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Global index of lifestyle quality and non-suicidal self-injury in the SESSAMO project: a Spanish adolescents cohort

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Abstract

Adolescents' failure to embrace healthy lifestyles constitutes a serious public health issue, such that its relationship to non-suicidal self-injury (NSSI) merits further research. The aim of the study was to ascertain the association between a Global Index of Lifestyle Quality (GILQ) and the presence of NSSI. Cross-sectional analysis of a sample of 2nd- to 4th-year ESO students (Obligatory Secondary Education, from ages 14 to 16) recruited for the SESSAMO project, a multicenter prospective cohort study. Exposure variables were collected, including eating patterns, physical activity, screen use, the consumption of cannabis, alcohol and tobacco, risky sexual behavior, gambling, spend time with friends, and sleep quality. To determine the presence of NSSI, a validated questionnaire was administered. The association between different lifestyles and the presence of NSSI was analyzed through multivariate logistic regression models. 2042 adolescents were included. Physical activity, screen use, risky sexual behavior, sleep quality, and daytime sleepiness showed inverse and statistically significant associations with the presence of NSSI in multivariate models. A higher lifestyle score was associated with a 71% reduction in the likelihood of engaging in NSSI (OR for extreme quartiles of GILQ adherence =0.29; 95% CI = 0.15–0.57). The result was similar when boys and girls were analyzed separately. A healthy lifestyle was inversely associated with the presence of NSSI in this sample of Spanish adolescents. Lifestyles could function as potential predictors of NSSI.

Introduction

Adolescence is a critical period in which physical, cognitive, emotional and social changes occur. Moreover, behavior patterns and lifestyles in this period could affect young people's future health and well-being [1]. Healthy behaviors have been established as protective factors in mental disorders prevention in adolescence [2].

Non-suicidal self-injury (NSSI) has been defined as the deliberate, self-inflicted destruction of bodily tissue resulting in immediate damage, for purposes not culturally sanctioned, and without suicidal intent [3]. It includes different patterns, such as cutting or burning one's skin, hitting, scratching, banging one's head, pulling one's hair, or punching objects. Its prevalence in the general population is 17.7% (21.4% among girls and 13.7% among boys) for adolescents aged 10–19 in different countries in North America, Asia, Australia, and Europe. In clinical samples the ratio can rise to 40%–60% [4]. The main reason for this behavior is to vent overwhelming negative emotions [5]. Although they are usually characterized by their low lethality, they are associated with worse psychosocial functioning. In addition, if they are repetitive and early-onset, before the age of 13, they can be predictors of suicide attempts, and even suicide and other mental health problems [6].

Research linking lifestyles to NSSI is recent. Some systematic reviews identify as risk factors, among others, sleep disturbances, problematic use of the Internet, mobile phones, or screens, in general; as well as the consumption of tobacco, alcohol, and other substances [7–9], but these have not been analyzed independently.

Identifying modifiable risk factors may be essential for NSSI prevention and intervention. Our objective was to analyze the association between lifestyle habits, such as diet patterns, physical activity, screen use, consumption of alcohol, tobacco and cannabis, risky sexual behaviors, gambling, spending time with friends, sleep quality and the presence of NSSI; and to develop a Global Index of Lifestyle Quality (GILQ) yielding a better understanding of the association between global lifestyle patterns and the presence of NSSI.

Methods

Study participants

The SESSAMO (follow-up of secondary school students to assess mental health and obesity) project is a prospective, multicenter cohort study which aim is to associate the lifestyles and bullying,

impact of stress and adverse experiences of Spanish adolescents aged 14–16 with their mental and physical health. Baseline information was collected at school through an *ad hoc* digital platform, as described elsewhere [10].

All 2nd- to 4th-year ESO (Obligatory Secondary Education) students, from public and charter schools in three Spanish regions were invited to participate. Participation was voluntary, and all students and their parents or legal guardians received a study information sheet and individual informed consent forms. The minor's assent was also obtained. A total of 58 schools participated (60.3% public, 39.7% charter), enrolling 2060 students. Eleven students were excluded due to incomplete questionnaires, resulting in a final sample of 2049 students, of whom 92.9% were Spanish, and the remaining were primarily from Latin American countries.

The SESSAMO project was conducted in accordance with Spanish regulations regarding confidentiality and data management (Organic Law 3/2018 on the Protection of Personal Data and Digital Rights). Moreover, the Research Ethics Committees from each recruitment center approved the protocol: Hospital Dr Negrín Canarias, PI_2019-478-1; Navarre Department of Health, PI_2020-132; and Basque Department of Health, PI_2021/124.

Exposure variables

As exposure variables, the participant's different lifestyles were analyzed individually, and subsequently grouped on the GILQ.

Diet quality

Diet was collected through a consumption frequency questionnaire previously validated in Spain in an adolescent population [11]. Frequency of consumption of healthy foods groups (legumes, fruits, vegetables, nuts, and fish) and unhealthy ones (sweets, sauces, and processed products) was calculated. A diet quality index was created with a scale ranging from 0 to 8. Participants consuming healthy products above the sample's median (P50) received 1 point, as did participants with consumption below the sample's median for unhealthy products. The tertiles of this dietary quality index were then calculated.

Physical activity

Frequency of physical activity in leisure time was measured employing a questionnaire validated in Spain, the Physical Activity Questionnaire for Adolescents [12]. The weekly frequency of up to 22 different activities was calculated, determining the total frequency of weekly physical activity, which was subsequently categorized into tertiles.

Leisure time and the consumption of alcohol, tobacco, and cannabis

The evaluation of different activities (screen use, going out with friends, gambling) and toxic habits (tobacco, alcohol, cannabis) was carried out following the ESTUDES survey (National Drug Plan of the Health Ministry in Spain 2021) [13]. Screen use included the frequency and amount of time spent using 4 types of apps: social media, video games, the Internet, and WhatsApp. The usage (frequency and amount of time per connection) of each of these applications was divided into 3 categories: Low (2 points), Moderate (1 point), and High (0 points). A global screen usage index was calculated considering the 4 applications; therefore, this index could range from 0 to 8 points. The overall screen usage index was categorized into tertiles. Any participant who reported spending time with friends at least once a week was considered a participant who socialized with friends.

A participant was considered as a gambler if the/she answered in the affirmative to either of the two gambling questions included on the ESTUDES questionnaire: online and offline gambling (slot machines, lotteries, casino games, bingo, sports betting) at least once a week. Tobacco and cannabis consumption in the last 30 days was calculated (no/yes), as well as the presence of any drunkenness during this period (no/yes).

Risky sexual behavior

Risky sexual behavior data was ascertained through the 2019 Middle School Youth Risk Behavior Survey. Having sexual intercourse under the influence of alcohol or drugs, or without adequate prophylactic measures, was defined as risky sexual behavior.

Sleep quality

Sleep quality was assessed using the 19-item Pittsburgh Sleep Quality Index [14]. Daily sleep hours were categorized into 2 groups, between 8 and 9 hours/day and <8 hours/day or >9 hours/day. The questionnaire also analyzes the self-reported quality of sleep (Very High, High, Low, Very Low). Presence of sleepiness was assessed through 2 questions included in this scale: "*In the last month, how often have you had trouble staying awake while studying, eating or participating in social activities (≥1 time/week)?*" and, "*Have you found it difficult to maintain enough enthusiasm to finish things? Has this been a considerable or a very big problem?*"

All the variables mentioned made up the GILQ are shown in Table S1. This index was categorized into quartiles. On this index, the higher the score, the healthier the lifestyle.

Outcome variable: the presence of non-suicidal self-injury

The presence of NSSI was evaluated through a specific module included in the Self-Injurious Thoughts and Behaviors Interview validated in Spanish adolescents [15] through the following question: "*Sometimes people self-harm or hurt themselves without wanting to end their life. In the past year, have you ever self-harmed?.*"

Other covariables

Sociodemographic variables

Biological sex (male, female), type of school (secular, religious), parents' educational level (primary, secondary, university), and cohabitation situation (living with both parents, living with both parents alternately, single-parent family, living with another family member, living at an institutional center) were collected.

Bullying, impact of stress, and adverse experiences

Bullying and cyberbullying were evaluated using the Olweus Bully Victim Questionnaires instrument [16], and impact of stress and parents' adverse experiences were assessed using the Stressful Life Events Inventory [17], and the Inventory of Adverse Childhood Experiences [18], respectively.

Mental health problems

The presence of symptoms of depression was recorded with the Depression, Anxiety and Stress scale [19].

As a quality control mechanism, the 10-item Oviedo Response Infrequency Scale was administered to detect participants who responded randomly [20]. Those who had errant scores on two or more items were eliminated in the sensitivity analysis.

Statistical analysis

A sample size of 1708 participants was estimated to detect a minimum difference of 5% in the prevalence of NSSI (OR = 1.25) across extreme levels of each exposure variables, with a statistical power of 90% and a significance level of 0.05.

Logistic regression models were fitted to assess the relationship between each component of the lifestyle quality index and the GILQ, and NSSI. Odds Ratios (OR) and their 95% CI were calculated

considering the lowest level of the GILQ as the reference category. Moreover, the GILQ was also analyzed as a continuous variable to assess linear associations.

To avoid the presence of confounding factors, models were adjusted for sex, type of school, impact of stressful events, presence of bullying or cyberbullying, parents' psychological abuse, and parents' physical abuse. The results were also adjusted for the score in depressive symptoms to assess the mediating effect of depression on the associations. The adjustment for other variables, such as the parents' educational level, cohabitation type, the presence of neglect, or difficulties being suffered by parents did not change the results, thus, they were not included in the final models.

Results

Sample characteristics

The study included 2042 adolescents aged 14–16. Two hundred and seventy-six reported NSSI (13.5%). Table 1 presents the distribution of the main sociodemographic characteristics and bullying, impact of stress and parents' adverse experiences according to the GILQ, categorized into quartiles. The adolescents with the best lifestyles were preferably boys who lived with both their parents. Conversely, those adolescents with the worst lifestyles were more likely to have reported suffering bullying, very high impact of stressful events, and parental psychological abuse.

Association of each component of the GILQ and the NSSI

The results of the association of each of the lifestyle variables and the presence of NSSI are shown in Table 2. Inverse and statistically significant associations were observed for physical activity, less screen use, no risky sexual behavior, sleep quality, and lack of daytime sleepiness in the multivariate models adjusted for possible confounding factors. Those more physically active participants were 35% less likely to present NSSI compared to those more sedentary. Less screen use was associated with a reduction in NSSI odds (OR = 0.60; 95% CI = 0.41–0.87) compared to those with higher use. Participants with no risky sexual behaviors were 45% less likely to present NSSI compared to those with this behavior. Participants with good sleep quality were less likely (OR = 0.48; 95% CI = 0.34–0.69) to commit NSSI compared to those with poorer sleep quality. Regarding daytime sleepiness, the risk reduction was 48% for those who did not report it compared to those who did.

Association between the GILQ and the NSSI

Table 3 shows the results for the association between the GILQ and the presence of NSSI. Participants with the best lifestyles were 82% less likely to inflict NSSI compared to adolescents with the worst lifestyles (OR between extreme quartiles of the GILQ =0.18; 95% CI = 0.09–0.34). When the results were adjusted for the presence of depression, the results were moderated but remained statistically significant (OR = 0.29; 95% CI = 0.15–0.57). In addition, a dose-response relationship was observed. For each additional point on the GILQ the odds of presenting NSSI decreased by 21% in the multivariate analysis (OR = 0.79; 95% CI= 0.74–0.85) and by 14% when the results were further adjusted for the presence of depressive symptomatology (OR = 0.86; 95% CI = 0.80–0.93).

Analysis by sex

The results differentiated by sex are shown in Table 4. The association between GILQ and the presence of NSSI was similar in both sexes. The results were partially attenuated by including the presence of depressive symptomatology in the model, although they remained, as in the main analysis, statistically significant.

Table 1. Distribution of the baseline characteristics of the sample according to the GILQ

	GILQ: range 0–15			
	Lowest quartile Median: 8 (*n* = 382)	**Second quartile Median: 10 (*n* = 574)**	**Third quartile Median: 11 (*n* = 648)**	**Highest quartile Median: 13 (*n* = 438)**
Sociodemographic variables				
Girls (%)	70.9	63.1	50.8	37.0
Participant lives with (%)				
Both parents	64.7	69.9	73.9	82.6
Both parents alternatively	22.0	19.9	16.0	13.7
Single-parent family	11.3	8.2	8.2	3.4
With another family member or at a welfare center	2.1	2.1	1.9	0.2
Mother's educational level (%)				
Low	19.1	15.2	13.7	8.7
Moderate	57.9	62.2	68.5	76.3
High	23.0	22.6	17.7	15.1
Father's educational level (%)				
Low	25.4	19.7	17.6	16.9
Moderate	43.5	55.2	60.8	65.3
High	31.2	25.1	21.6	17.8
Religious school (%)	31.4	34.1	38	40.2
Stress factors				
Victim of bullying (%)	19.4	12.7	10.3	6.6
Impact of stressful events (%)				
Low	8.4	21.1	28.1	40.4
Moderate	15.2	25.3	26.1	29.2
High	32.2	24.2	25.9	21.5
Very high	44.2	29.4	19.9	8.9
Parents' adverse experiences				
Parents' psychological abuse (%)	38.5	21.4	16.0	9.1
Parents' physical abuse (%)	21.7	11.7	8.3	5.9
Parents' negligence (%)	9.4	4.7	2.2	0.7
Parents' difficulties[a] (%)[a]	13.4	4.5	4.6	2.1

a: Mental health or drug-abuse related problems.

Table 2. Association between each component of the GILQ and NSSI

	Cases/*N*	Sex-adjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)
Diet quality				
First tertile (0 point)	107/734	1 (ref.)	1 (ref.)	1 (ref.)
Second tertile (1 point)	63/452	0.99 (0.70–1.39)	0.99 (0.68–1.44)	1.06 (0.72–1.56)
Third tertile (2 points)	106/856	0.88 (0.65–1.18)	0.92 (0.67–1.26)	1.08 (0.77–1.53)
Frequency of physical activity				
First tertile (0 point)	102/651	1 (ref.)	1 (ref.)	1 (ref.)
Second tertile (1 point)	105/709	1.05 (0.77–1.42)	1.17 (0.84–1.62)	1.18 (0.83–1.68)
Third tertile (2 points)	69/682	0.82 (0.58–1.15)	0.65 (0.45–0.95)	0.65 (0.44–0.96)
Screen use				
High (0 point)	147/741	1 (ref.)	1 (ref.)	1 (ref.)
Medium (1 point)	65/522	0.56 (0.41–0.78)	0.72 (0.51–1.03)	0.82 (0.57–1.19)
Low (2 points)	64/779	0.38 (0.28–0.52)	0.52 (0.37–0.74)	0.60 (0.41–0.87)
Cannabis use in the last month				
Yes (0 points)	14/33	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	262/2009	0.20 (0.10–0.42)	0.46 (0.20–1.06)	1.08 (0.40–2.96)
Tobacco use in the last month				
Yes (0 points)	36/96	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	240/1946	0.26 (0.17–0.41)	0.45 (0.28–0.74)	0.55 (0.29–1.02)
Drunkenness in the last month				
Yes (0 points)	36/180	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	240/1862	0.61 (0.41–0.91)	0.75 (0.48–1.16)	1.04 (0.63–1.70)
Risky sexual behavior				
Yes (0 points)	33/90	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	243/1952	0.27 (0.17–0.43)	0.47 (0.28–0.77)	0.55 (0.32–0.94)
Gambling ≥1 time/week				
Yes (0 points)	4/18	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	272/2024	0.30 (0.09–0.99)	0.75 (0.21–2.65)	0.68 (0.18–2.59)
Spend time with friends ≥1 time/week				
No (0 point)	113/766	1 (ref.)	1 (ref.)	1 (ref.)
Yes (1 point)	163/1276	0.81 (0.62–1.06)	0.92 (0.69–1.23)	0.96 (0.70–1.30)
Hours of sleep				
<8 h/d or >9 h/d (0 point)	208/1048	1 (ref.)	1 (ref.)	1 (ref.)
8–9 h/d (1 point)	68/994	0.35 (0.26–0.47)	0.57 (0.42–0.79)	0.80 (0.57–1.12)
Sleep quality				
Low or very low (0 point)	112/279	1 (ref.)	1 (ref.)	1 (ref.)
High or very high (1 point)	164/1763	0.19 (0.14–0.25)	0.37 (0.27–0.52)	0.48 (0.34–0.69)
Sleepiness during the day				
Yes (0 points)	177/587	1 (ref.)	1 (ref.)	1 (ref.)
No (1 point)	99/1455	0.20 (0.15–0.27)	0.40 (0.29–0.54)	0.52 (0.38–0.72)

a: Model 1. Adjusted for sex, type of school (secular/religious), the impact of stressful events, the presence of bullying or cyberbullying, and psychological abuse or physical abuse by parents.
b: Model 2. Adjusted for the score in depressive symptoms.

Table 3. Association between each component of the GILQ and NSSI

	Cases/*N*	Sex-adjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)
GILQ				
Lowest quartile	121/382	1 (ref.)	1 (ref.)	1 (ref.)
Second quartile	81/574	0.37 (0.27–0.51)	0.49 (0.35–0.70)	0.54 (0.37–0.79)
Third quartile	62/648	0.27 (0.19–0.38)	0.43 (0.29–0.62)	0.62 (0.42–0.93)
Highest quartile	12/438	0.08 (0.04—0.15)	0.18 (0.09–0.34)	0.29 (0.15–0.57)
+1 point increment		0.70 (0.66–0.75)	0.79 (0.74–0.85)	0.86 (0.80–0.93)

a: Model 1. Adjusted for sex, type of school (secular/religious), the impact of stressful events, the presence of bullying or cyberbullying, and psychological abuse or physical abuse by parents.
b: Model 2. Adjusted for the score in depressive symptoms.

Sensitivity analyses

Sensitivity analyses were performed to examine the robustness of the results of the main analyses. When the participants with the Oviedo Scale <8 ($n = 90$) were eliminated, the results did not vary. The OR for the extreme quartile of the GILQ was 0.29 (95% CI = 0.15–0.56). When subjects of undefined sexual identity ($n = 7$) were included in the analysis, the results also remained similar (OR for extreme quartiles of GILQ = 0.28; 95% CI = 0.14–0.54).

Discussion

This cross-sectional study, carried out with adolescents from three Spanish regions, concludes that regular physical activity, higher-quality sleep, and the absence of daytime sleepiness, no risky sexual behavior, and limited use of screens are inversely associated with the presence of NSSI. Although some epidemiological studies have already established the clustering of lifestyles in adolescents that could have synergistic or antagonistic effects on various health

Table 4. Association between the GILQ and NSSI in boys and girls

	Cases/*N*	Crude OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)
BOYS (*n* = 918)				
GILQ				
Lowest quartile	23/111	1 (ref.)	1 (ref.)	1 (ref.)
Second quartile	12/212	0.23 (0.11–0.48)	0.30 (0.13–0.66)	0.30 (0.13–0.71)
Third quartile	10/319	0.12 (0.06–0.27)	0.17 (0.08–0.40)	0.25 (0.11–0.60)
Highest quartile	6/276	0.08 (0.03–0.22)	0.18 (0.07–0.48)	0.26 (0.09–0.73)
+1 point increment		0.63 (0.55–0.72)	0.71 (0.62–0.82)	0.77 (0.66–0.89)
GIRLS (*n* = 1124)				
GILQ				
Lowest quartile	98/271	1 (ref.)	1 (ref.)	1 (ref.)
Second quartile	69/362	0.42 (0.29–0.59)	0.55 (0.37–0.81)	0.61 (0.40–0.93)
Third quartile	52/329	0.33 (0.22–0.49)	0.54 (0.35–0.82)	0.80 (0.51–1.27)
Highest quartile	6/162	0.07 (0.03–0.16)	0.15 (0.06–0.35)	0.25 (0.10–0.63)
+1 point increment		0.73 (0.68–0.78)	0.82 (0.76–0.89)	0.90 (0.83–0.98)

a: Model 1. Adjusted for sex, type of school (secular/religious), the impact of stressful events, the presence of bullying or cyberbullying, and psychological abuse or physical abuse by parents.
b: Model 2. Adjusted for the score in depressive symptoms.

outcomes [21], to our knowledge this is the first time that a global lifestyle index has been explored with NSSI.

The recommendations of the WHO and scientific associations to perform 60 minutes/day of moderate-vigorous physical activity, and sleep between 8 and 10 hours, are not followed by many adolescents [2]. It is known that the passage from childhood to adolescence usually leads to more sedentary lifestyles and a reduction in sleep hours [22], and that screen time can result in increases in sedentary behavior and decreases in sleep time [1].

In this analysis, physically active adolescents were significantly less likely to present NSSI, yielded comparable results with a longitudinal study [23] and with a recent cross-sectional study of a representative sample of Chinese adolescents [24]. One explanation may be that activity contributes to the regulation of stress and emotions through psychological and physiological mechanisms. At the psychological level, a greater degree of physical activity is related to an improvement in self-esteem and self-control, as well as an opportunity to interact in participatory activities [25]. Physiologically, it modulates stress hormones and increases endorphins, improving moods and reducing pain, which could contribute to the decrease in NSSI [26].

Our findings indicate a 52% reduction in the odds of NSSI in participants who reported good sleep quality, or who did not suffer from daytime sleepiness, in line with a previous review that associated sleep disturbances—such as interrupted sleep, low-quality sleep, or insomnia—with the presence of NSSI [27]. However, longitudinal studies present contradictory results. Whereas some of them did not find significant associations during the follow-up [28, 29], others found that decreased sleep hours are associated with an increased risk of NSSI [22], and that poor sleep predicts NSSI in girls [30]. The reasons for this possible relationship are not clear and could be mediated by multiple factors, such as brain changes in the prefrontal cortex, greater reactivity to stress, or changes in circadian rhythm and chronotype [27]. Sleep deprivation in adolescents has a negative impact on attention, impulse control, as well as lower frustration tolerance and a degraded ability to cope with stress, and can contribute to NSSI [24]. Sleep disturbances are known to be a risk factor for emotional dysregulation, and a majority of adolescents who suffer NSSI are struggling to regulate intense emotions, so it is hypothesized that emotional dysregulation mediates the relationship between sleep disturbances and NSSI [31].

In line with more impulsive behavior and lower risk perception, this work has found an association between risky sexual behavior and NSSI. Other studies suggest that the two behaviors overlap and fulfill similar functions, such as alleviating feeling of emptiness, regulating negative emotions, and seeking self-punishment, but also that they feature a social function, allowing young people to feel part of a group, or to get reactions from others, even they are negative [32].

In this analysis, adolescents with less screen use were 40% less likely to engage in NSSI. Adolescents' use of the Internet has generated a substantial change in their lifestyles and in the way they communicate [33]. There are authors who report that the number of hours during which adolescents use mobiles is not highly relevant [34], while the specific stressors they experience, and the patterns of behavior in which they participate online are [35]. Online images play an important role in self-harm rituals, and certain adolescents might search harmful content to learn new self-harming practices. They ultimately normalize NSSI via social reinforcement, exchanging techniques and even engage in competition [36]. Therefore, it must be taken into account that those adolescents who are more vulnerable will be more exposed to harmful effects, hindering their self-regulation and normalizing pathological behaviors [33]. Due to the increase in images and content in recent years, the security of digital platforms is a cause for concern, making it necessary to develop protection policies aimed at adolescents [37].

In our study, no associations were found between alcohol or cannabis use and the presence of NSSI, and a marginally significant association was found with tobacco. The association between tobacco and alcohol use has been previously suggested in cross-sectional studies [24]. A recent systematic review with meta-analysis of longitudinal studies showed a statistically significant increased risk of NSSI with regular smoking, alcohol use an early cannabis use and concluded that these substances may act as a risk factor in adolescents [38], suggesting that they share similar psychological processes and that substance use may be a coping mechanism to avoid negative emotions, with this favoring habituation to self-harm [5]. The results of our study may be due to the small number of participants who reported the consumption of alcohol, tobacco and cannabis in this sample. This low percentage could be a consequence of the presence of a non-differential social desirability information bias. The consequence of this bias is to underestimate the true effect on NSSI of the exposure studied.

The association between healthier lifestyles and NSSI (highest GILQ score) was moderated when depression was considered, but the reduction remained 71%, which may indicate that the presence of depression could explain, in part, the relationship observed between GILQ and the presence of NSSI. In fact, a longitudinal study suggested that NSSIs predicted increases in depressive symptoms, hopelessness, and emotional dysregulation, underscoring important bidirectional associations between NSSIs and risk factors throughout adolescence [39]. Other studies have also concluded that depression

and NSSI are concomitant and characterized by common factors [23].

Our results are consistent with other studies that have already found that the likelihood of suffering from mental health problems increases with the number of unhealthy behaviors in which one engages [2]. A study conducted with a large-scale school survey concluded that the cumulative effect of more than five unhealthy behaviors out of the seven it analyzed, and a high-risk lifestyle score, entailed a higher likelihood of NSSI [24]. Our study has incorporated twelve behaviors into the GILQ highlighting the co-occurrence of different lifestyles and health outcomes.

Our data revealed that the magnitude of the association between GILQ and the presence of NSSI was similar in both sexes. That is, sex did not function as a modifier of the effect of the association between lifestyles and the presence of NSSI. If we consider that lifestyles could be risk markers for NSSI, their predictive capacity would be similar in boys and girls. It would have been desirable to analyze those participants who reported being non-binary, but the number of subjects was insufficient.

Strengths and limitations

As a main strength, the novel contribution of a 12-item GILQ in the adolescent population stands out, which makes it possible to group lifestyles in clusters and not only analyze individual factors. Another strength is that all the instruments used in the evaluation are validated in the adolescent population. Extensive information has been collected on possible factors that could distort the associations analyzed by including these variables in multivariate models. This study has several limitations that may affect the generalization of its conclusions. First, it is a cross-sectional study, such that we cannot talk about causality. Second, although participants from different types of schools and from three regions have been included, the sample is not representative. Third, the use of self-reported questionnaires can lead to participants not responding accurately, as they may underreport or overreport behaviors that are stigmatized. To address this, project personnel were available in the classroom during the baseline evaluation to answer questions and assist the students. In addition, a sensitivity analysis was performed using the Oviedo Scale, and participants who answered randomly were eliminated. Even so, the presence of a social desirability bias cannot be ruled out, a consequence of which is that the estimates calculated tend to be null (OR = 1), such that some associations observed are probably greater in magnitude than those cited in this work.

Conclusion

Some unhealthy lifestyles were associated with NSSI, regardless of self-reported depressive symptomatology in this sample of Spanish adolescents. Unhealthy behaviors, such as limited physical activity, poor sleep quality and daytime sleepiness, risky sexual behavior, and excessive screen use could be predictors or risk indicators of NSSI in the adolescent population. Adolescent health policies should include the assessment of lifestyles as markers of NSSI risk.

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Author contributions

The study was conceived by Almudena Sánchez-Villegas and Adriana Goñi-Sarriés. Formal analyses were carried out by Almudena Sánchez-Villegas. The original draft manuscript was written by Adriana Goñi-Sarriés and Almudena Sánchez-Villegas and revised with substantial text contribution from Leticia Morata-Sampaio, Guillermo Pírez, Azucena Díez-Suárez, and Iñaki Zorrilla. All authors reviewed the manuscript and approved of its final version.

Supplementary data

Supplementary data are available at *EURPUB* online.

Conflicts of interest: The authors declare that they have no conflicts of interest to disclose.

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

Key points

- Adolescents' failure to embrace healthy lifestyles constitutes a serious public health issue, such its relationship to NSSI merits further research.
- Some unhealthy lifestyles were associated with NSSI, regardless of self-reported depressive symptomatology.
- A limited physical activity, poor sleep quality and daytime sleepiness, risky sexual behavior, and excessive screen use could be risk indicators of NSSI in the adolescent population.
- Adolescent health policies should include the assessment of lifestyles as markers of NSSI risk.

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