finding
Roebuck et al. (68)	Resilience	Adult	Both	Not reported	Australia	Running distance/time; strength training frequency	Ultramarathoners had significantly higher resilience than non-runners.
San Román-Mata et al. (69)	Resilience	Young adult (university students)	Both	Not reported	Spain	Meeting PA guidelines	Meeting weekly PA guidelines was associated with higher total resilience and all subscales.
Seçer and Çakmak Yıldızhan (70)	Resilience	Young adult (university students)	Both	Not reported	Turkey	MET-min/week	PA significantly predicted resilience in Turkish students.
To et al. (72)	Resilience	Adult	Both	Not reported	Australia	Meeting MVPA guidelines	Meeting MVPA guidelines predicted higher resilience in both longitudinal and cross-sectional samples.
Wermelinger Ávila et al. (73)	Resilience	Older adult	Both	Not reported	Brazil	Regular vs. intermittent PA over 4 years	Older adults who remained regularly active for 4 years had significantly higher resilience than intermittently active peers.
Xu et al. (74)	Resilience	Young adult (university students)	Both	Not reported	China	MVPA/LPA	PA positively predicted resilience in Chinese university students.
Yu and Ye (75)	Resilience	Young adult (university students)	Both	Not reported	China	Meeting MPA/VPA/MVPA guidelines	Higher resilience increased odds of meeting MVPA recommendations.
Atkinson and Martin (76)	Grit and Resilience	Adult	Both	Not reported	USA	Sport engagement	In wheelchair rugby athletes, both grit and resilience predicted greater sport engagement.
Dunston et al. (14)	Grit and Resilience	Young adult (university students)	Both	Not reported	USA	VPA	VPA positively predicted resilience and perseverance of effort. but negatively predicted consistency of interest.
Schaefer et al. (77)	Grit and Resilience	Young adult (military)	Both	Not reported	USA	Military Movement Course scores	Both grit and resilience predicted overall military performance; resilience predicted most individual events, whereas grit predicted only the strength event.
(B) Non-significant and negative relationships between grit and/or resilience and physical activity outcomes							
Benedict et al. (53)	Grit	Adult (military)	Both	Not reported	USA	Months of strength training prior to US Army ranger school	Grit not associated with months of strength training prior to entering US Army ranger school.
Flinchbaugh et al. (51) Study 1	Grit	Adult (working)	Both	Not reported	USA	Weekly PA volume	PA negatively predicted consistency-of-interest but no association with perseverance of effort.
Martin et al. (15) Study 2	Grit	Adult (active-duty military and veterans)	Both	Not reported	USA	MVPA	MVPA was not associated with grit in active-duty or veterans.
Martin et al. (15) Study 4	Grit	Adult (performing artists)	Both	Not reported	USA	MVPA	Grit was *not* associated with MVPA in performing artists.
Blanco-García et al. (59)	Resilience	Young adult (athletes)	Both	Not reported	Spain	Sport participation	No significant resilience differences by sport type or level.
Chow and Choi (61)	Resilience	Young adult (university students)	Both	Not reported	China	Leisure PA	No significant correlation between leisure PA and resilience.
Thogersen-Ntoumani et al. (71)	Resilience	Older adult	Both	Not reported	UK	Work/leisure/sports PA	No significant associations between resilience and PA were found in older manual workers.
Dunston et al. (14)	Grit and Resilience	Young adult (university students)	Both	Not reported	USA	VPA	VPA negatively predicted consistency of interest.

LPA, light physical activity; MET, metabolic equivalent; MPA, moderate physical activity; MVPA, moderate to vigorous physical activity; PA, physical activity; VPA, vigorous physical activity.

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in populations where activity is structured around sport-specific demands. However, the authors acknowledge the distinction between direct measures of PA and sport-related outcomes, and this review aims to critically evaluate these distinctions while synthesizing the broader relationships between grit, resilience, and PA outcomes. The type of review conducted could be viewed as a limitation. Ultimately, a systematic review was chosen to provide a structured and transparent approach to synthesize the evidence. As the authors had prior knowledge of the general body of literature it was discussed that a narrative or rapid review would not adequately capture the breadth and depth of the research, while the heterogeneity of the included studies made a meta-analysis impractical.

A general shortcoming of the included studies the overall body of literature did not account for participants' level of interest or goals regarding PA. Grit is a goal-driven trait (25) and future studies assessing PA should consider incorporating a question with the grit survey that captures whether participants engage in PA out of necessity or have specific goals related to PA. Since grit is characterized by passion and perseverance towards long-term goals, individuals whose goals are misaligned with PA participation may participate in lower levels of PA. This was inadequately addressed in the reviewed studies, which limits the interpretation of the findings by introducing potential variations among individuals driven by divergent PA motives. Considering that grit is associated with sustained effort towards achieving long-term goals, while resilience is a broader construct that encompasses the ability to cope with and rebound from various challenges and adversities (31), these traits may be of unique value in different circumstances to support PA outcomes. A second limitation is that, by including both grit and resilience in the present review, we adopted a broad approach to synthesizing the literature on these related constructs. As a result, we did not conduct a more detailed analysis of grit's subcomponents (i.e., consistency of interest and perseverance of effort). Future research should address this gap to better understand how individual components of grit may differentially influence physical activity engagement. Third, a potential source of bias in the systematic review may stem from publication bias, where studies with statistically significant results are favored for publication (107). Another potential limitation is that most studies used self-report PA data, which has been shown to be inherently biased (84). To address potential publication bias in future research, investigators are encouraged to pre-register study protocols and hypotheses, which promotes transparency and helps prevent selective reporting (108). Additionally, researchers can be encourage to publish null findings as they are important to disseminate to add to the body of knowledge on a topic (109). Although sociodemographic and cultural factors likely influence the development and expression of grit and resilience (43, 45), the included studies did not provide sufficient evidence to determine whether the relationships between these traits and physical activity differ across cultural contexts. Most studies were conducted in Western, individualist societies, limiting the generalizability of findings. Future research should investigate whether cultural orientation (e.g., collectivist vs. individualist values) moderates the associations between grit, resilience, and PA behaviors.

A final, and arguably primary, limitation was that while the current body of research suggests a positive association between grit, resilience, and PA behaviors, most of the included studies were cross-sectional, limiting the ability to infer causality or directionality. As a result, it remains unclear whether higher grit or resilience promotes greater PA engagement, or whether regular PA participation contributes to the development of these traits. Future research should employ longitudinal study designs to assess how grit and resilience may change over time in relation to PA behaviors. Additionally, randomized controlled trials that target either the enhancement of grit/resilience (e.g., through mindset training, goal-setting programs) or promote PA (e.g., structured exercise interventions) could help clarify causal pathways. For example, interventions aimed at increasing PA could assess whether sustained engagement leads to improvements in grit or resilience over time. Conversely, interventions focused on enhancing psychological traits could measure their downstream effects on PA adherence and intensity. Such research designs would provide stronger evidence regarding the modifiability of these traits and their potential as intervention targets to promote long-term PA outcomes.

5 Conclusion

In conclusion, this systematic review provides valuable insights into the relationship between grit and resilience with PA. The findings of this review contribute to our understanding of how grit and resilience may be associated with PA participation and adherence, which are important for health and wellbeing across the lifespan. It highlights the importance of considering personality traits, encompassed in grit and resilience, as factors in promoting and sustaining PA behaviors. Future research should further explore the relationship between grit, PA, and motivation, as motivation plays a crucial role in initiating and maintaining exercise habits. From a practical standpoint, incorporating grit and resilience assessments into the initial screening process in real-world settings, such as athletic teams, community fitness programs, or clinical exercise interventions, could help identify individuals who may be at higher risk for poor adherence or dropout. These assessments could then inform individualized strategies, such as incorporating psychological skills training, goal-setting, or structured social support, to enhance commitment and persistence. In clinical populations, such assessments may also help clinicians tailor rehabilitation or health promotion programs to better address patient needs and increase long-term engagement in PA.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author/s.

Author contributions

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Examination of the relationship between perceived freedom levels in leisure time and multidimensional leadership orientations of individuals engaged in nature sports as a recreational activity

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Introduction: The purpose of this study is to examine the relationship between perceived freedom in leisure and multifaceted leadership orientations among individuals engaged in recreational nature sports residing in various provinces of the Central Anatolia region.

Methods: In this study, a quantitative research method was used. The sample consisted of 633 randomly selected volunteers from Kayseri, Kýrşehir, and Nevşehir. Data collection instruments included the "Multifaceted Leadership Orientations Scale", "Perceived Freedom in Leisure Scale", and demographic information form. Participants' personal information, inventory scores, and factor scores were presented using frequency (f) and percentage (%) values. For comparing scale scores, independent *t*-test statistics were used for gender and marital status variables, while one-way analysis of variance (LSD) was employed for age, educational status, sports discipline, duration of engagement in nature sports, and welfare level comparisons. Pearson correlation analysis (r) was applied to determine the relationship between the scores obtained from the scales.

Results: The research findings indicate that individuals participating in recreational nature sports activities exhibit high levels of perceived freedom in leisure and average levels of leadership orientation. On the other hand, analysis of various variables revealed significant differences between perceived freedom in leisure time and marital status, sport discipline, and years of participation, as well as between the some sub-dimensions of multifaceted leadership orientations and gender, marital status, education level, age, sport discipline, years of participation, and welfare level.

Discussion: The correlation analysis revealed a strong positive relationship between perceived freedom in leisure levels and multifaceted leadership orientations. This positive correlation is thought to stem from individuals' desire to prioritize their own wishes, emotions, and ideas to feel free during their leisure time.

KEYWORDS

recreation, nature sports, perceived freedom, leadership, leisure time

Introduction

Nature sports are defined as any type of sport performed in nature (Ardahan and Lapa, 2010). Nature sports are expressed as activities of struggling against the existing potential difficulties and risks of nature and sustaining life without any motor or animal power support, using only the knowledge, skills, and conditioning possessed by humans. Sporting activities in nature have been classified under various names such as "nature sports," "outdoor recreation activities," "adventure sports," "adventure recreation," and "extreme sports," depending on the level of danger they involve, risk factors, and auxiliary elements used (Koçak and Balci, 2010). Moreover, activities in a natural environment have positive roles on the participants' experiences of experiential learning, self-awareness and socialization (Yıldız, 2022).

Today, participation in recreational activities, the desire to connect with nature, and the utilization of leisure time have become a necessity for modern humans. The modern individual, fulfilling their obligations and oppressed under the pressure of daily compulsory actions, obtains renewal within their leisure time through recreational activities in which they participate according to their interests (Bilgen and Yüksel, 2021. Recreation and leisure are fundamentally for relaxation, entertainment, and personal development; as such, activities have emerged that address individual needs, particularly including stress management, freedom, self-esteem, and identity development (Atchley, 1970).

Individuals who experience a high level of perceived freedom in their leisure time perceive themselves as competent and in control of what happens before, during, and after leisure participation. Perceived freedom has been reported as the primary defining criterion of leisure (Ellis, and Ve Witt, 1994). Perceived freedom is a matter of degree. Most of the time, there is some kind of constraint on people's leisure time. Despite these constraints, they experience a sense of freedom in their leisure choices (Mannell and Kleiber, 1997).

Perceived freedom in leisure reflects individuals' self-assessments of their ability to participate in leisure activities and is therefore affected by events occurring in their lives (Yerlisu et al., 2012) According to Zowislo (2010), "What seems striking and meaningful is that everything about human beings actually originates from leisure time." In other words, people can set recreation and leisure as a goal for themselves and also experience the outcomes that result from achieving this goal. According to Sartre (2011), since human essence is not predetermined, humans will find their own essence and reconstruct themselves through their experiences, actions, and choices, which is only possible as long as humans are free in their actions and choices. In recreational activities, individuals may want to prioritize their own values, ideas, and orientations in order to feel free. At this point, the concept of leadership gains importance within the scope of group recreational activities in which the individual participates.

Leaders are individuals who pursue group goals through personal motivation rather than through coercion (Bolden, 2004). As the concept of recreation has evolved, so too has the idea of recreational leadership (Kirtepe and Ugurlu, 2022), which has become increasingly important today, particularly in supporting individuals facing weakened mental resilience, intense work demands, and experiences of personal control loss and ego burnout (Irhan, 2023). Freedom in leisure time is a fundamental aspect that allows individuals to choose activities voluntarily, fostering a sense of autonomy and personal fulfillment. This perceived freedom enhances motivation and engagement, which are crucial for effective leadership and group dynamics. Recreational leadership refers to the capacity to organize and direct group activities while motivating members within the group (Russell, 2001). A recreation leader is expected to foster a sense of joy in both the group and its tasks, ensure that members enjoy their participation, provide guidance, act as a role model, and influence members by engaging them in various activities (Karakuçük et al., 2017). In this way, leadership in leisure activities not only guarantees that recreational pursuits are carried out correctly and healthily but also supports team members in discovering their own essence (Kozak et al., 2017).

This study aims to investigate the relationship between individuals' perceived freedom in leisure time and their multifaceted leadership orientations, focusing specifically on those involved in nature sports for recreational purposes.

Materials and methods

Study group

This research employs a correlational survey model. This survey model can be defined as "research models aiming to determine the existence and/or degree of covariance between two or more variables" (Karasar, 2015).

The research carries descriptive characteristics as it aims to establish the relationship between perceived freedom levels in leisure time and multifaceted leadership orientations among individuals engaging in recreational outdoor sports residing in different provinces of the Central Anatolia region. The Central Anatolia Region is located in the heart of Turkey and is characterized by vast and diverse natural areas. This region offers significant opportunities for nature sports, with activities such as cycling, mountaineering, paragliding, orienteering, camping, trekking, and canoeing being widely practiced. The rugged terrain, open spaces, and lakes of Central Anatolia provide a suitable environment for nature sports enthusiasts, contributing to the development of these activities in the region.

Inclusion and exclusion in the study

The study included individuals aged 18 and above who regularly participate in nature sports for recreational purposes. Participants were required to engage consistently in activities such as cycling, mountaineering, paragliding, orienteering, camping, trekking, and canoeing. Those excluded from the study were individuals under the age of 18, those who do not engage in nature sports recreationally, and individuals who did not consent to participate voluntarily. This criteria ensured that the sample consisted of relevant participants whose experiences could accurately reflect the study's objectives.

Data collection tools

During the administration of the surveys, the researchers aimed to provide an adequate evaluation process for each participant within a sufficient time frame, ensuring that no rush occurred and necessary explanations were given. Moreover, appropriate conditions were created to allow participants to complete the forms in a comfortable environment. On average, it took participants ~10 min to complete the scales. The data collection instruments used in this study included the "Multifaceted Leadership Orientations Scale" developed by Dursun et al. (2019), the "Perceived Freedom in Leisure Scale" developed by Yerlisu Lapa and Tercan Kaas (2019), and a socio-demographic information form.

Formation of volunteer groups

The research was conducted through a study group. The study group was selected using a convenience sampling method. The study group comprised individuals residing in different provinces of the Central Anatolia region. A total of 633 individuals participated in the study. The study was conducted in three provinces within the Central Anatolia Region of Turkey: Kayseri, Kirşehir, and Nevşehir. Participants were reached through recreational sports clubs, local outdoor sports organizations, and public activity areas commonly used for nature sports. Convenience sampling was employed, and voluntary participation was encouraged through direct contact and informational briefings. The sample size was determined based on the accessible population in the selected provinces, using standard formulas for quantitative research to ensure statistical significance and representation. All participants took part in the study voluntarily and were informed about the purpose and confidentiality of the research prior to their participation. Data collection was carried out between January and March 2024.

TABLE 1 Socio-demographic characteristics of participants.

Socio-demographic characteristics	Variables	*N*	%
Gender	Male	343	54.2
	Female	290	45.8
Marital status	Married	283	44.7
	Single	350	55.3
Age	18–28	113	17.9
	29–39	245	38.7
	40–50	144	22.7
	51 and above	131	20,7
Educational status	High School	121	19.1
	Associate/Bachelor's Degree	427	67.5
	Graduate Degree	85	13.4
Branches	Cycling	56	8.8
	Mountaineering	103	16.3
	Paragliding	108	17.1
	Orienteering	100	15.8
	Camping	124	19.6
	Trekking	91	14.4
	Canoeing	51	8.1
Individuals' years of participation in recreational activities	0–2	93	14.7
	3–5	193	30.5
	6–8	238	37.6
	9 and above	109	17.2
Welfare level	Poor	77	12.2
	Moderate	169	26.7
	Good	279	44.1
	Very good	108	17.1

Demographic information form

In developing the demographic information form, research studies containing multifaceted leadership orientations and perceived freedom in leisure scales, along with socio-demographic information forms in the literature, were examined, and a pool of characteristics to be identified in athletes was created. Subsequently, with assistance from statistical experts, the socio-demographic information form was developed. This form contains seven questions designed to obtain information about gender, marital status, age, educational status, sports discipline of interest, duration of engagement in outdoor sports, and welfare level.

Multifaceted Leadership Orientations Scale (MLOS)

The Multifaceted Leadership Orientations Scale, developed by Dursun et al. (2019), is designed to measure individuals' leadership tendencies across four key dimensions: Political Leadership, Human-Oriented Leadership, Charismatic Leadership, and Structural Leadership. The scale consists of 19 items distributed as follows: Political Leadership (5 items), Human-Oriented Leadership (5 items), Charismatic Leadership (5 items), and Structural Leadership (4 items). Each item is rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher scores indicating a stronger inclination toward the respective leadership style. The scale contains no reverse-scored items. It aims to reflect the multifaceted nature of leadership by assessing how individuals display different leadership styles in varying contexts. The internal consistency coefficients (Cronbach's alpha) reported by the original authors were 0.80 for Political Leadership, 0.73 for Human-Oriented Leadership, 0.74 for Charismatic Leadership, and 0.72 for Structural Leadership, with an overall reliability of 0.85. In the current study, the overall reliability was found to be 0.90, with sub-dimension coefficients of 0.73 for Political Leadership, 0.77 for Human-Oriented Leadership, 0.76

TABLE 2 Descriptive statistics of scores obtained by individuals from perceived freedom in leisure and multifaceted leadership orientations scales.

Scale	*N*	Minimum	Maximum	M ± Sd	Skewness	Kurtosis
Perceived freedom in leisure	633	84.00	114.00	101.79 ± 5.79	−0.318	−0.279
Political leadership	633	5.00	25.00	15.11 ± 3.95	0.305	−0.307
Human resource leadership	633	6.00	25.00	15.60 ± 3.98	0.126	−0.634
Charismatic leadership	633	5.00	25.00	15.63 ± 4.23	0.133	−0.508
Structural leadership	633	5.00	20.00	12.94 ± 3.18	0.050	−0.389
Multifaceted leadership	633	62.00	88.00	77.24 ± 4.81	0.347	0.215

M, Mean; Sd, Standard Deviation.

for Charismatic Leadership, and 0.78 for Structural Leadership, demonstrating high internal consistency.

Perceived Freedom in Leisure Scale

The "Perceived Freedom in Leisure Scale" developed by Yerlisu Lapa and Tercan Kaas (2019) was adapted as a 5-point Likert format: Strongly disagree (1), Disagree (2), Undecided (3), Agree (4), Strongly agree (5). The scale provides scores based on the mean score, with all items being positively worded. The mean score is calculated by summing item scores and dividing by the number of items, with higher mean scores indicating greater perceived freedom in leisure time. The scale is unidimensional, consisting of 25 items, with a Cronbach's Alpha coefficient of 0.93.

Data analysis

Personal information, inventory scores, and factor scores were analyzed using frequency (f) and percentage (%) values. The distribution of scores was examined using Skewness-Kurtosis values. The data distribution was determined to be within the ±1 range, which Büyüköztürk (2007) interprets as appropriate for normality. Consequently, parametric test statistics were employed for data comparison. Independent T-tests were utilized for binary comparisons, while one-way analysis of variance was applied for comparing three or more variables. For sub-dimensions showing significant differences in one-way analysis of variance, LSD test statistics were employed for paired comparisons in cases of homogeneous distribution and unequal group numbers. Pearson Product-Moment Correlation analysis (r) was conducted to determine relationships between scale scores. Table 1 shows the socio-demographic characteristics of the participants.

Findings

Table 2 shows that for individuals engaged in nature sports as a recreational activity, the mean subdimension score of the perceived freedom in leisure scale is 101.79 ± 5.79. For the multifaceted leadership orientations scale, the mean scores are as follows: political leadership subdimension 15.11 ± 3.95, human resource leadership subdimension 15.60 ± 3.98, charismatic leadership subdimension 15.63 ± 4.23, structural leadership subdimension 12.94 ± 3.18, and multifaceted leadership subdimension 77.24 ± 4.81.

TABLE 3 Comparison of perceived freedom in leisure and multifaceted leadership orientations scale scores according to individuals' gender.

Subdimensions	Gender	*N*	M ± Sd	t	*p*
Perceived freedom in leisure	Male	343	101.66 ± 5.42	−0.569	0.573
	Female	290	101.92 ± 6.15		
Political leadership	Male	343	15.42 ± 3.90	0.970	***0.043***
	Female	290	14.78 ± 3.97		
Human resource leadership	Male	343	15.99 ± 3.93	0.890	***0.007***
	Female	290	15.14 ± 3.94		
Charismatic leadership	Male	343	16.11 ± 4.07	0.192	***0.002***
	Female	290	15.06 ± 4.33		
Structural leadership	Male	343	12.83 ± 3.14	0.700	0.353
	Female	290	13.07 ± 3.21		

M, Mean; Sd, Standard Deviation; t, *t*-value; p, *p*-value. $p < 0.05$. Bold numbers are used to emphasize significant differences.

Table 3 presents a comparison of perceived freedom in leisure and multifaceted leadership orientations scale scores according to individuals' gender. No significant difference was observed between male ($N = 343$) and female ($N = 290$) participants in terms of perceived freedom in leisure levels (t = −0.569, $p = 0.573$). However, in political leadership orientations, males (X ± SD: 15.42 ± 3.90) scored significantly higher than females (X ± SD: 14.78 ± 3.97) (t = 0.970, $p = 0.043$), indicating that males have stronger political leadership orientations than females. A similar trend is observed in human resource leadership, with a significant difference (t = 0.890, $p = 0.007$) between males (X ± SD: 15.99 ± 3.93) and females (X ± SD: 15.14 ± 3.94), suggesting that males have a more dominant attitude in human resource leadership. In charismatic leadership, males (X ± SD: 16.11 ± 4.07) again scored significantly higher than females (X ± SD: 15.06 ± 4.33) (t = 0.192, $p = 0.002$). No significant difference was found in structural leadership orientations between genders (t = 0.700, $p = 0.353$). Overall, the comparison between genders reveals that males score higher in political, human resource, and charismatic leadership orientations compared to females, while they are at similar levels in perceived freedom in leisure and structural leadership.

Table 4 presents a comparison of the effects of marital status on perceived freedom in leisure and multifaceted leadership

TABLE 4 Comparison of perceived freedom in leisure and multifaceted leadership orientations scale scores according to individuals' marital status.

Subdimensions	Marital status	*N*	M ± Sd	t	*p*
Perceived freedom in leisure	Married	283	100.92 ± 5.11	−3.391	***0.001***
	Single	350	102.47 ± 6.16		
Political leadership	Married	283	15.62 ± 3.67	2.837	***0.005***
	Single	350	14.72 ± 4.11		
Human resource leadership	Married	283	16.20 ± 3.73	3.460	***0.001***
	Single	350	15.12 ± 4.07		
Charismatic leadership	Married	283	16.14 ± 4.02	2.272	***0.006***
	Single	350	15.22 ± 4.34		
Structural leadership	Married	283	12.96 ± 3.06	0.139	0.587
	Single	350	12.92 ± 3.27		

M, Mean; Sd, Standard Deviation; t, *t*-value; p, *p*-value. $p < 0.05$. Bold numbers are used to emphasize significant differences.

orientations. The results indicate that married individuals' mean score for perceived freedom in leisure (X = 100.92) is significantly lower than that of single individuals (X = 102.47) (t = −3.391; $p = 0.001$). Furthermore, in the assessments conducted among leadership orientations, married individuals obtained higher scores compared to single individuals in the areas of political leadership (t = 0.034; $p = 0.005$), human resource leadership (t = 0.080; $p = 0.001$), and charismatic leadership (t = 2.272; $p = 0.006$), while no significant difference was observed in the area of structural leadership (t = 0.139; $p = 0.587$). These results suggest that married individuals may be more successful or effective in certain leadership orientations, while also revealing that the perception of leisure time may be negatively affected by marital status.

Table 5 compares perceived freedom in leisure and multifaceted leadership orientation scale scores across age groups, examining statistical differences between age categories. The scores for perceived freedom in leisure averaged 102.44 (SD = 5.66) in the 18–28 age group, while this value was observed as 100.83 (SD = 6.16) in the 51 and above age group. In the political leadership subdimension, the highest score was recorded in the 40–50 age group (15.91; SD = 3.96); however, no statistically significant difference emerged ($p = 0.053$). The human resources leadership analysis revealed that the 18–28 age group demonstrated the lowest mean value of 14.61 (SD = 3.70), while the 29–39 age group showed a significantly higher mean (15.93; SD = 4.04; $p = 0.007$). Furthermore, there was a significant difference with the 40–50 age group (16.10; SD = 3.96). Regarding charismatic leadership and structural leadership dimensions, no significant differences were found among age groups. Overall, the results indicate that there are variations in leadership perception across age groups, although these differences become more pronounced in specific leadership types within certain age brackets.

Table 6 presents a comparative analysis of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' educational status. Overall, no significant difference is observed in perceived freedom in leisure levels, with no statistically significant variation ($p = 0.131$) among high school (M = 102.69), associate/bachelor's degree (M = 101.63), and graduate degree (M = 101.22) groups. However, in terms of leadership orientations, the high school group's mean score in political leadership (M = 14.05) falls below both associate/bachelor's degree (M = 15.35) and graduate degree (M = 15.46) groups, with this difference being statistically significant ($p = 0.005$). Regarding human resources leadership, the high school group's score (M = 14.98) was found to be lower than both associate/bachelor's degree (M = 15.58) and graduate degree (M = 16.58) groups, which is also statistically significant ($p = 0.017$). In charismatic leadership, the high school group's score (M = 14.34) is significantly lower compared to other groups ($p = 0.001$). Similarly, in the structural leadership dimension, the high school group's mean (M = 12.01) remains below both associate/bachelor's degree (M = 12.89) and graduate degree (M = 13.08) groups, showing a significant difference ($p = 0.002$). These findings clearly demonstrate the effects of educational level on leadership orientations, indicating that high school graduates exhibit lower levels of leadership characteristics.

Table 7 presents a comparative analysis of perceived freedom in leisure and multifaceted leadership orientation scale scores across various recreational activity branches. When examining the scores for perceived freedom in leisure, the canoeing branch demonstrates the highest mean score (M = 103.65), while the orienteering branch shows the lowest mean (M = 98.99), with the difference being statistically significant ($p < 0.001$). While no significant differences were found among branches in political leadership and human resources leadership dimensions, in the charismatic leadership dimension, the orienteering branch exhibits the highest score (M = 17.04), while the trekking branch shows the lowest score (M = 14.34), with results being statistically significant ($p < 0.001$). In the structural leadership dimension, orienteering (M = 13.96) achieves the highest mean score, while the canoeing branch demonstrates the lowest mean score (M = 12.04). Overall, the analysis reveals that different recreational branches have significant effects on individuals' perception of leisure time and leadershistyles.

Table 8 examines the differences in perceived freedom in leisure and multifaceted leadership orientations based on individuals' duration of participation in recreational activities. In terms of perceived freedom in leisure, the lowest score (102.25 ± 5.65) was observed among participants with 0–2 years of experience, while those with 9 years and above demonstrated the highest score (103.59 ± 6.48), showing statistical significance (f = 5.982, $p = 0.001$). A similar trend is observed in political leadership, where participants with 0–2 years of experience showed notably lower means (13.76 ± 4.34) compared to other groups (f = 4.986, $p = 0.002$). Regarding human resources leadership, individuals with 0–2 years of participation again demonstrated the lowest scores (14.24 ± 4.07), with a significant difference (f = 5.722, $p = 0.001$). In the charismatic leadership category, no significant differences were found between group scores ($p > 0.05$). In the domain of structural leadership, those with 0–2 years of participation (12.08 ± 3.21) obtained lower scores compared to other groups, with this difference being statistically significant (f = 6.377, $p = 0.000$). Overall, the findings indicate that as the duration of participation increases, individuals' scores in perceived freedom in leisure and leadership orientations show an upward trend.

TABLE 5 Comparison of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' ages.

Subdimensions	Age	*N*	M ± Sd	f	*p*	LSD
Perceived freedom in leisure	18–28[a]	113	102.44 ± 5.66	2.091	0.100	-
	29–39[b]	245	102.13 ± 5.58			
	40–50[c]	144	101.52 ± 5.70			
	51 and above[d]	131	100.83 ± 6.16			
Political leadership	18–28[a]	113	14.96 ± 3.86	2.581	0.053	-
	29–39[b]	245	14.80 ± 3.99			
	40–50[c]	144	15.91 ± 3.96			
	51 and above[d]	131	14.98 ± 3.83			
Human resource leadership	18–28[a]	113	14.61 ± 3.70	4.063	***0.007***	***a<b*** ***a<c***
	29–39[b]	245	15.93 ± 4.04			
	40–50[c]	144	16,10 ± 3,96			
	51 and above[d]	131	15,28 ± 3,85			
Charismatic leadership	18–28[a]	113	14,84 ± 3,53	2.332	0.073	-
	29–39[b]	245	15,56 ± 4,05			
	40–50[c]	144	16,21 ± 5,03			
	51 and above[d]	131	15.81 ± 4.04			
Structural leadership	18–28[a]	113	12.99 ± 2.90	1.013	0.387	-
	29–39[b]	245	12.95 ± 3.16			
	40–50[c]	144	13.22 ± 3.71			
	51 and above[d]	131	12.56 ± 2.74			

M, Mean; Sd, Standard Deviation; f, F-value; p, *p*-value; LSD, Least Significant Difference. $p < 0.05$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

TABLE 6 Comparison of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' educational status.

Subdimensions	Educational status	*N*	M ± Sd	f	*p*	LSD
Perceived freedom in leisure	High School[a]	121	102.69 ± 5.71	2.039	0.131	-
	Associate/Bachelor's Degree[b]	427	101.63 ± 5.82			
	Graduate Degree[c]	85	101.22 ± 5.45			
Political leadership	High School[a]	121	14.05 ± 3.82	5.414	***0.005***	***a<b*** ***a<c***
	Associate/Bachelor's Degree[b]	427	15.35 ± 3.97			
	Graduate Degree[c]	85	15.46 ± 3.77			
Human resource leadership	High School[a]	121	14.98 ± 3.50	4.106	***0.017***	***a<c*** ***b<c***
	Associate/Bachelor's Degree[b]	427	15.58 ± 3.99			
	Graduate Degree[c]	85	16.58 ± 4.25			
Charismatic leadership	High School[a]	121	14.34 ± 4.08	7.718	***0.001***	***a<b*** ***a<c***
	Associate/Bachelor's Degree[b]	427	15.84 ± 4.09			
	Graduate Degree[c]	85	16.41 ± 4.71			
Structural leadership	High School[a]	121	12.01 ± 2.75	6.127	***0.002***	***a<b***
	Associate/Bachelor's Degree[b]	427	12.89 ± 3.20			
	Graduate Degree[c]	85	13.08 ± 3.39			

M, Mean Sd; Standard Deviation; f, F-value; p, *p*-value; LSD, Least Significant Difference. $p < 0.05$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

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TABLE 7 Comparison of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' recreational activity branches.

Subdimensions	Branches	*N*	M ± Sd	f	*p*	LSD
Perceived freedom in leisure	Cycling[a]	56	103.00 ± 6.09	5.709	***<0.001***	***a>d*** ***b>d*** ***b<g*** ***c>d*** ***e>d*** ***f>d*** ***g>d***
	Mountaineering[b]	103	101.72 ± 5.47			
	Paragliding[c]	108	102.07 ± 3.73			
	Orienteering[d]	100	98.99 ± 6.73			
	Camping[e]	124	102.11 ± 6.16			
	Trekking[f]	91	102.31 ± 5.49			
	Canoeing[g]	51	103.65 ± 5.38			
Political leadership	Cycling[a]	56	15.04 ± 4.56	1.874	0.083	-
	Mountaineering[b]	103	15.09 ± 3.70			
	Paragliding[c]	108	15.78 ± 3.96			
	Orienteering[d]	100	14.79 ± 4.11			
	Camping[e]	124	15.41 ± 4.46			
	Trekking[f]	91	14.12 ± 2.23			
	Canoeing[g]	51	15.65 ± 4.17			
Human resource leadership	Cycling[a]	56	15.54 ± 4.38	1.350	0.233	-
	Mountaineering[b]	103	15.59 ± 4.22			
	Paragliding[c]	108	15.98 ± 4.00			
	Orienteering[d]	100	16.11 ± 3.94			
	Camping[e]	124	15.41 ± 4.12			
	Trekking[f]	91	14.70 ± 3.10			
	Canoeing[g]	51	15.96 ± 3.70			
Charismatic leadership	Cycling[a]	56	15.05 ± 4.58	3.892	***0.001***	***a<d*** ***b<d*** ***c>f*** ***d>a*** ***d>b*** ***d>e*** ***d>f*** ***d>g*** ***e>f***
	Mountaineering[b]	103	15.41 ± 4.71			
	Paragliding[c]	108	16.03 ± 4.07			
	Orienteering[d]	100	17.04 ± 3.60			
	Camping[e]	124	15.74 ± 4.04			
	Trekking[f]	91	14.34 ± 3.40			
	Canoeing[g]	51	15.14 ± 5.16			
Structural leadership	Cycling[a]	56	12.29 ± 4.07	4.715	***<0.001***	***a<c*** ***a<d*** ***b<c*** ***b<d*** ***b<e*** ***b<f*** ***c>g*** ***d>e*** ***d>g*** ***f>g***
	Mountaineering[b]	103	12.07 ± 3.11			
	Paragliding[c]	108	13.43 ± 3.30			
	Orienteering[d]	100	13.96 ± 2.74			
	Camping[e]	124	12.90 ± 3.02			
	Trekking[f]	91	13.15 ± 2.65			
	Canoeing[g]	51	12.04 ± 3.27			

M, Mean Sd; Standard Deviation; f, F-value; p, *p*-value; LSD, Least Significant Difference. $p < 0.05$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

Table 9 presents data comparing perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' welfare levels. Regarding perceived freedom, no significant difference is observed among individuals of different welfare levels (f = 2.350, $p = 0.071$). Similarly, no significant differentiation was detected in the domains of political leadership and human resources leadership. However, in the charismatic leadership dimension, individuals with poor welfare levels demonstrated a score (M = 15.56) that showed a significant increase compared to the moderate welfare group (M = 15.25) (*p*

TABLE 8 Comparison of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' years of participation in recreational activities.

Subdimensions	Years	*N*	M ± Sd	f	*p*	LSD
Perceived freedom in leisure	0–2[a]	93	102.25 ± 5.65	5.982	***0.001***	***a<d*** ***b<d*** ***c<d***
	3–5[b]	193	102.36 ± 5.96			
	6–8[c]	238	102.55 ± 5.07			
	9 and above[d]	109	103.59 ± 6.48			
Political leadership	0–2[a]	93	13.76 ± 4.34	4.986	***0.002***	***a<b*** ***a<c*** ***a<d***
	3–5[b]	193	15.03 ± 3.42			
	6–8[c]	238	15.13 ± 4.09			
	9 and above[d]	109	15.39 ± 3.92			
Human resource leadership	0–2[a]	93	14.24 ± 4.07	5.722	***0.001***	***a<b*** ***a<c*** ***b>d***
	3–5[b]	193	16.16 ± 3.55			
	6–8[c]	238	15.85 ± 4.26			
	9 and above[d]	109	15.24 ± 3.57			
Charismatic leadership	0–2[a]	93	14.92 ± 4.38	1.931	0.123	-
	3–5[b]	193	15.36 ± 4.40			
	6–8[c]	238	16.03 ± 4.10			
	9 and above[d]	109	15.83 ± 3.95			
Structural leadership	0–2[a]	93	12.08 ± 3.21	6.377	***<0.001***	***a<b*** ***a<d*** ***b>c***
	3–5[b]	193	13.59 ± 3.20			
	6–8[c]	238	12.60 ± 3.06			
	9 and above[d]	109	13.27 ± 3.11			

M, Mean; Sd, Standard Deviation; f, F-value; p, *p*-value; LSD, Least Significant Difference. $p < 0.05$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

= 0.004), while individuals with good welfare levels achieved an even higher score (M = 16.26); this interestingly indicates that charismatic leadership levels are higher for the good welfare group when compared to the poor welfare group. A similar situation exists in the structural leadership dimension, where individuals with poor welfare levels scored significantly higher (M=12.68) compared to those at moderate levels (M = 12.30) ($p = 0.009$). Overall, these findings reveal complex and multilayered relationships between individuals' welfare status and their perceived freedom and various leadership orientations.

Analysis of Table 10 reveals significant correlations between the perceived freedom in leisure scale and various subdimensions of the multifaceted leadership orientation scale: a low positive significant correlation with political leadership (r = 0.096, $p = 0.016$); a low positive significant correlation with human resources leadership (r = 0.078, $p = 0.049$); a low positive significant correlation with charismatic leadership (r = 0.102, $p = 0.019$); a low positive significant correlation with structural leadership (r = 0.096, $p = 0.016$); and a high positive significant correlation with multifaceted leadership orientations (r = 0.848, $p < 0.001$).

Examination of Table 11 indicates that the model constructed between the perceived freedom in leisure scale and the score of multifaceted leadership orientation scale presents a significant relationship (r = 0.849, $r^2 = 0.721$; $p < 0.01$). When analyzing the *t*-test results regarding the significance of the regression coefficient, it was observed that the level of perceived freedom in leisure predicts multifaceted leadership orientation (t = 10.530, $p = 0.000$) and explains 72.1% of the variance (f = 318.697, $p < 0.01$).

Discussion

The findings of this research reveal the relationships between perceived freedom levels in leisure time and multifaceted leadership orientations among individuals engaged in outdoor sports. When examined from a gender perspective, the absence of significant differences in perceived freedom levels during leisure time indicates that individuals involved in outdoor sports share similar perceptions of freedom. This finding demonstrates consistency with previous research (Lapa and Agyar, 2012; Serdar and Ay, 2016; Gürbüz and Henderson, 2014; Chen et al., 2013) and supports the gender equality perspective in outdoor sports. While some studies have found higher male participation in leisure activities, this reflects a different dimension related to participation rates rather than perceived freedom levels (Demir and Demir, 2006).

Regarding multifaceted leadership orientations, males achieving higher scores in political leadership aligns with literature findings on men's task-oriented leadership styles (Eagly and Johnson, 1990). However, the narrowing gender

TABLE 9 Comparison of perceived freedom in leisure and multifaceted leadership orientation scale scores according to individuals' welfare level.

Subdimensions	Welfare level	*N*	M ± Sd	f	*p*	LSD
Perceived freedom in leisure	Poor[a]	77	102.40 ± 6.26	2.350	0.071	-
	Moderate[b]	169	101.36 ± 6.00			
	Good[c]	279	101.43 ± 5.60			
	Very good[d]	108	102.91 ± 5.28			
Political leadership	Poor[a]	77	14.79 ± 3.53	2.569	0.053	-
	Moderate[b]	169	14.90 ± 4.81			
	Good[c]	279	15,60 ± 3,34			
	Very good[d]	108	14,51 ± 4,04			
Human resource leadership	Poor[a]	77	15,23 ± 3,46	1,016	0.385	-
	Moderate[b]	169	15.30 ± 4.57			
	Good[c]	279	15.88 ± 3.54			
	Very good[d]	108	15.63 ± 4.25			
Charismatic leadership	Poor[a]	77	15.56 ± 3.98	4.482	***0.004***	***b<c*** ***c>d***
	Moderate[b]	169	15.25 ± 4.43			
	Good[c]	279	16.26 ± 4.02			
	Very good[d]	108	14.66 ± 4.36			
Structural leadership	Poor[a]	77	12.68 ± 3.01	3.904	***0.009***	***b<c*** ***b<d***
	Moderate[b]	169	12.30 ± 3.53			
	Good[c]	279	13.26 ± 3.02			
	Very good[d]	108	13.29 ± 2.95			

M, Mean; Sd, Standard Deviation; f, F-value; p, *p*-value; LSD, Least Significant Difference. $p < 0.05$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

TABLE 10 Correlation analysis between perceived freedom in leisure scale and multifaceted leadership orientation scales.

		1	2	3	4	5	6
Perceived freedom in leisure[a]	r	1					
	p						
	n	633					
Political leadership[b]	r	0.096*	1				
	p	0.016					
	n	633	633				
Human resource leadership[c]	r	0.078*	0.660**	1			
	p	0.049	***<0.001***				
	n	633	633	633			
Charismatic leadership[d]	r	0.102*	0.666**	0.654**	1		
	p	0.019	***<0.001***	***<0.001***			
	n	633	633	633	633		
Structural leadership[e]	r	0.096*	0.437**	0.537**	0.534**	1	
	p	0.016	***<0.001***	***<0.001***	***<0.001***		
	n	633	633	633	633	633	
Multifaceted leadership[f]	r	0.848**	0.121**	0.124**	0.117**	0.114**	1
	p	***<0.001***	0.002	0.002	0.003	0.004	
	n	633	633	633	633	633	633

r, Correlation coefficient; p, *p*-value; n, Sample size. *$p < 0.05$, **$p < 0.001$. Bold numbers are used to emphasize significant differences. Letters were used to indicate the differences between the variables on the left side of the tables.

gaps in leadership effectiveness represents a noteworthy development (Paustian-Underdahl et al., 2014). The finding that males also scored higher in human-oriented and charismatic leadership challenges traditional stereotypes and suggests the developmental effects of outdoor sports on these characteristics. The absence of gender differences in structural leadership is consistent with Bolman and Deal's (2017) model.

The results obtained regarding marital status reveal that single individuals possess higher perceptions of leisure freedom compared to married individuals. This finding parallels Akyüz and Türkmen's (2016) research and can be explained by single individuals having greater flexibility in time management. The more restricted leisure time perception among married individuals can be evaluated within the framework of Stebbins (2012) serious leisure theory. The constraints imposed by family responsibilities may affect participation in recreational activities such as outdoor sports.

In terms of leadership orientations, married individuals achieving higher scores in political leadership, human resources leadership, and charismatic leadership differs from Gürer's (2012) findings. This divergence may stem from sample group characteristics or study context. The superiority of married individuals in these leadership areas can be explained within (Bolman and Deal, 1991) multifaceted leadership theory framework through the responsibilities and experiences that married life brings. The high performance in human resources leadership, in particular, can be associated with the development of family communication and empathy skills (Yilmaz and Karahan, 2010). Regarding charismatic leadership, this can be explained by the increase in life experiences and development of responsibility consciousness, as suggested by Avolio and Gardner (2005).

When examining the age variable, the absence of significant differences in perceived freedom levels during leisure time is consistent with Lapa and Agyar's (2012) findings. However, the divergence from Serdar and Ay's (2016) finding that freedom perception increases with age may result from sample characteristics. Regarding leadership orientations, the presence of significant differences among age groups in the human resources leadership dimension, with the 29–39 and 40–50 age groups scoring higher than the 18–28 age group, aligns with Avolio et al.'s (2009) findings that leadership skills develop with age. The highest scores in political leadership achieved by the 40–50 age group also support Day et al.'s (2014) findings that political skills develop with age.

Concerning educational status, the absence of significant differences in perceived freedom levels during leisure time is consistent with various studies in the literature (Lapa and Agyar, 2012; Serdar, 2021). This indicates that educational level is not a determining factor in leisure freedom perception. However, high school graduates achieving lower scores in all leadership dimensions emphasizes the critical role of education in leadership skill development. These findings parallel studies by Bass and Avolio (1994), House and Aditya (1997), and Northouse (2018) that emphasize the importance of the educational process in developing leadership competencies.

The findings obtained regarding sports disciplines demonstrate that different outdoor sports affect individuals' freedom perception and leadership characteristics at varying levels. Canoeing achieving the highest score in leisure freedom can be explained by this sport providing individuals with a greater sense of freedom due to its inherent nature (Ewert and Sibthorp, 2014). Orienteering's prominence in charismatic and structural leadership can be associated with this sport's development of individual decision-making abilities and systematic thinking and organizational skills (Priest and Gass, 2018; McKenzie, 2003).

TABLE 11 Regression analysis of perceived freedom in leisure level predicting multifaceted leadership orientation values.

Predictor	B	Std error	β	t	*p*
Constant	22.794	2.165		10.530	<0.001
Multifaceted leadership	1.019	0.026	0.849	39.512	<0.001

$R = 0.849$; $R^2 = 0.721$.
$F = 318.69$; $p < 0.001$.

The results obtained regarding participation duration reveal that long-term participation positively affects both leisure freedom perception and leadership orientations. This aligns with Cotterill and Fransen's (2016) findings emphasizing the importance of experience acquisition in leadership development. Consistent with Kleiber et al.'s (1986) findings that leisure activities provide psychological relaxation and personal control, long-term participation in outdoor sports appears to enhance freedom perception.

Regarding welfare level, the absence of significant differences in leisure freedom perception supports Kleiber et al.'s (1986) and Iso-Ahola's (1997) findings that the benefits derived from activities are more important than economic status. Those with good welfare levels achieving higher scores in charismatic leadership is consistent with House and Aditya's (1997) and Northouse's (2018) findings that economic security supports confidence and leadership characteristics. Those with poor welfare levels achieving higher scores in structural leadership can be explained by Pearce and Sims' (2002) and Hackman and Wageman's (2005) findings that difficult economic conditions develop structural leadership skills.

The correlation and regression analysis results reveal a strong and positive relationship between perceived freedom levels in leisure time and multifaceted leadership orientations. This relationship explaining 72.1% of the variance demonstrates the powerful effect of freedom perception on leadership behaviors. Van Dierendonck's (2011) findings that leadership style affects freedom perception and Bass and Avolio's (1994) findings revealing the significant relationship between these two variables support our research results.

In conclusion, it was determined that individuals engaged in outdoor sports possess high levels of perceived freedom in leisure time and moderate levels of leadership orientations. Various demographic and personal variables were observed to affect these perceptions at different levels. The strong positive relationship between perceived freedom levels in leisure time and multifaceted leadership orientations reveals the mutually supportive nature of these two concepts.

This study has certain limitations. Primarily, the sample is restricted to individuals from a specific geographical region and selected on a voluntary basis, which limits the generalizability of the

findings. Additionally, since the data were collected through self-report measures, there is a potential risk of social desirability bias in participants' responses.

Future research is recommended to include larger and more diverse samples encompassing different age groups, professional backgrounds, and cultural contexts. Furthermore, the use of qualitative data collection methods (such as in-depth interviews or focus group discussions) may provide a deeper understanding of the relationship between leadership orientation and perceived freedom in leisure time. Longitudinal studies could also be conducted to examine how these variables interact and evolve over time. Lastly, comparative studies that explore the effects of various sports disciplines on individuals' leadership orientations and perceptions of freedom would make valuable contributions to the literature.

- Considering that regular participation in outdoor sports contributes to individuals' leadership behaviors, increasing such activities in university programs could be encouraged.
- In light of the findings indicating that the level of freedom individuals perceive in their leisure time is associated with leadership tendencies, it may be recommended to consider activities involving nature sports as a tool in the field of personal development.
- Given that recreational activities provide not only physical but also psychosocial benefits, nature sports could be structured to support individuals' perceptions of freedom and leadership competencies.
- In future studies, examining the differences between freedom perception and leadership orientations according to different types of nature sports could provide more in-depth contributions to the literature.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/ participants or patients/participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

KK: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. MS: Writing – original draft, Writing – review & editing. HU: Conceptualization, Writing – original draft, Writing – review & editing. MZS: Writing – original draft, Writing – review & editing. OU: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. SK: Conceptualization, Data curation, Writing – original draft, Writing – review & editing. EK: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing.

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Measuring the physical activity in the EU using a fuzzy hybrid synthetic index and an ordered probit model

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Introduction: Physical activity can be measured by different attributes, such as sports activities, moderate exercise, or even walking time. The most recent Eurobarometer on Sport and Physical Activity included nine questions that permit physical activity measurement at the EU.
Methods: The study uses a Fuzzy Hybrid Analysis approach to calculate a synthetic index that measures the physical activity of EU citizens. The method is applied to the dataset obtained from a survey administered to a total of 26,578 respondents who represent the EU. Nine items measure the physical activity latent variable with an answer format based on three different semantic ordinal point scales.
Results: The method provides a synthetic indicator at aggregated and individual levels. Seventeen covariates were used to analyze the main determinants of physical activity, particularly gender, age, education, social class, and political orientation.
Discussion: The results reveal that certain covariates influence the latent variable under study, providing interesting insights to inform the development of targeted programs that reduce physical inactivity in the EU.

KEYWORDS

physical activity, sport participation, walking, moderate exercise, eurobarometer, fuzzy-hybrid analysis

1 Introduction

The importance of physical activity and sport in promoting health, well-being, and social cohesion is widely recognized for its role in controlling chronic non-contagious diseases such as hypertension, diabetes, coronary heart disease, obesity, and certain cancers. All these ailments increase the risk of mortality and mental health problems, affecting citizens' quality of life. Lack of or weak physical activity implies high economic costs, social disparities, and detriment to public health (1, 2).

Despite the promotion by international organizations, an estimated 27.5% of the global adult population fails to meet the recommended physical activity standards, significantly impacting public health issues. Several studies report significant differences in inactivity depending on gender, age, geographic area, and income level. Both women and older adults tend to have lower rates of physical activity, partly due to socio-cultural barriers and access to sports facilities (3).

In the present study, we analyze the physical activity of European Union (EU) citizens based on data obtained from the "Special Eurobarometer 525—Sport and Physical Activity", a survey administered to more than 26,000 people in the 27 member states of

the EU. Due to its large sample size and detailed socio-demographic clustering, this information provides in-depth insights into physical activity practices, including cultural and economic factors, as well as personal preferences (4).

The methodology is based on applying the multi-criteria technique TOPSIS (Technique for Order of Preference by Similarity to Ideal Solutions) with the perspective of Fuzzy Hybrid Analysis. The primary purpose of this approach is to address the ordinal and semantic nature of the responses more realistically and robustly (5). The method also handles the information vagueness more adequately than other traditional methods (6). In addition, the well-grounded properties of the fuzzy logic algebra provide an adequate framework for the construction of the aggregated synthetic indicators (7).

After obtaining this synthetic index, we applied an ordinal regression econometric model (ordered probit) to determine which covariates have a significant influence on the probability that an individual will be highly sedentary. Among the variables included in the selection are those related to age, level of education, citizens' perception of their EU membership, social class, gender, urban/rural area of residence, and purchasing power. The variety of these variables enables a multidimensional analysis that encompasses economic, socio-demographic, and personal attitudes and perceptions.

The main findings indicate a marked geographical polarization across the EU: northern and central nations (Finland, the Netherlands, Estonia, and Denmark) emerge as having higher physical activity; in contrast, southern and eastern regions (Portugal, Greece, Italy, and Poland) tend to have lower levels of physical activity. These differences may be associated with cultural elements (lower use of active transport and habits) and with government policies and urban infrastructure (existence of bicycle routes, pedestrian areas, and facilities for accessible sports spaces).

Furthermore, it is corroborated that older individuals and those with a lower educational and economic level have a significantly higher tendency towards sedentary lifestyles. However, young people, the upper-middle classes, and people with higher levels of life satisfaction tend to have higher rates of physical activity. Additionally, a sense of belonging to the community and a positive perspective on the EU's future are associated with a higher level of motivation to be physically more active.

We conclude that these findings underscore the need for policies promoting physical activity in Europe to be tailored to specific population groups and to account for each country's unique cultural and socio-demographic characteristics. The analysis methodology used, combining fuzzy logic with TOPSIS and a structured probit model, has proven to be particularly useful in revealing nuances that might be hidden in conventional measurements. In the context of EU and local government initiatives to reduce sedentary lifestyles, this analytical approach could be an efficient tool for managing decisions and developing more focused and effective public health strategies and sports policies.

2 Literature review

Physical inactivity has been associated with various pathologies, including obesity, overweight, and different health conditions associated with prolonged sedentary behavior (8). Indeed, it has been estimated that sedentary behavior contributes to between 6% and 10% of all deaths (9). Furthermore, it has been demonstrated that inactivity has a detrimental impact not only on the physical health of the population but also on its mental health and quality of life (10).

The promotion of physical activity and the reduction of sedentary behavior are considered essential for the prevention of non-contagious diseases, reduction of mortality and improvements in quality of life (11–13). This issue has gained significant attention from international organizations and governments (10–13).

Despite the systematic promotion of regular physical activity by various international organizations, it is estimated that 27.5% of the global adult population does not meet the recommended minimum levels of exercise (3). This reveals a significant health challenge: sedentary lifestyles not only increase the risk of noncommunicable diseases, but also have considerable economic costs for health systems and an impact on social inequality.

Initiatives such as the Global Strategy on Diet, Physical Activity and Health of the WHO—World Health Organization in 2004, the Global Action Plan for the Prevention and Control of Non-Contagious Diseases of 2013, or the Global Action Plan on Physical Activity (GAPPA) 2018-2030 highlight the need for integrated approaches to create favorable environments that facilitate the regular practice of physical activity.

Regarding the topic of study, we highlight research by Guthold et al. (3) on identifying patterns of inactivity not only at the global level but also stratified by gender, age, geographical regions, and national income. The authors collected and standardized data from 358 surveys conducted between 2001 and 2016, with an unprecedented sample of 1.9 million adults in 168 countries. In addition, by applying validated measurement instruments such as the International Physical Activity Questionnaire (IPAQ) and the Global Physical Activity Questionnaire (GPAQ), information on physical activity at work, at home, during transportation, and during leisure time could be gathered for the first time. The analysis was disaggregated by gender and income level, using multilevel mixed models that incorporated variables such as urbanization, educational level, and belonging to one of the nine macro-regions defined by the WHO. The author found inequalities and challenges public health programs face, providing governments with well-targeted policy design.

Overall, the study describes how by 2016, approximately 27.5% of the adult population worldwide did not achieve WHO-recommended levels of physical activity, corresponding to at least 150 minutes of moderate activity per week, 75 minutes of vigorous activity, or an equivalent combination (14). It was also found that income, urbanization dynamics, transport use, and sedentary jobs affected the levels of physical activity (15). High-income countries have a prevalence of inactivity more than twice as high as that observed in low-income countries, a finding that could be explained by an increase in transport motorization, a sedentary

employment-oriented lifestyle, increasing urbanization, and a displacement of traditional and more physical activities (16, 17).

Regarding gender differences, in 159 out of 168 countries, women exhibited higher levels of inactivity than men, with gaps of at least 10 percentage points in 65 countries (in 9 of them even exceeding a 20-point difference). There were significant differences between men and women, with a gap of more than 8 percentage points globally, with women being the most inactive in most regions. This disparity could be due to socio-cultural factors that constrain women's participation in recreational or sports activities, as well as their greater dedication to care roles and household duties, which are not always classified as formal physical activity (14).

The success of interventions such as improving pedestrian infrastructure, promoting cycling or public transport, developing urban parks and green spaces, as well as consciousness-raising campaigns, depends to a large degree on political willingness and the cross-cutting cooperation of government agencies, the private sector, and citizens (16). From a sociological perspective, it is essential to understand that the adoption of active habits is directly related to socio-economic, cultural, and symbolic factors; therefore, individual recommendations alone are not enough. There is also a clear relationship between income inequality and health (18).

There are many programs scattered worldwide, aligned with the Global Action Plan on Physical Activity 2018-2030 promoted by WHO (15), aiming to reduce physical inactivity levels by 15% by 2030. To achieve this goal, a multi-sectoral strategy involving governments, health systems, local organizations, enterprises, and community groups appears essential. The success of such physical activity promotion policies depends to a large degree on how the supply of sports infrastructure and health education is aligned with the conditions of inequality. This is the only way to overcome sedentary tendencies resulting from modern life by promoting physical activities as an accessible, culturally meaningful, and valued practice for large population sectors.

Klepac Pogrmilovic et al. (19) proposed a framework of accurate definitions to categorize and evaluate physical activity policies, which they named "Comprehensive Analysis of Policy on Physical Activity" (CAPPA). They identified a series of variables that affect policies related to physical activity, for example, health, sport, transport, environment, job/employment, education, tourism, urban planning, public finances, and research, among others (15). Thus, they generated a comprehensive approach to studying physical activity policies that promote healthy behaviors. This conceptual framework could guide and focus resources, identifying gaps, opportunities, and challenges of the existing physical activity promotion policies. The modular structure of the framework would enable its adaptability to local contexts, allowing for the comparability of results across different countries.

We conclude the literature review by focusing on the analysis of two key determinants: age and education. It is essential for older adults to engage in activities to maintain their physical health, mental well-being, and social well-being. Older adults often face barriers to accessing suitable physical activity programs, including mobility difficulties, chronic diseases, and a lack of personalized activities (20–22). For children, regular and consistent physical exercise is also essential for optimal physical and mental development. They are a particularly vulnerable group due to the absence of appropriate infrastructure, the lack of safe and affordable exercise programs, and sedentary lifestyles promoted by the increasing use of digital technologies. Children's vulnerability in this area can have long-term impacts on their health, including obesity, metabolic disturbances, and difficulties in developing motor and social skills (23, 24).

Low childhood physical activity is a growing concern, given its direct association with the prevalence of obesity, cardiovascular problems, and diabetes (2, 25). The WHO recommends that children aged 5–17 years engage in at least 60 minutes of moderate to vigorous physical activity per day. However, multiple studies indicate that most children do not reach this level (22, 26). This problem is not only explained by individual factors such as motivation or skills, but also by characteristics of the socio-cultural environment and, in particular, school environments (27, 28). The existence of school policies promoting physical activity, along with available facilities and opportunities for physical activity (e.g., through recreational breaks, extracurricular sports, and sports competitions), can substantially support schoolchildren's participation in regular physical activity (29).

Finally, education emerged as a strong, positively correlated factor. Increased knowledge of the benefits of physical activities, combined with better socio-economic conditions, facilitates the overcoming of obstacles (Janke et al., 2006). Living in one's own home and being employed were also positively associated with activity, indicating the complexity of older people's life trajectories and their socio-economic circumstances. While there was no significant main effect of gender on activity, the interaction with "fear of injury" resulted in women being particularly vulnerable to sedentary lifestyles when this perception was present (30).

3 Data

The special Eurobarometer 525 was commissioned by the Directorate-General for Education, Youth, Sport and Culture at the European Commission to explore public opinion about sport and physical activity, covering the following topics: (1) Frequency and levels of engagement in sport and other physical activity; (2) Places where citizens engage in sport and other physical activity; (3) Europeans' motivators and barriers to sports participation; (4) Opportunities for sports participation in citizens' local areas; (5) Europeans' engagement in volunteering in sport; (6) Impact of COVID-19 on the frequency of sport and physical activity; (7) Awareness of the impact of sport and physical activity on the environment and perceptions of measures taken to support the environment; and (8) Opinions about gender equality issues in sport and physical activity.

The current study primarily addresses questions related to the first topic, analyzing a synthetic index that measures the physical activity of EU citizens. The survey was conducted among 26,578 EU citizens by the Kantar network across the 27 Member States of the European Union between 19 April and 16 May 2022. The

sample was representative of the EU, and participants were drawn from various social and demographic categories. For more details and technical specifications of the survey, please refer to the European Commission (4).

The physical activity scale is based on nine indicators that correspond to the following questions of the survey: (QB1): How often do you exercise or play sport? By "exercise", we mean any form of physical activity which you do in a sports context or sport-related setting, such as swimming, training in a fitness center or a sports club, or running in the park; (QB2): And how often do you engage in other physical activities such as cycling from one place to another, dancing, gardening, etc.? By "other physical activity", we mean physical activity for recreational or non-sport-related reasons; (QB3): In the last 7 days, on how many days did you do vigorous physical activity like lifting heavy things, digging, aerobics or fast cycling?; (QB4) In general, on days when you do a vigorous physical activity, how much time do you spend at it?; (QB5) In the last 7 days, on how many days did you do moderate physical activity like carrying light loads, cycling at normal pace or doubles tennis? Please do not include walking; (QB6): In general, on days when you do a moderate physical activity, how much time do you spend at it?; (QB7) In the last 7 days, on how many days did you walk for at least 10 minutes at a time?; (QB8): In general, on days when you walk for at least 10 min at a time, how much time do you spend walking?; (QB9): How much time do you spend sitting on a usual day? This may include time spent at a desk, visiting friends, studying, or watching television.

One of the issues to be discussed in the methodology section is that the answer format of the questions is different in format and the number of points chosen for the response. For example, the answer format of the questions QB1 and QB2 was based on a 6-point ordinal time per month scale as follows: (1) Never; (2) Less often than 1–3 times a month; (3) 1–3 times a month; (4) 1–2 times a week; (5) 3–4 times a week; and (6) 5 times a week or more. Meanwhile, for the questions QB3, QB5, and QB7, the answer format was based on an 8-point ordinal time per week scale as follows: (1) Never; (2) 1 day; (3) 2 days; (4) 3 days; (5) 4 days; (6) 5 days; (7) 6 days; and (8) 7 days. For the questions QB4, QB6, and QB8, the answer format was based on a 6-point ordinal time per day as follows: (1) Never; (2) 30 min or less; (3) 31 to 60 min; (4) 61 to 90 min; (5) 91 to 120 min; and (6) More than 120 min. Finally, for QB9, the answer format scale is based on a 10-point ordinal time per day as follows: (1) More than 8 h and 30 min; (2) 7 h 31 min to 8 h 30 min; (3) 6 h 31 min to 7 h 30 min; (4) 5 h 31 min to 6 h 30 min; (5) 4 h 31 min to 5 h 30 min; (6) 3 h 31 min to 4 h 30 min; (7) 2 h 31 min to 3 h 30 min; (8) 1 h 31 min to 2 h 30 min; (9) 1 h 1 min to 1 h 30 min; and (10) 1 h or less.

In summary, we have four different answer format scales based on ordinal times at different periods with six, eight and ten points. The direction of the scale for all the items was consistent, meaning that higher figures are aligned in all cases with more physical activity, either by participating in sports, vigorous or moderate physical activities, walking, or staying seated less.

The physical activity synthetic indicator (PASI) will be constructed at the individual level and aggregated level using fifteen different covariates: country, age, life satisfaction, personal opinion about whether belonging to the EU is good or bad for the country, opinion about the future of the EU, opinion about if the national countries should help refugees, political orientation, marital status, education, gender, household location, having or not difficulties in paying bills, social class, opinion about the future for the next EU generations, and community type. Thus, it would be possible to analyze to what extent PASI is affected by these factors. Thus, we significantly extend the analysis of each variable studied in the Eurobarometer in terms of the covariates used. For example, in the final report (4), the answers given to QB2 were only cross-tabulated with country, gender, age, education, and difficulties in paying bills.

4 Methodology

PASI will be obtained at the individual level using the Technique for Order of Preference by Similarity to Ideal Solutions (TOPSIS) proposed by Hwang and Yoon (31). The method chooses the individuals who have carried out the most and the least physical activity in the sample and compares each individual with these two by calculating the relative distance to both ideal solutions. Unfamiliar readers in TOPSIS methodology often find it challenging to assimilate the negative ideal solution (or anti-ideal solution) as an "ideal" reference point, especially when understood in our context of minimizing the physical activity. It is true that linking ideal with low physical activity seems to be counterintuitive. However, this negative ideal solution and the positive ideal solution (those individuals with the highest physical activity) are only chosen as reference points to rank all the individuals' physical activity.

Thus, the synthetic indicator is obtained by calculating the ratio between the distance to the least physical activity over the sum of distances to both ideal solutions. The idea is that when the ratio is closer to one, the individual is closer to the individual who has carried out the most physical activity.

TOPSIS is still one of the most used multi-criteria decision-making methods and was extended to fuzzy sets using a fuzzy-hybrid analysis (FHA) in which the attribute values are represented by fuzzy numbers instead of crisp numbers (32). Thus, a more robust analysis can better address the uncertainty of Likert, semantic, or ordinal scale (33). This hybrid approach has been applied in different fields, such as selecting the best shopping websites (34), fish consumption in the EU (5), commuter satisfaction in Central Europe (35), analyzing service quality in the MICE industry (7), tourist destination competitiveness (36), transshipment site selection (37), and wind power potential plants (38). More recently, the application has also gained popularity in social science to measure attitudes toward migrants (39), or to analyze citizens' national identity (6).

We omit the mathematical formulation for the ease of exposition and because there are excellent manuals that cover the methods used in the study (40–42). Nevertheless, for the sake of replicability, a crucial aspect of this study, the conversion of

ordinal scales to Triangular Fuzzy Numbers (TFNs) was conducted according to the following procedure: 6-point scales (1 = (0 0 30); 2 = (5 20 35); 3 = (25 40 55); 4 = (45 60 75); 5 = (65 80 95); v6 = (70 100 100)); 8-point scales (1 = (0 0 25); 2 = (5 15 25); 3 = (20 30 40); 4 = (35 45 55); 5 = (45 55 65); 6 = (60 70 80); 7 = (75 85 95); 8 = (75 100 100)), and 10-point scale (1 = (0 0 10); 2 = (0 10 20); 3 = (10 20 30); 4 = (20 30 40); 5 = (27.5 40 52.5); 6 = (47.5 60 72.5); 7 = (60 70 80); 8 = (70 80 90); 9 = (80 90 100); 10 = (90 100 100)). It can be seen that in all the cases, the intersection of the converted TFNs of any pair of consecutive points is not empty. This is the essence of the nature of the fuzzy logic when the human knowledge is limited and precise information on significant statements about our behavior does not exist (43).

In our study, the conversion process was guided by established practices and interpretations within the fuzzy set theory literature relevant to social science data (44). The main idea is to represent the inherent imprecision and vagueness associated with ordinal scales in a way that is both meaningful and preserves the underlying order of the categories. Furthermore, other empirical studies have specifically addressed the potential impact of different conversion approaches on the robustness of results within the context of fuzzy-hybrid TOPSIS. For example, Martín et al. (45) showed that, while the specific TFN values assigned can influence the absolute scores, the relative ranking and the overall conclusions derived from the fuzzy-hybrid TOPSIS approach tend to be quite robust across a range of sensible conversion strategies.

One of the steps of TOPSIS consists of normalizing the decision matrix. This is done to ensure that all the criteria are comparable. In the current study, it would be challenging to compare ordinal scales from different time periods, such as hours in days, days in weeks, or times per month. There are a number of ways to normalize a decision matrix (46), but in the current study, this is resolved by the conversion of the ordinal scales into TFNs that belong to the universe of discourse in the range [0, 100]. The linearity between the points in an ordinal scale is also a relevant issue, that can be partly resolved by using TFNs. It is unreasonable to think that there is the same distance between never, less often than 1–3 times a month, and 1–3 times a month. Less often than 1–3 times a month can be either 1 time every two months or 2 times per term. In the case of the highest scores, it can be seen that, for example, in the first scale, 5 times per week or more would be comparable to at least 20 times per month, in comparison with the ordinal values considered as 2 and 6. This issue is known as the non-linear scaling effect (47).

Once PASI was calculated, we preferred to discretize it, as the aim of the study is not to explain physical activity but to characterize the factors that affect two main categories of individuals: those who are quite sedentary in comparison with the most active segment. Thus, the PASI distribution is categorized according to the five quintiles to estimate an ordered probit model, where y denotes the random variable whose value ranges from 1 to 5, corresponding to each quintile according to PASI values. Thus, the model uses an auxiliary latent variable y^* determined by:

$$y^* = x\beta + \varepsilon \tag{1}$$

Where x is a vector formed, in principle, by the fifteen variables explained in the data section that are included in the model as the determinant factors that affect PASI, beta is the vector of parameters to be estimated by the model, and epsilon is the error term that distributes as a standard normal distribution. The model also determines four threshold parameters $\eta_1 < \eta_2 < \eta_3 < \eta_4$, which permit to linking the observed dependent variable with the unobserved latent variable as follows:

$$\begin{aligned} y &= 1 \quad \text{if } y^* \le \eta_1 \\ y &= 2 \quad \text{if } \eta_1 < y^* \le \eta_2 \\ y &= 3 \quad \text{if } \eta_2 < y^* \le \eta_3 \\ y &= 4 \quad \text{if } \eta_3 < y^* \le \eta_4 \\ y &= 5 \quad \text{if } \eta_4 < y^* \end{aligned} \tag{2}$$

All the parameters are estimated by maximizing, as usual, the log-likelihood function, which is consistent and asymptotically normal. The probability of observing a particular outcome for $(1 \le j \le 5)$ is given by

$$\begin{aligned} P(y_i = j|x_i) &= P(\eta_{j-1} \le y_i^* \le \eta_j) \\ &= P(\eta_{j-1} - x_i\beta \le \varepsilon_i \le \eta_j - x_i\beta) \\ &= F(\eta_j - x_i\beta) - F(\eta_{j-1} - x_i\beta) \end{aligned} \tag{3}$$

Where F is the cumulative normal distribution function assumed for the error term, $\eta_0 = -\infty$, and $\eta_5 = \infty$. Then, we can write the log-likelihood function as follows:

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{5} y_{ij} \log [F(\eta_j - x_i\beta) - F(\eta_{j-1} - x_i\beta)] \tag{4}$$

The log-likelihood is maximized with respect to the parameters of the distribution function and the cut thresholds. There are various specifications of categorical variables (normalization) in choice or ordinal models. The most used is that of the dummies normalization, but other normalizations like the effects code and Daly normalization, less common in the literature, are more informative regarding the comparisons that can be made. Interested readers are referred to the following excellent references on the topic (48–50). In the current study, we decided to normalize all the categorical variables with the normalization proposed by Daly et al. (48) to address interpretation issues with respect to the average EU citizen.

5 Results

Table 1 shows the ideal solutions, the representative of each value, and the percentage variation between the positive and

negative ideal solutions. The figures and the representative values provide valuable information regarding which covariates can play a determinant role. It can be seen that most of the representative values correspond to the country covariate, so it can be easily inferred that PASI is highly affected by some cultural issues. Sterk & Bürgi (51) note that cultural environment can significantly influence physical activity patterns, confirming that country variable plays a significant role in interpreting the PASI index. The only two exceptions are presented in the negative ideal solution for the frequency of the sports activity and the time spent sitting, for which the representative values are the low-education segment and those who have refused to answer the social class self-classification question, respectively.

The last column of the table –the percentage variation between the ideal solutions figures- also provides interesting insights regarding in which indicators there is more or less heterogeneity in the sample. Thus, it can be seen that in the EU, there is more homogeneity in the time citizens spend sitting on a usual day, including time spent at a desk, visiting friends, studying, or watching television, and the number of days walking at least ten minutes in the last week. Interestingly, the representative values for the ideal solutions were seen in Spain (74.54) and Poland (43.64). On the other hand, more heterogeneity is observed in (QB2):—other physical activities such as cycling from one place to another, dancing, gardening, etc., i.e., physical activity for recreational or non-sport-related reasons, (QB4)—time spent doing a vigorous physical activity, and (QB5)—the number of days in the last 7 days, doing moderate physical activity like carrying light loads, cycling at a normal pace or doubles tennis, without including walking. Again, interestingly, the representative values for the positive ideal solution are observed in Northern countries –Latvia and the Netherlands, and Portugal was the representative value for the negative ideal solution for the three indicators. In the three cases, the percentage variation is around four hundred percent. This is concordant with the findings of Van Bottenburg (52) who found significant disparities in sport participation between different regions of the EU, with northern countries leading the physical activity levels.

Table 2 presents PASI for the total sample (EU27), and some covariates like country, age, life satisfaction, opinion on whether being a member state of the EU or not is a good thing, and the opinion on the future of the EU. The result of the EU27 was surprisingly 0.5, a value that can be used as a reference to analyze whether other segments have more or less physical activity than the average citizen in the EU. The country results determine a clear differentiation between the South (Portugal, Greece, Malta, and Italy), which, jointly with Poland, exhibits the least physical activity, and the North (Estonia, Sweden, Denmark, Finland, and the Netherlands), which exhibits the highest physical activity.

The age results also show a clear division between seniors (less physical activity) and young segments (more physical activity). Regarding life satisfaction, it can be seen that the two extremes are presented as not at all satisfied (least physical activity) and very satisfied (highest physical activity). Finally, a similar pattern is found for those who are pessimists or optimists on the future of the EU, being more physically active, the optimist group. In this regard, it is noteworthy that Mangra et al. (53) found a significant correlation between physical activity, general life satisfaction, and personal expectations about the future of the European Union. They also found that North-South and generational disparities directly influence the likelihood of adopting a more or less dynamic lifestyle.

Supplementary Table A1 reports the estimation results of the ordered probit model. It can be seen that most of the covariates are significant except for left-right political orientation and the community type, i.e., whether the citizen's household is in a city urban neighborhood, a suburb, or a rural community. These two results mean that physical activity does not depend on political orientation and the type of community in which citizens reside. This coincides with the results of Lira et al. (54) in their study on the irrelevant relationship between political orientation and possible solutions to physical inactivity. Out of these two covariates, the remaining thirteen covariates affect physical activity. The table also shows how the threshold coefficients were also significant.

Supplementary Table A2 shows the marginal effects of being in the first category of the endogenous variable, i.e., those who performed the least physical activity. The remaining marginal effects were computed and can be provided upon request. The estimated parameters offer significant insights into how variations in independent variables affect the outcomes related to physical activity levels. By analyzing these parameters, we can gain a deeper understanding of the factors that contribute to individuals becoming more or less physically active, shedding light on the complex relationships between various influences and their impact on overall activity levels.

TABLE 1 Ideal solutions.

Indicator	A^+	Representative	A^-	Representative	Perc. Variation
Sport activity—frequency	57.04	FI—Finland	14.96	Education 15-	281.3%
Physical activity—frequency	74.98	NL—The Netherlands	14.89	PT—Portugal	403.5%
Vigorous physical activity—days last week	32.98	FI—Finland	9.66	PT—Portugal	241.4%
Vigorous physical activity—how much time	43.46	LV—Latvia	9.88	PT—Portugal	339.9%
Moderate physical activity—days last week	49.02	NL—The Netherlands	9.64	PT—Portugal	408.6%
Moderate physical activity—how much time	40.48	EE—Estonia	9.97	PT—Portugal	305.9%
Walked at least 10 minutes—days last week	74.54	ES -Spain	43.64	PL—Poland	70.8%
Walked at least 10 minutes—how much time	39.22	LV—Latvia	18.18	CY—Cyprus (Republic)	115.7%
Time spent sitting—usual day	65.60	MT—Malta	43.73	Social class Refusal (SPONT.)	50.0%

TABLE 2 PASI for some covariates.

Covariate	Segment	PASI	Covariate	Segment	PASI
-	EU27	0.500	Age	Age65+	0.410
Country	PT—Portugal	0.073		AgeRefusal	0.429
	PL—Poland	0.226		Age55–64	0.462
	GR—Greece	0.239		Age45–54	0.492
	IT—Italy	0.257		Age35–44	0.518
	MT—Malta	0.262		Age25–34	0.593
	CY—Cyprus (Republic)	0.271		Age15–24	0.710
	RO—Romania	0.282	Life Satisfaction	LS Not at all satisfied	0.257
	BG—Bulgaria	0.346		LS Not very satisfied	0.329
	HU—Hungary	0.389		LS DK (SPONT.)	0.402
	ES -Spain	0.451		LS Fairly satisfied	0.486
	IE—Ireland	0.461		LS Very satisfied	0.667
	HR—Croatia	0.469	Being a member state in the EU	EU MB DK (SPONT.)	0.364
	FR—France	0.473		EU MB Neither a good thing nor a bad thing	0.421
	AT—Austria	0.511		EU MB A bad thing	0.422
	BE—Belgium	0.523		EU MB A good thing	0.545
	DE-E Germany East	0.529		EU Future DK (SPONT.)	0.334
	CZ—Czech Republic	0.566	EU future	EU Future Very pessimistic	0.406
	SK—Slovakia	0.570		EU Future Fairly pessimistic	0.439
	LT—Lithuania	0.578		EU Future Fairly optimistic	0.544
	SI—Slovenia	0.628		EU Future Very optimistic	0.555
	DE-W—Germany—West	0.630			
	LU—Luxembourg	0.656			
	LV—Latvia	0.661			
	EE—Estonia	0.674			
	SE—Sweden	0.753			
	DK—Denmark	0.754			
	FI—Finland	0.797			
	NL—The Netherlands	0.805			

Nevertheless, as our main objective was to characterize the EU citizen's profile as being sedentary, we have preferred to present only the results of the marginal effects of outcome 1. In addition, as the model contains more than one hundred coefficients, for ease of exposition, we present a table with the main drivers and barriers to being a sedentary person in the EU (Table 3).

It can be seen that the main barriers to being an EU sedentary citizen are being a citizen from the following countries: Finland, the Netherlands, Latvia, Estonia, Denmark, Sweden, Lithuania, Slovakia, Germany, Slovenia, the Czech Republic, and Luxembourg. As a general summary by country, it can be said that residing in the Northern EU makes one less likely to be a sedentary person. Other barriers are related to age, as citizens in the age groups 15–24 and 25–34 are less sedentary. Similarly, the upper classes of society –the higher and upper-middle- are also less sedentary. Education –still studying or highly educated citizens are also less sedentary than the average citizen. Citizens who are very satisfied with their lives are less sedentary, similar to citizens living in rural areas or villages, men and those who totally agree that governments must help refugees. López-Valenciano et al. (55) also found variations in sedentary lifestyles in the EU adult population between 2002 and 2017, with marked differences by age group and region. And in line with this analysis by highlighting the importance of country of residence, educational level and age as determinant and explanatory variables of physical inactivity.

On the other hand, the main drivers to be a sedentary person in the EU are characterized by being: from Portugal, Poland, Malta, Cyprus (Republic), Italy, Greece, Romania, Hungary, Ireland, Bulgaria, Belgium, or Croatia; non binary; low-educated (no full-time education, education 15, or education 16–19); no self-identified in any social class, or identified as the working class of society or the lower middle class of society; widows; respondents no knowing the EU future; not very satisfied or not at all satisfied with their lives; more than 65 years or between 55 and 64; respondents having difficulties in paying the bills most of the time; citizens living in large towns; respondents who think that in the future in the EU, the life for the next generation will be about the same; respondents tending to agree in that the government must help refugees; and women.

6 Conclusions

Growing evidence indicates that regular physical exercise helps prevent various chronic diseases and has a positive impact on the socio-economic context. Conversely, a lack of physical activity is associated with high health costs, increasing social inequality, and a declining quality of life. In this context, physical activity serves as a crucial component of public policies, necessitating multi-sectoral strategies that integrate health, urban planning, and education.

Several structural factors influence the adoption of either active or sedentary lifestyles. This conclusion is drawn from a study based on a

TABLE 3 Drivers and barriers to be a sedentary person in the EU.

Barriers			Drivers		
Variable	Marg.Eff	Disc	Variable	Marg.Eff	Disc
FI—Finland	−14.4%	***	PT—Portugal	19.2%	***
NL—The Netherlands	−10.9%	***	Non binary	17.5%	**
LV—Latvia	−10.6%	***	PL—Poland	15.5%	***
EE—Estonia	−10.4%	***	MT—Malta	14.8%	***
Age15–24	−8.8%	***	CY—Cyprus (Republic)	11.4%	***
DK—Denmark	−8.2%	***	IT—Italy	10.2%	***
SE—Sweden	−7.9%	***	Education No full-time education	10.1%	***
LT—Lithuania	−6.9%	***	GR—Greece	9.4%	***
SK—Slovakia	−6.8%	***	RO—Romania	8.2%	***
DE-W—Germany—West	−5.7%	***	Social class DK (SPONT.)	5.5%	**
SI—Slovenia	−5.4%	***	Education Don't know	5.5%	***
Social class The higher class of society	−4.6%	**	Education 15-	5.4%	***
Education Still Studying	−3.9%	***	Education Refusal	5.2%	*
DE-E Germany East	−3.9%	**	Marital Status Widow	4.7%	***
CZ—Czech Republic	−3.7%	***	HU—Hungary	4.0%	***
LU—Luxembourg	−3.4%	**	IE—Ireland	3.9%	***
LS Very satisfied	−3.1%	**	BG—Bulgaria	3.8%	***
Age25–34	−3.1%	**	EU Future DK (SPONT.)	3.7%	***
Social class The upper middle class of society	−3.1%	***	LS Not very satisfied	3.5%	***
Education 20+	−2.7%	***	Age65+	3.5%	***
Rural area or village	−1.9%	***	LS Not at all satisfied	3.1%	**
Man	−1.6%	***	BE—Belgium	2.5%	**
Help Refugees Totally agree	−1.5%	***	Social class The working class of society	2.3%	***
			Diff. Paying bills Most of the time	2.2%	***
			HR—Croatia	1.7%	*
			Large town	1.7%	***
			EU Future. Life NextGen About the same	1.4%	***
			Help Refugees Tend to agree	1.4%	***
			Woman	1.4%	***
			Social class The lower middle class of society	1.4%	***
			Age55–64	1.3%	***
			Education 16–19	1.1%	***

Discussion: *** ($p < 0.001$); ** ($p < 0.01$); * ($p < 0.05$);. ($p < 0.1$).

physical activity survey conducted among citizens in the 27 countries of the European Union. We employed a methodology that combines fuzzy logic with the multi-criteria technique known as TOPSIS to develop the Physical Activity Synthetic Indicator (PASI) index. Additionally, we estimated an ordered probit model to assess the significance of socio-demographic, educational, economic, and attitudinal variables on having a more or less sedentary life.

Confirming territorial inequalities in Europe, mainly between north-south and, to a lesser degree, east-west. A higher rate of exercise and physical activity in northern countries could be attributed to the development of infrastructure for non-motorized mobility. Southern and some Eastern European countries are more sedentary, primarily due to cultural and climatic factors, as well as a possible lack of integrated physical activity promotion strategies. Geographical gaps reflect differences in the availability of physical activity environments and reflect citizens' public policy priorities and physical activity traditions.

To analyze patterns of physical inactivity, it is relevant to consider socio-demographic variables such as age, social class, and educational level. Elderly adults are more likely to be in the lower PASI quintiles due to their functional limitations and lack of adapted exercise programs. People with lower levels of education are more likely to be sedentary due to less access to health information and more difficult employment conditions. Young people with higher education and from higher socio-economic groups tend to participate more in regular physical activities.

We also highlight the dimension of gender differences. Social care roles, domestic obligations, and difficulties reconciling work and family life may hinder regular participation in physical activities, leading to lower reporting rates. The sense of insecurity in public spaces and the limited availability of physical activities for women may also contribute to the gap, as well as cultural barriers.

The study found that life satisfaction and positive perceptions of the EU correlate positively with physical activities in the attitudinal and subjective dimensions. Physical exercise promotion campaigns, linked to optimism and collective well-being messages, can improve physical activity rates. Willingness to show solidarity, such as favoring countries helping refugees, is associated with lower levels of sedentary behavior, reflecting greater social openness and civic engagement in the greater common good.

From a public policy management perspective, we consider it necessary to design specific interventions targeted toward groups

at higher risk of inactivity: the elderly, women, people with low levels of education, children, and residents in countries or regions with poor sports and non-motorized transport infrastructures. It is also important to encourage "walkability" in cities, promote efficient public transport, and create green spaces and safe areas for outdoor activities. Health promotion strategies should integrate interdisciplinary approaches, including urban planning, education, and social protection systems. Furthermore, policies and initiatives to reduce socioeconomic inequality could positively impact participation in physical activities and sports.

Finally, it is clear that physical inactivity is conditioned by several variables in each region of the EU and is not only a matter of individual choice or personal motivation. This contribution could provide an impulse for more targeted and equitable policies to promote a sustained increase in physical activity in Europe, addressing the implications of sedentary lifestyles for public health and social well-being.

Moreover, this study confirms the validity and usefulness of the hybrid fuzzy methodology combined with TOPSIS and the ordered probit model. TOPSIS facilitates the aggregation of multiple items into a synthetic indicator. The fuzzy logic mitigates the problems arising from the ordinal and subjective nature of the questionnaire questions. Identifying which covariates show statistically significant associations with the probability of belonging to a lower or higher activity stratum enables better evidence-based decision-making by providing a comprehensive understanding of the determinants of physical activity.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

JM: Methodology, Software, Writing – original draft, Writing – review & editing. PM: Investigation, Methodology, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fspor.2025.1582658/full#supplementary-material

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