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A FUZZY SEGMENTATION STUDY OF GASTRONOMICAL EXPERIENCE

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Abstract

Gastronomy is an essential component of cultural heritage for tourists. Culinary pleasures become motivations that determine the choice of destination and, at the same time, an essential variable for the composition of tourist satisfaction in the travelling experience. The aim of the study is to analyze the gastronomic experiences of the foreign visitors (tourists and excursionists) who visit Córdoba, a remarkable World Heritage Site of Spain, through a fuzzy clustering segmentation method. The results of this research highlight the existence of three tourist segments named as *foodies*, *non-foodies* and intermediaries on the basis of their perceptions regarding the gastronomic experiences of the city. We conclude that the previous knowledge of local dishes such as Salmorejo, Rabo de Toro y Flamenquín is one of the main determinants to have a higher probability to belong to the ‘foodies’ segment, meanwhile the lack of knowledge also increases the probability to belong ‘the no-foodies’ segment. Interesting insights for policy makers, destination marketers and restaurateurs are discussed.

Keywords

Fuzzy logic, TOPSIS, gastronomy, gastronomic satisfaction, Córdoba, fuzzy segmentation.

1. Introduction

The value that specifies the gastronomy of a place can range from purely physiological aspects, derived from the need that every individual has to feed oneself, whether a tourist or not, to considering it as a privileged form of understanding the ancestral customs of a destination, its history or its social relationships. In this sense, it

is necessary to identify the different segments of tourists according to their interrelationship with the gastronomy of the place visited and, therefore, discover their motivations and perceptions in relation to this variable of attraction and tourist loyalty (Hjalager, 2004; Pesonen *et al.*, 2011; López-Guzmán *et al.*, 2017). As a result, there is a wide range of possibilities that determine the gastronomic experience, from a purely auxiliary and logistical sustenance of the journey to becoming a key factor for the composition of the traveller's tourist experience and, even, being the determining factor of the choice of the destination (Basil and Basil, 2009; López-Guzmán *et al.*, 2017; Correia *et al.*, 2019).

Balderas-Cejudo *et al.* (2019) sustain that food and tourism are two industries with important synergies that have been under researched in the analysis of hospitality, destination marketing, and tourism development. They conclude that gastronomic tourism as an academic field of study is still in its infancy, and it is only recently when the interest in studying how satisfaction is affected by some socio-demographic variables in this niche market is receiving more attention. In the authors' words, "researchers have previously assumed that they all tourists experience gastronomic tourism in similar ways. As a result, little research has been found in the tourism literature (p.1)". Thus, there exists a number of gaps to fill in the field and our analysis is mainly focused on the niche of gastronomic international tourists and excursionists who experience a foreign culinary culture and may have very different food preferences.

Segmentation analysis and the methods used have generated an intense debate in marketing and tourism literature (D'Urso *et al.*, 2016; Dolnicar. 2002; Dolnicar and Lazarevski, 2009). According to Dolnicar and Lazarevski (2009), one of the more problematic areas of the segmentation analysis resides in the large proportion of managers (60%) who see the methods as 'black-boxes' whose results are not easily transferred into managerial practices. D'Urso *et al.* (2016) point out also that the majority of scales are based on semantic or Likert answer formats which by nature are subjective and imprecise. For this reason, the authors propose fuzzy clustering techniques as the best approach to segment 'postmodern' tourists. The main difference that exists with other classical cluster techniques is that tourists are not forced to belong exclusively to one cluster and more realistic and flexible segments are obtained.

The literature of gastronomic tourist segmentation is divided into three different groups: analysis of the tourist destinations (Kivela and Crofts, 2005; McKercher *et al.*, 2008; López-Guzmán *et al.*, 2017; Medina-Viruel *et al.*, 2019), the study of gastronomic festivals (Kim, Ducan and Chang, 2015, López-Guzmán *et al.*, 2017) and the analysis of gastronomic markets (Crespi-Vallbona *et al.*, 2019; Pérez-Gálvez *et al.*, 2020). Our study belongs to the first group as it aims adopting a fuzzy clustering method to segment Córdoba visitors according to the gastronomic satisfaction experienced. The fuzzy clustering method is based on D'Urso *et al.* (2016). Thus, we first transform the segmentation variables into fuzzy triangular numbers (FTNs). Secondly, we adopt a fuzzy clustering method to obtain the segments. And, finally, each visitor is characterized by the fuzzy membership function and the fuzzy prototypes of each cluster.

The current study contributes significantly to the gastronomic segmentation literature using a novel approach based on fuzzy clustering method applied to a satisfaction scale and provides valuable insights to tourism providers and marketers in order to better understand the gastronomic satisfaction in Córdoba. Córdoba is one of the most paradigmatic destinations in which gastronomy tourism can be studied, as gastronomy can only complement the rest of world known cultural attributes of Córdoba such as the Mosque-Cathedral, the Judería or the jasmine patios. The originality and contribution of the current research is summarized as follows: (1) the gastronomic satisfaction in Córdoba is analyzed with a fuzzy hybrid method applied to a gastronomic satisfaction scale of eight attributes; (2) A fuzzy segmentation analysis is applied in order to better distinguish the food preferences of tourists and excursionists; and (3) we distilled important policy implications for tourism providers and marketers in Córdoba in order to develop strategies that reinforce the competitiveness position of the city.

The remainder of the paper is organized as follows: Section 2 provides the literature review. Section 3 describes briefly the area of the study and the questionnaire. Section 4 presents the methodology. Section 5 analyzes and discusses the results. And finally, section 6 concludes.

2. Theoretical framework and literature review

2.1 Gastronomical tourism

Hall *et al.* (2003) describe gastronomic tourism as visiting primary or secondary food producers, gastronomic festivals, restaurants and other places to consume, taste and/or have gastronomic experiences with local or regional products. There are two perspectives in order to define the concept of gastronomic tourism (Ellis *et al.*, 2018). The first one is focused on the analysis of the tourist and addresses the study of tourist activity and their motivation. The second perspective of gastronomic tourism is focused on the destination itself and analyses four different matters: the different types of tourism, the resources in the destination, the tourist products and the promotion of the destination on the basis of gastronomy.

On the other hand, there are five topics that restrict the study of gastronomic tourism, (Ellis *et al.*, 2018): motivation, authenticity, culture, management and marketing, and destination. The first of the concepts that restricts gastronomic tourism is motivation, where aspects such as experience or matters related to health are addressed (Kim *et al.*, 2013). The second one refers to authenticity, a basic aspect for the development of the gastronomy of a place and a driving force for the promotion of tourism (Gupta and Sajani, 2019). Thirdly, the relationship between culinary processes and culture is analysed and, accordingly, gastronomy is highlighted as a part of the cultural heritage of the local community (López-Guzmán *et al.*, 2018). In fourth place, it is necessary to refer to how the management and the marketing of the place are conducted, studying basic aspects such as the consumer's behaviour; and, in fifth place, the study of the relationship that exists between a specific destination and gastronomy.

Nevertheless, more recently, Sthapit et al. (2019) extend the analysis of gastronomical tourism with a new model that includes memorable local food experiences. The authors contend that 'memorable tourist experience' (MTE) scale is controversial because local cultural dimension is usually restricted only to social interaction with local people, and the role of local food is lacked and neglected.

2.2 Service quality and satisfaction

The competitiveness that is currently taking place among the different tourist destinations specifies the need to add cultural and authentic aspects in the face of the traditional standardisation that the sector has had. Due to this, the appropriate management of a destination, and its differentiation, cannot be solely based on a general offer of resources given that the tourist of the 21st century shall have greater satisfaction with the destination if this provides an attractive tourist offer that responds to the experience that this tourist demands (Cracolici *et al.*, 2008). Accordingly, the research related to tourist satisfaction with local gastronomy is analysed by means of a double cognitive-affective component, representing loyalty towards this destination as a variable consequence of the satisfaction achieved. And, for this, the local gastronomy conforms as an important ally for the development of unique and unforgettable experiences (Haven-Tang and Jones, 2005).

Babolian (2016) concludes that tourist satisfaction with the gastronomy of the destination is conditioned by the cultural wealth that comes from these culinary processes, and from the healthy nature of the products used in their creation, normally coming from the local producers themselves. In any case, gastronomic satisfaction is also influenced by flavour (Crespi-Vallbona and Domínguez Pérez, 2016), many times derived from preparations of ancestral recipes that are an integral part of the cultural heritage of the inhabitants of the destination itself. These suggest unique and distinct experiences to those that the traveller enjoys in their place of origin. Thus, in this way, gastronomic experiences become a determining factor of the traveller's satisfaction (Babolian, 2016).

Definitively, the local gastronomy may be a determining factor in the composition of the tourist's satisfaction with the destination (Björk and Kauppinen-Räsänen, 2016; López-Guzmán, *et al.*, 2017), relating constructs of first magnitude such as experience, motivation or satisfaction.

2.3. Segmentation of gastro-tourists

The segmentation of the tourists who visit a specific tourist destination is a basic element in order to develop an appropriate management of the place on behalf of the private businesses and the public managers, and, at the same time, this segmentation may enable the development of specific tourist products that manage to satisfy the different needs that each one of the groups obtained has. Accordingly, in the segmentation analysis, variables such as motivations, lifestyles or socio-demographic profiles of the travellers are usually included. As a result, and in the area of gastronomic

tourism, it is necessary to identify the group of tourists with homogeneous characteristics in order to respond to a complexity of travellers that visit a specific destination interested in their gastronomy (Levitt, Zhang, DiPietro and Meng, 2017; Ko, Kang, Kan and Lee, 2018) and also due to the degrees of interest that the visitors show in said gastronomy (Kivela and Crofts, 2005).

Each tourist segment is, generally, considered as a group with the same interest, identical needs, similar perspectives and similar socio-demographic characteristics. This information is fundamental for the development of promotion campaigns and for the creation of tourist products. In terms of the segmentation of the gastro-tourists, we can highlight, among others, the studies of Kivela and Crofts (2005), McKercher, Okumus and Okumus (2008), Robinson, Getz and Donilcar (2018) and Björk and Kauppinen-Räsänen (2019). These studies conclude that the tourists who are most attracted by the gastronomy of a place generally have a higher purchasing power. Therefore, this research indicates that this tourist type has a higher degree of demand in relation to aspects such as the uniqueness and authenticity of the local cuisine or its quality.

The segmentation of gastronomic tourists is usually based on the motivations scale (Björk & Kauppinen-Räsänen, 2016; Pérez-Gálvez et al., 2020). The studies that use this scale to segment visitors find three different segments: (1) ‘experiencers’ form the segment of those who are very interested in gastronomy of the object of the study (tourist destination, gastronomic festivals or food markets); (2) ‘survivors’ form the segment of visitors who are not really interested in the local gastronomy; and (3) ‘enjoyers’ form the segment of those who have a positive attitude towards food.

Robinson et al. (2018) contend that tourism marketing studies need to pay more attention to the heterogeneity that exists not only in motivational preferences when ‘food tourism’ is analyzed because behavioral preferences are also very important. The authors highlight that food tourism segmentation is mostly dominated by motivation-driven data and only a limited number of studies has segmented the market with other food-related variables. Thus, the authors perform a segmentation analysis on a 15-items scale that measures food related activities such as food markets, ethnic festivals, wine tasting events or very expensive restaurants.

In our study, we use an 8-items gastronomical scale to perform the segmentation. This is a novel feature that has not been frequently studied in the past. Normally, satisfaction scales have been used in food tourism to analyze particular types of restaurants or national cuisines (Ponnan et al., 2011; Ko et al., 2018). Ponnan et al. (2011) perform a satisfaction-based segmentation analysis to study young Indian consumers in fast food restaurants. The authors find four segments named as value for money seekers, variety/novelty seekers, taste seekers and traditionalists, respectively. On the other hand, Ko et al. (2018) perform a segmentation analysis based on a 30-items perception scale (a satisfaction antecedent) and find that there are 7 factors and 4 segments (authenticity seekers, knowledge seekers, guidance seekers, and utmost experience seekers) in the Korean food tour market niche.

3. Area of study and questionnaire

The gastronomy of Córdoba is characterised by strong Arabian influences as the Caliphate of Córdoba was one of the main Islamic states that existed in the Iberian Peninsula. Therefore, the gastronomy is based on the agricultural products of the area and especially olive oil, a basic ingredient in the culinary techniques of the city. On the other hand, another of the characteristics of this city's gastronomy is the establishments, known as *tabernas*, that represent places for meeting and socialising with the local community, which also implies a place for tourists to discover the culture of the city.

The factors that influence gastronomical satisfaction of international tourists and excursionists in Córdoba are analyzed through a survey administered in the period March-September of the year 2018 in the historical center of the city, near the Mosque-Cathedral where a number of culinary establishments (restaurants, bars and taverns) are located. The survey is based on the previous literature (Björk & Kauppinen-Räsänen, 2016; Kim et al., 2013; Pérez-Gálvez et al. 2015, 2017) and it includes a number of questions related to tourism and gastronomy. In particular, most of the constructs analyzed in the literature review such as gastronomic motivations, gastronomic satisfaction, visit satisfaction, sensorial gastronomic experience and loyalty are included in the questionnaire. The questionnaire also includes other socio-demographic variables of respondents as well as characteristics of the trip. The preliminary reliability of the scales was tested using Cronbach's alpha tests, and all the items were representative of the respective scales.

The fieldwork to a representative sample of foreign visitors to the city of Córdoba aims to discover their satisfaction, their sensorial experience and their motivations in relation to the local gastronomy. The fieldwork was performed with the premise that the respondents to be selected needed to have spent a specific amount of time in the destination and, as such, were able to give a fundamental opinion on the local gastronomy (Correia *et al.*, 2013; Remoaldo *et al.*, 2014). The total number of surveys was 748, of which 710 were valid.

The survey is divided into three large blocks. The first of these collects the characteristics of the journey or the visit such as, for example, the length of the stay in the city or the type of establishment that is used for staying overnight. A second block is focused on gastronomic questions such as the interest in gastronomy of those surveyed and its importance when it comes to travelling, the motivations that contribute to the experience of the traveller in terms of local gastronomy, knowledge of the typical dishes of Cordovan cuisine, an assessment of the general attributes related to the dishes being tasted or the service received in the culinary establishments where they were consumed. And a third block where the socio-demographic profile of the visitors such as age, gender, economic level, place of origin and degree of academic training. The survey used questions with "yes/no" type answers, questions with open and closed answers and questions which used a Likert scale of 5 points (1, of little importance, and 5, very important). The survey was distributed in two languages (Spanish and English).

The Gastronomical Satisfaction Scale (GSAT) is formed by a list of 8 attributes (Table 1). The answer format scale is based on 5-point semantic Likert scales anchored in the extreme points according to the following: (1) 1 = “Very bad” and 5 = “Excellent”.

Table 1: List of attributes included in the gastronomical satisfaction scale (GSAT)

Quality of the food
Variety of the food
Prices
Facilities
Atmosphere and environment
Innovation and new flavours in the dishes
Staff. Service and hospitality
Traditional Gastronomy

4. Methodology

The methodology of fuzzy set theory is gaining certain reputation to measuring service quality or satisfaction in a number of research areas related to transport and tourism that include airlines (Chou et al., 2011), airports (Martín et al., 2019a; Tlig & Rebai, 2017), rail transit (Aydin, 2017), public transport (Dehghani et al., 2017), events (Martín & Román, 2017), hotels (Benítez et al., 2007, Martín & Román, 2017), tourist destinations (Martín et al., 2019b-d), national parks (Saayman et al., 2016), service apartments (Martín et al., 2019c), second house tourism (Martín and Bustamante-Sánchez, 2019), transport and tourism (Martín et al., 2016) and food tourism (Correia et al., 2019).

There are multiple advantages of employing fuzzy set methods when dealing with semantic Likert scales (Bai et al., 2014; Martín et al., 2019b; Saayman et al., 2016; Saeida Ardakani et al., 2015). In particular, issues like responses vagueness and uncertainty associated with the semantic nature of the answer format are better resolved by fuzzy set theory (D'Urso, 2007, Hsu et al., 2004, Lin & Yeh, 2013). Additionally, hybrid fuzzy clustering techniques overcome the critical, and sometimes, unjustified assumption that tourists or excursionists belong to only one cluster (D'Urso et al., 2016, Li et al., 2013). The exclusive assignment of consumers to one cluster is not realistic when some of them are similar at the same time with the cluster representatives (Chiang, 2011; D'Urso et al., 2016; Li et al., 2013). The study prefixes the preferred three cluster solution (D'Urso et al., 2016): foodies, no-foodies and intermediate satisfied.

4.1 Triangular fuzzy numbers

The study uses the popular triangular fuzzy numbers \tilde{A} , which are parameterized using a triplet (a_1, a_2, a_3) with the following membership function $\mu_A(x)$:

$$\mu_A(x) = \begin{cases} \frac{x-a_1}{a_2-a_1}, & a_1 \leq x \leq a_2, \\ \frac{x-a_3}{a_2-a_3}, & a_2 \leq x \leq a_3, \\ 0, & \text{otherwise.} \end{cases} \quad (\text{Eq. 1})$$

Thus, the semantic 5-point scale of GSAT is now converted to triangular fuzzy numbers (TFNs). Table 2 shows the triplets selected in the study. The membership function (equation 1) can be used to obtain the lower and upper bounds as well as the most likely value of each of the answers provided by respondents.

Table 2. Triangular fuzzy numbers. Default values of linguistic terms

Linguistic terms	Fuzzy Number
Very low (1)	(0,0,30)
(2)	(20,30,40)
(3)	(30,50,70)
(4)	(60,70,80)
Excellent (5)	(70,100,100)

The algebra of the fuzzy set theory permits the aggregation of TFNs so it is possible to proxy the GSAT experienced by some segment such as males, females, tourists or excursionists. The average fuzzy number of n TFNs $\tilde{A}_i = (a_1^{(i)}, a_2^{(i)}, a_3^{(i)})$, where $i = 1, 2, 3, \dots, n$, is defined as follows:

$$\tilde{A} = (a_1, a_2, a_3) = \left(\frac{1}{n}\right) \bullet (\tilde{A}_1 \oplus \tilde{A}_2 \oplus \dots \tilde{A}_n) = \left(\frac{\sum_{i=1}^n a_1^{(i)}, \sum_{i=1}^n a_2^{(i)}, \sum_{i=1}^n a_3^{(i)}}{n}\right), (\text{Eq. 2})$$

The \bullet operator denotes the external multiplication of the real numbers and TFNs, and \oplus is the internal addition of TFNs. The algebra of the fuzzy sets guarantees that the aggregated value over all the segments is also a new TFN (Buckley, 1985).

4.2 The defuzzification of the TFN information matrix

Equation 2 is now used to transform the information matrix based on all the respondents in an aggregated TFN information matrix based on the segments according to the variables included in the questionnaire such as, for example, socio-demographic variables. The aggregation phase dissects the information for 110 different segments obtained from 14 segmentation variables. Thus, a matrix (8, 110) of TFNs is obtained by applying eq. 2. The TFN information matrix provides a lot of information that is not easily traceable for those non-experts in fuzzy set theory. For that reason, a clarification or defuzzification method is needed. Interested readers can consult many different defuzzification methods (Kumar, 2017). The author refines more concepts like those associated to accuracy functions, intuitionist fuzzy numbers, and hesitancy vs. membership degree.

The defuzzification method in this study is based on Chen (1996), and it is calculated as $v_{\tilde{a}} = (a_1 + 2a_2 + a_3)/4$. The method is also known as the centre of gravity defuzzification method and has been extensively used in many empirical applications for its simplicity and properties (Martin et al. 2016, 2019a). The following good properties of the method can be highlighted: (1) the method is robust; (2) the theoretical ideas of Kaufmann and Gupta (1988) were taken into account; (3) the method is equivalent to other more sophisticated methods based on total integral values; and (4) the method is more neutral than others which polarized more the extreme, more optimistic or pessimistic, judgements.

4.3 TOPSIS

GSAT index is obtained applying the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), one of the most employed multi-criteria decision-making techniques (Hwang & Yoon, 1981; Zeleny, 1982), to the clarified information matrix. The method is computed as follows:

$$A^+ = \left\{ \left(\max V_{ij} \mid j \in J \right), \left(\min V_{ij} \mid j \in J' \right), i = 1, 2, \dots, m \right\} \quad (\text{Eq. 3})$$

$$A^- = \left\{ \left(\min V_{ij} \mid j \in J \right), \left(\max V_{ij} \mid j \in J' \right), i = 1, 2, \dots, m \right\} \quad (\text{Eq. 4})$$

where J and J' divide the different attributes included in the GSAT scale according to the benefit or cost characteristic. In our case, the total eight attributes included in the GSAT scale are considered as a benefit.

The relative GSAT index for each segment can now be calculated as the relative distance of each segment over the obtained ideal solutions observed in the dataset according to:

$$S_i^+ = \text{dist}(V_i, A^+) = \sqrt{\sum_{j=1}^n (V_{ij} - A_j^+)^2} \quad i = 1, 2, \dots, m \quad (\text{Eq. 5})$$

$$S_i^- = \text{dist}(V_i, A^-) = \sqrt{\sum_{j=1}^n (V_{ij} - A_j^-)^2} \quad i = 1, 2, \dots, m \quad (\text{Eq. 6})$$

$$GSAT_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad i = 1, 2, \dots, m, \quad (\text{Eq. 7})$$

where $0 \leq GSAT_i \leq 1$. A particular segment of tourists or excursionists is more satisfied with the gastronomy in Córdoba whenever the relative index is closer to 1. Thus, GSAT synthetic indicator can be used to rank all the observed segments. The ranking rationality provided by GSAT is clear as GSAT is higher for a particular segment when the defuzzified vector for the segment is closer to the positive ideal solution and/or further from the negative solution.

4.4 Hybrid fuzzy clustering

The methodology section ends with the basics of the hybrid fuzzy clustering method (D'Urso et al., 2016). As said, the method overcomes the critical assumption that consumers belong to only one cluster (Kotler, 1988; Li et al., 2013). Additionally, some empirical applications show that an important loss of information is found when the cluster methods assign consumers to only one cluster (Chaturvedi et al., 1997; Chiang, 2011; Li et al., 2013). Fuzzy clustering techniques resolve these two important shortcomings (Kruse et al., 2007).

The method is an extension of the Bagged Cluster algorithm introduced by Leisch (1999). The fuzzy C-means algorithm for fuzzy data (FCM-FD) is adopted following D'Urso et al. (2013, 2015, 2016) as follows:

$$\begin{aligned} \min : & \sum_{i=1}^n \sum_{c=1}^C u_{ic}^m d_F^2(x_i, p_c) = \sum_{i=1}^n \sum_{c=1}^C u_{ic}^m [w_2^2 \|a_2^i - p_2^c\|^2 + \\ & + w_1^2 (\|a_1^i - p_1^c\|^2 + \|a_3^i - p_3^c\|^2)] \quad (\text{Eq. 8}) \\ \text{st. } & m > 1, u_{ic} \geq 0, \sum_{c=1}^C u_{ic} = 1, \\ & w_1 \geq 0, w_2 \geq 0, w_1 + w_2 = 1 \end{aligned}$$

where, $d_F^2(x_i, p_c)$ represents the squared fuzzy distance between the i th respondent and the profile of the c th cluster; the $\tilde{x}_i \equiv \{\tilde{x}_{ik} = (a_{1ik}, a_{2ik}, a_{3ik}) : k = 1 \dots K\}$ denotes the TFN vector for the i th respondent obtained from the observation of the K attributes, in our case 8; $\tilde{p}_c \equiv \{\tilde{p}_{ck} = (p_{1ck}, p_{2ck}, p_{3ck}) : k = 1 \dots K\}$ represents the fuzzy profile of the c th cluster; $\|a_2^i - p_2^c\|^2$ is the squared Euclidian distances between the centres of the TFN vectors of the i th respondent and profile of the c th cluster; $\|a_1^i - p_1^c\|^2$ and $\|a_3^i - p_3^c\|^2$ are

the squared Euclidian distances between the left and right extreme components of the TFN vectors of the ith respondent and profile of the cth cluster, respectively; $w_1^3 w_2^3 0$ are suitable weights for the center and extreme components for the fuzzy distance considered; $m > 1$ is a weighted exponent that controls the fuzziness of the obtained partition; u_{ic} gives the membership degree of the ith respondent in the cth cluster. Cluster validation and cluster profiles are discussed in D'Urso et al. (2013, 2015, 2016).

5. Results

The descriptive statistics (Table 3) of the distribution of the socio-demographic variables of the respondents show that there is a pre-dominance of women over men in terms of gender, accounting for almost two-thirds of the total (61.5%) of those being surveyed. Additionally, the most representative age range found is between that of 18 and 30 years in almost half (48.4%) of the sample collected. In relation to academic training, 44.2% indicate having university studies, while a little more than a quarter of the total of those surveyed have Master or Doctorate studies (27.8%), with those working for private companies (24.1%) and students (36.2%) being the most represented professions. In terms of the level of income, it relates to a medium-high level, due to 72.4% declaring income levels higher than 1,500 euros a month. Within this group, the 22.9% which declared income between 1,501 and 2,500 euros stands out, as does the third of those surveyed who declared an income of more than 3,500 euros. In terms of nationality, we single out the United Kingdom as being the most represented, with 15.1% of the total, followed by France (14.1%), Italy (10.8%) and the United States (8.9%).

Table 3. Socio-demographic characteristics of the respondents

Variables	Percentage	Variables	Percentage
Gender Male Female	38.5% 61.5%	Academic training	
		Primary education	2.8%
		Secondary education	25.2%
Age Less than 18 years old 18-30 years old 31-42 years old 43-54 years old 55-66 years old More than 66 years old	10.3% 48.4% 16.8% 13.4% 8.3% 2.8%	Occupation	
		University graduate	44.2%
		Master/Doctorate	27.8%
		Civil servant	14.2%
		Self-employed	15.1%
		Private employee	24.1%
		Student	36.2%
Country of origin United Kingdom France Italy USA	15.1% 14.1% 10.8% 8.9%	Income	
		Unemployed	1.6%
		Retired	6.7%
		Housework	2.1%
		Less than 700€	7.9%
701 a 1,000€	5.8%		
1,001 a 1,500€	13.9%		
1,501 a 2,500€	22.9%		

Germany	7.0%	2,501 a 3,500€	16.4%
Belgium	5.9%	More than 3,500€	33.1%
The Netherlands	4.4%		
Poland	4.1%		
Brasil	2.1%		
Others	27.6%		

Table 4 shows the TFNs and defuzzified values that correspond to the total sample of tourists or excursionists, and four different segments: first visitors, repeated visitors, excursionists and tourists. As said, it can be seen that the respective TFN matrices provide excessive information that cannot be easily interpreted for those who are not familiar with the fuzzy set theory. Looking at the values of the respective columns, it can be easily seen that the majority of the TFNs overlap. For example, this is even the case when the analysis is done at the attributes that provide the least satisfaction (innovation and new flavours in the dishes) and the most satisfaction (traditional gastronomy). This issue is usually found as it is the cornerstone of the fuzzy set theory implementation. The defuzzification method that transforms TFNs into real numbers facilitates the interpretation of the information provided by the matrix. Thus, it can be seen that the attributes that produce more satisfaction are: atmosphere and environment (68.80) and traditional gastronomy (69.04). In both cases, the figures are higher than 68. On the other hand, the attributes that produce least amount of satisfaction are: innovation and new flavours in the dishes (60.45) and variety of the food (61.39). Interestingly, it can be seen that for all the attributes and segments, the values are larger than 58 which mean that gastronomical satisfaction in Córdoba is acceptable for the segments shown in the table. The pattern for all the segments is similar but it can be seen that first visitors are more satisfied in general than repeated visitors and tourists are more satisfied than excursionists.

Table 4. TFNs and Crisp values. Total and some tourist segments

Attributes	Total		First visit		Repeated visit		Excursionists		Tourists	
	TFN	Crisp value	TFN	Crisp value	TFN	Crisp value	TFN	Crisp value	TFN	Crisp value
Quality of the food	(50.70 , 66.15 , 77.59)	65.15	(51.23 , 66.81 , 78.02)	65.72	(48.42 , 63.31 , 75.71)	62.69	(48.85 , 63.91 , 76.13)	63.20	(51.73 , 67.40 , 78.40)	66.23
Variety of the food	(46.37 , 62.27 , 74.66)	61.39	(46.98 , 62.60 , 74.84)	61.75	(43.68 , 60.83 , 73.91)	59.81	(46.36 , 61.74 , 74.86)	61.18	(46.37 , 62.56 , 74.55)	61.51
Prices	(47.93 , 64.72 , 76.48)	63.46	(47.66 , 64.51 , 76.31)	63.25	(49.10 , 65.64 , 77.22)	64.40	(46.84 , 63.44 , 75.53)	62.31	(48.53 , 65.43 , 77.00)	64.10
Facilities	(47.62 , 63.37 , 75.77)	62.53	(48.23 , 63.71 , 76.01)	62.92	(44.96 , 61.88 , 74.74)	60.86	(46.05 , 62.53 , 75.34)	61.61	(48.49 , 63.83 , 76.02)	63.04
Atmosphere and environment	(53.06 , 70.77 , 80.59)	68.80	(53.57 , 71.42 , 81.06)	69.37	(50.83 , 67.97 , 78.57)	66.33	(50.36 , 67.31 , 78.34)	65.83	(54.55 , 72.69 , 81.84)	70.44
Innovation and new flavours in the dishes	(45.32 , 61.23 , 74.04)	60.45	(45.93 , 61.85 , 74.35)	61.00	(42.71 , 58.50 , 72.71)	58.10	(45.53 , 61.26 , 74.03)	60.52	(45.21 , 61.20 , 74.05)	60.42
Staff. Service and hospitality	(51.90 , 68.89 , 79.07)	67.19	(52.06 , 69.01 , 79.05)	67.28	(51.20 , 68.35 , 79.17)	66.77	(49.17 , 64.90 , 76.25)	63.80	(53.41 , 71.09 , 80.63)	69.06
Traditional Gastronomy	(53.20 , 71.13 , 80.69)	69.04	(53.54 , 71.39 , 80.92)	69.31	(51.73 , 70.00 , 79.70)	67.86	(51.50 , 68.34 , 78.77)	66.74	(54.14 , 72.67 , 81.75)	70.31

The positive and negative ideal solutions (PIS and NIS) are now calculated according to equations (3) and (4). Table 5 shows the ideal solutions, and it can be seen that all the segments for which the values are obtained are based on the nationality of the respondents. It can be seen that there is always a segment for which all the attributes are valued at their largest mark. The PIS is characterized by a mix of Serbia, Philippines and Brazil. It is out of the scope of the current study to analyse the cultural dimension associated with GSAT, but it seems that some nationalities are more inclined to be more satisfied. Analysing whether this is because the gastronomy in Córdoba is more or less similar to the gastronomy of the place of origin of the respondents is still an issue to further explore. Analysing now the NIS vector, it can be seen that Lebanese tourists are the responsible segment for it, which it is a surprise as the Lebanese gastronomy can be considered closer to the gastronomy in Córdoba in comparison with the countries responsible for the PIS vector.

Table 5. Gastronomy satisfaction. Ideal solutions

Attributes	Positive	Segment	Negative	Segment	Perc. Variation
Quality of the food	92.50	Serbia	7.50	Lebanon	1113%
Variety of the food	92.50	Philippines	7.50	Lebanon	1113%
Prices	92.50	Brazil	7.50	Lebanon	1113%
Facilities	92.50	Philippines	7.50	Lebanon	1113%
Atmosphere and environment	92.50	Serbia	7.50	Lebanon	1113%
Innovation and new flavours in the dishes	92.50	Philippines	7.50	Lebanon	1113%
Staff. Service and hospitality	92.50	Philippines	7.50	Lebanon	1113%
Traditional Gastronomy	92.50	Philippines	7.50	Lebanon	1113%

5.1 The fuzzy clusters

Table 6 shows the Likert scale answers of the three representative profiles of each cluster. We have preferred to present the Likert scale answers instead of the converted TFN for ease of exposition. It can be seen that the table shows three vectors of eight values in the range between one and five. The names of the cluster representatives are as follows: (1) Foodies; (2) No-foodies; and (3) Intermediate. The meaning of the names is clear as the first cluster profile is characterized by those respondents whose GSAT synthetic indicator is equal to 1, that is the visitors who have experienced the maximum satisfaction with the gastronomy. The profile of the second cluster, on the other hand, is characterized by those respondents whose GSAT is equal to 0 (those visitors who have experienced the minimum satisfaction with the gastronomy). And finally, the third cluster profile of the intermediate cluster is characterized by respondents whose GSAT value is the median of the distribution, and, for that, it was decided to name the cluster as ‘intermediate’. Thus, the conceptual approximation of the profiles that represent foodies, no-foodies and intermediate is determined by GSAT. Thus, in our case, gastronomic satisfaction narrows the normal definition of foodies as the culinary travellers who search for a genuine and memorable

gastronomical experience and is seen as someone who has a great interest in food and beverages beyond a mere human need (Chaney & Ryan, 2012). The concept used in the study is also concordant with Sthapit (2018) and Sthapit et al. (2019), as in both studies, the authors find that satisfaction is a strong predictor of a memorable experience. According to Balderas-Cejudo et al. (2019), “the ultimate goal of culinary tourism is to educate tourists about the local area, learn about local food trends, cooking techniques and food history” (p 3).

The segment names depend on the scale used in the data-driven segmentation analysis, as well as in the algorithm that determines the number of segments. For example, the paper by Pérez-Gálvez et al. (2020) uses the segmentation model of gastronomic tourists proposed by Björk and Kauppinen-Räsänen (2016). In this case, the scale is only based on three items that measure the importance of food and eating to travel, to choose a particular destination and to be satisfied. The segmentation studies based on this scale find three different segments: experiencers – those who travel to have food experiences; enjoyers – those with a positive attitude towards food; and survivors – those with very little or no interest in food.

Table 6. Gastronomy cluster profiles

Attributes	Foodies	No Foodies	Intermediate
Quality of the food	5	1	4
Variety of the food	5	1	4
Prices	5	1	2
Facilities	5	1	3
Atmosphere and environment	5	1	4
Innovation and new flavours in the dishes	5	1	5
Staff. Service and hospitality	5	1	4
Traditional Gastronomy	5	1	5

The intermediate representative profile is characterized by: (1) one low valued attribute with a value of 2 (prices); (2) one intermediate valued attribute with a value of 3 (facilities); and (3) 6 high valued attributes with two and four attributes showing values of 4 and 5, respectively (innovation and new flavours in the dishes and traditional gastronomy; quality of the food, variety of the food, atmosphere and environment, and staff –service and hospitality).

Figure 1 shows the ternary plot. The ternary plots represent graphically the distribution of the visitors according to the weights that characterize the membership function of each visitor to each of the three clusters. The graph allows us to understand at a glance how the visitors are distributed among the three clusters. Analyzing the graph, it can be observed that there is a considerable group of visitors who are closer to the intermediate representative profile with a high membership degree (between 80% and 100%). An important group of visitors is situated in the small triangle of the right vertex where the intermediate representative is situated. This triangle is characterized because the complementarity probability between 0 and 20 per cent is split between the other two

clusters, “foodies” and “no-foodies”. The left small triangle is characterized for having a smaller number of visitors who are closer to the representative of the foodies cluster. And finally, the upper small triangle is characterized for having less than 10 observations who are closer to the no-foodies representative. There are also a number of visitors in the intermediate triangles that are located in the line that joins the intermediate and the foodies clusters. Unsurprisingly, the number of visitors in the triangles located in the line that joins the clusters foodies and no-foodies is zero. Calculating the average probability of the membership degree, it is found that “foodies” are on average represented by 40.60%, “no-foodies” by 9.34%, and “intermediates” by 50.06%. Thus, it can be concluded that tourists and excursionists are satisfied or moderately satisfied with the gastronomy in Córdoba, that is, 90 percent of the visitors can be considered as ‘foodies’ or ‘intermediate’, and only less than 10 percent of the visitors are ‘no-foodies’.

Satisfaction Gastronomy

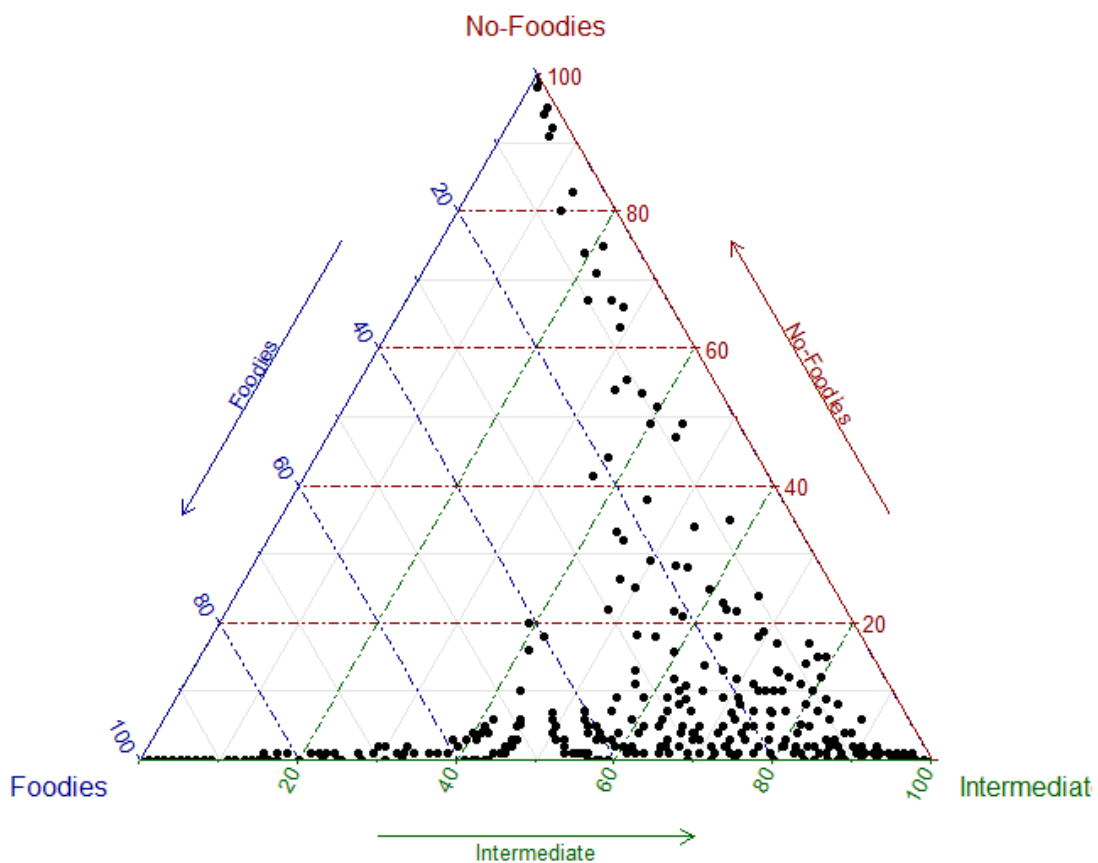


Figure 1. Fuzzy hybrid segmentation

A further analysis can be used to analyse the factors that affect cluster membership which provides important insights to tourist and gastronomy managers, practitioners and other stakeholders interested in the synergies between tourist and food industries. Thus, ANOVA and Tukey-Kramer coefficients are used to analyze whether the following factors have a significant effect on the distribution of membership function of the obtained clusters: (1) first vs. repeated visit; (2) excursionists vs. tourists; (3) number of nights for tourists; (4) type of accommodation; (5) Salmorejo previous knowledge; (6) Rabo de Toro previous knowledge; (7) Flamenquín previous knowledge; (8) Other dish previous knowledge; and (9) gender.

Table 7 shows the results. It can be seen by analyzing the p-value columns that the following conclusions are obtained: (1) there is no evidence that first time visitors are more or less satisfied with the gastronomy in Córdoba than repeated visitors; (2) excursionists are less satisfied than tourists; (3) there are no significant differences observed for the number of nights that tourists stay in the city; (4) soft evidence exists regarding tourists who stay in private houses who tend to be less satisfied than other tourists; (5-7) respondents who have previous knowledge about the three main dishes in Córdoba (Salmorejo, Rabo de Toro and Flamenquín) are more satisfied and less unsatisfied with the gastronomy in the city; (8) Previous knowledge of other dishes show only evidence of less unsatisfied respondents; and (9) there are no significant differences observed for males and females.

Table 7. Factor ANOVA results

Variables	Foodies	No Foodies	Intermediate	p-value		
				F	NF	I
Total	40.60%	9.34%	50.06%			
Type of visit						
First visit	41.11%	9.35%	49.54%			
Repeated visit	38.37%	9.34%	52.29%			
Accommodation						
Excursionists	40.40%	12.24%	47.36%		*	.
Tourists	40.71%	7.74%	51.55%			
Number of nights						
1 night	40.52%	12.24%	47.24%			
2 nights	39.66%	7.57%	52.77%			
3 nights	43.82%	4.80%	51.38%			
4 nights	35.55%	5.85%	58.60%			
5 nights	37.16%	8.05%	54.79%			
6 nights	36.14%	14.18%	49.69%			
7 nights	47.93%	9.52%	42.55%			
8-15 nights	41.21%	3.39%	55.40%			
> 15 nights	45.96%	5.57%	48.47%			
Type of accommodation						
4-5 Star	43.02%	6.20%	50.78%		.	*
2-3 Star	38.55%	8.34%	53.11%			
1 Star	31.74%	8.84%	59.42%			
P. House	44.41%	9.68%	45.91%			
Apartment	42.30%	5.52%	52.18%			
Prior knowledge of typical Cordoba dishes						

Salmorejo	<i>47.19%</i>	<i>6.27%</i>	<i>46.54%</i>	***	***	***
Salmorejo (N)	32.48%	<i>13.14%</i>	<i>54.39%</i>			
Rabo de Toro	<i>46.40%</i>	<i>6.96%</i>	<i>46.64%</i>	***	*	*
Rabo de Toro (N)	37.71%	<i>10.53%</i>	<i>51.76%</i>			
Flamenquín	<i>46.94%</i>	<i>5.86%</i>	<i>47.19%</i>	***	**	*
Flamenquín (N)	36.71%	<i>11.48%</i>	<i>51.81%</i>			
Other	42.30%	<i>6.88%</i>	<i>50.82%</i>		***	***
Other (N)	40.43%	<i>9.59%</i>	<i>49.98%</i>			
Gender						
Male	40.72%	<i>9.22%</i>	<i>50.05%</i>			
Female	40.44%	<i>9.47%</i>	<i>50.09%</i>			
Note: Significance F tests for analysis of variance are reported.						
Significant codes: 0 '****' 0.001 '**' 0.01 '*' 0.05 '.'						
Italic values show significant higher values for the segment						

6. Discussion

The analysis of the overall GSAT permits us to conclude that the two more satisfier attributes are atmosphere and environment, and traditional gastronomy. The two attributes are related to the traditional values associated with the new trends in tourism which encompasses respect for the culture and tradition, authenticity and sustainability (Testa et al., 2019). On the other hand, the two more dissatisfier attributes are innovation and new flavours in the dishes, and variety of the food. In this case, both attributes are more related with the authenticity and cultural symbolization of the gastronomic destination image (Fox, 2007) in which a novel combination of ingredients can be promoted as a culinary differentiation process. The analysis of the TFNs was only shown for the whole sample and four different segments: first visit vs. repeated visits; and excursionists vs. tourists. The results show that first visitors and tourists seem to be more satisfied with the gastronomy in Córdoba than repeated visitors and excursionists. Toudert & Bringas-Rábago (2019) contend that, in contrast to other tourism research fields, the segmentation analysis by tourists (overnight visitors) and excursionists (those who stay for a few hours) in food tourism research is scant. The authors find that Mexican food image is formed very differently for these two segments. Food quality dimension has a significant weight for tourists and food value for excursionists in the formation of food image. Regarding the first time and repeated visitors, the results of previous research are not conclusive. For example, Sanchez-Cañizares & Castillo-Canalejo (2015) find that gastronomy is the most important reason for the trip for first timers, and Kivela & Crofts (2006) find the opposite result for tourists visiting Hong Kong.

The analysis of the ideal solutions reveal that different nationalities are the responsible segments for the observed vectors. The results can be caused by familiarity, personal preferences, and similar used condiments and flavour that can evoke food memory (Chang & Mak, 2018). There is usually a trade-off between familiarity and novelty that affects the food consumption behaviour (Mak et al., 2012). Mak et al.

(2012) determine five main factors that affect tourist food consumption: (1) Cultural and religious; (2) Socio-demographic; (3) Personality; (4) Past experience; and (5) Motivational. For this reason, it is not strange that nationality affects tourists' gastronomical satisfaction. For example, Promsivapallop & Kannaovakun (2019) find that the Australian tourists have a more favourable image perception of food in Thailand than the Chinese tourists.

Regarding the segmentation analysis, we follow Robinson et al. (2018) and pay more attention to behavioral preferences. For this reason, we use an 8-items gastronomic satisfaction scale (GSAT) as the data driver to segment food Córdoba visitors. Thus, we also extend previous studies that have only analyzed food tourism for types of restaurants or Korean food tour markets (Ponnan et al., 2011; Ko et al., 2018). We find 3 segments: (1) 'foodies' is the segment characterized by those visitors who are extremely satisfied with the gastronomy in Córdoba; (2) 'no-foodies' is the segment characterized by those visitors who are extremely dissatisfied with the gastronomy in Córdoba; and (3) 'intermediate' which is characterized by those visitors who are moderately satisfied with the gastronomy in Córdoba. We remind here that the profile of the prototype of the intermediate cluster is a visitor who is not very satisfied with prices (2) and facilities (3), but is satisfied or very satisfied with the remaining 6 attributes.

The fuzzy clustering method provides important insights to tourist and gastronomy managers, practitioners and other stakeholders. The ternary graph shows that tourists and excursionists in Córdoba form a very heterogeneous market which in general is satisfied or moderately satisfied with the gastronomy serviced in the city. The results show how stakeholders interested in improving gastronomical satisfaction in Córdoba should focus in devising marketing campaigns that increase the tourists' previous knowledge of the three main dishes (Salmorejo, Rabo de Toro and Flamenquín). Thus, Córdoba can strength and consolidate its image beyond a well-known cultural destination including a more reinforced gastronomic image exploiting the mentioned existing synergies. In the future, it would be advisable that tourists could come to Córdoba not only to visit the main attractions such as the Mosque-Cathedral, the Judería or the jasmine patios, but to enjoy also some of the typical dishes. The local gastronomy needs to play an active role that complements the existing cultural jewels of Córdoba.

The previous knowledge of the local cuisine also opens new alternatives for developing new food products such as 'authentic Córdoba cuisine tour guides'. For example, Ko et al. (2018) contend that tour guides may have a strong impact on the satisfaction experienced by tour participants. In this sense, tour food participants would have a previous knowledge of local cuisine, but their role could be reinforced in order to achieve memorable experiences through an adequate interpretation of the local food and culture. For this reason, destination marketers should also invest in continuous training to put in value the role of food tour guides (Chang et al., 2011).

Other results show that first time visitors are not different from repeated visitors; excursionists are less satisfied than tourists; the length of stay and gender do not affect any of the segments but tourists staying in private houses seem to be less satisfied with the gastronomy than tourists who stay in other type of accommodation. In this sense, some of our results are different from those obtained by Tse & Crofts (2005) who find that gastronomical satisfaction is influenced by length of stay and repeat visitation and Testa et al. (2019) who find that females have more propensity to experience local food and beverages in agri-tourism destinations. Notwithstanding, our results are more concordant with Lee et al. (2014) who conclude that food tourism depends more on motivation and personality than in other differences such as culture, age, gender or occupation. The authors find similar preference patterns to experience local food among male and female senior tourists.

7. Conclusion

This research investigates the gastronomical satisfaction scale GSAT for international visitors in Córdoba. One of the main significant contributions of the study grounds in the application of a fuzzy clustering method applied to the GSAT scale as the primary data to obtain the segments of the international food visitors. The novelty of the study resides in these two features. Once the segments were obtained, a number of factors that could affect the membership function of each international tourist or excursionist based on GSAT is analysed. In so doing, the study fills some gaps detected from previous research as well as provides important insights to tourist and gastronomy managers, practitioners and other stakeholders interested in the synergies that exist between tourist and food industries.

The current research, to the best of the authors' knowledge, is the first attempt of the fuzzy clustering method to analyse how different factors affect GSAT of international tourists and excursionists. Previous research has analysed food tourist segments throughout conceptual categories, or typologies, descriptive profiles or motivation-driven groupings using other statistical methods such as factor analysis, multi-group SEMs or conventional cluster analysis (Robinson et al., 2018). Our study is based on a fuzzy hybrid method that calculates a synthetic GSAT index and on a fuzzy clustering method that segment the market into three segments named "foodies", "no-foodies" and "intermediates". The definition of 'foodies' based on GSAT narrows the definition given by Chaney & Ryan (2012) of culinary travellers who search for a genuine and memorable gastronomical experience and is seen as someone who has a great interest in food and beverages beyond a mere human need, and it also resembles the results obtained by Sthapit (2018) and Sthapit et al. (2019) because food satisfaction is a strong predictor of a memorable experience.

The study offers interesting insights into a number of issues which are related to gastronomical satisfaction of international tourists and excursionists in Córdoba. The study shows that gastronomy satisfaction is quite heterogeneous, so food-tourism experience cannot be considered homogeneous. The practical value rests in making some recommendations in order to exploit the existing synergies between cultural and

gastronomical industries in Córdoba. The main recommendations revolve around the necessity of making the knowledge of local dishes (Salmorejo, Rabo de Toro and Flamenquín) more accessible to visitors. For example, an annual contest between interested restaurants could be established in order to get the best establishments for each individual dish, and some culinary routes could be developed according to this. Then, some promotional material can be developed and distributed in visitor centres and hotels in order to enhance the local gastronomical offer in Córdoba making it more visible. Thus, Córdoba DMO managers need to market and promote better the local gastronomical dishes. In addition, new food products such as ‘authentic Córdoba cuisine tour guides’ could also be promoted from the public sector or from the provincial restaurants association, developing an authentic cultural product related to the gastronomy in Córdoba. The success of these products is mainly based on the quality of the tour guides (Chang et al., 2011; Ko et al., 2018), and, for that reason, the continuous training of tour guides could be provided by the university that could better exploit the important existing synergies between the food and the cultural heritage that exists in Córdoba.

The research is not exempt from limitations that can be used to invite academics and practitioners to further future research. An interesting venue of this is to analyse other type of factors that can affect GSAT such as behavioural attitudes like destination loyalty, other motivational segments (neophobia vs. neophilia), or the group size. It can be the case that couples or groups participate in determined food consumption just to gratify the preferences of only a single but persuasive member of the group. Another interesting issue to study is to find an adequate balance between the ideal promotion of Córdoba between a cultural and gastronomical destination. Thus, futures studies can also focus in obtaining the importance given by tourists to the portfolio determined by Córdoba image when they decide to visit Córdoba. Following Okumus & Cetin (2018), further research is needed to coordinate the unofficial promotional material developed by the private sector (hotels, tour operators and restaurants) and other professional associations with the official promotional material developed by DMOs in order to design better marketing strategies. Future research could also replicate the instrument in other Andalusian cities which are also well-known as cultural hallmark destinations to compare the results and find if they are generalizable.

CRedit authorship contribution statement

Juan Carlos Martín: Formal analysis, Methodology, Supervision, Writing – review & editing; **Concepción Román:** Formal analysis, Methodology, Software, Supervision, Writing – review & editing; **Tomás López-Guzmán:** Investigation, Formal analysis, Methodology, Supervision, Writing – review & editing; **Salvador Moral-Cuadra:** Conceptualization, Data curation, Formal analysis, Writing – original draft.

Declaration of competing interest

The authors declare that they have no conflict of interest

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References

- Aydin, N. (2017). A fuzzy-based multi-dimensional and multi-period service quality evaluation outline for rail transit systems. *Transport Policy*, 55, 87-98. doi: [10.1016/j.tranpol.2017.02.001](https://doi.org/10.1016/j.tranpol.2017.02.001)
- Babolian hendijani, R. (2016). Effect of food experience on tourist satisfaction: the case of Indonesia. *International Journal of Culture, Tourism and Hospitality Research*, 10(3), 272-282. doi: doi.org/10.1108/IJCTHR-04-2015-0030
- Bai, C., Dhavale, D., & Sarkis, J. (2014). Integrating Fuzzy C-Means and TOPSIS for performance evaluation: An application and comparative analysis. *Expert Systems with Applications*, 41(9), 4186-4196. doi: [10.1016/j.eswa.2013.12.037](https://doi.org/10.1016/j.eswa.2013.12.037)
- Balderas-Cejudo, A., Patterson, I., & Leeson, G. W. (2019). Senior Foodies: A developing niche market in gastronomic tourism. *International Journal of Gastronomy and Food Science*, 16(October 2018), 100152. doi: [10.1016/j.ijgfs.2019.100152](https://doi.org/10.1016/j.ijgfs.2019.100152)
- Basil, M. D. & Basil, D. Z. (2009). Reflections of ultra-fine dining experiences. En Lindgreen, A., Vanhammed, J. y Bervelan, M. B. (eds.). *Memorable customer experiences: a research anthology* (135-147). Surrey: Gower Publishing Company.
- Bénitez, J. M., Martín, J. C., & Román, C. (2007). Using fuzzy number for measuring quality of service in the hotel industry. *Tourism Management*, 28(2), 544-555. doi: [10.1016/j.tourman.2006.04.018](https://doi.org/10.1016/j.tourman.2006.04.018)
- Björk, P. & Kauppinen-Räsänen, H. (2016). Exploring the multi-dimensionality of travellers' culinary-gastronomic experiences. *Current Issues in Tourism*, 19(12), 1260-1280. doi: [10.1080/13683500.2013.868412](https://doi.org/10.1080/13683500.2013.868412)
- Björk, P., & Kauppinen-Räsänen, H. (2019). Destination foodscape: A stage for travelers' food experience. *Tourism Management*, 71, 466-475. doi: [10.1016/j.tourman.2018.11.005](https://doi.org/10.1016/j.tourman.2018.11.005)
- Buckley, J. J. (1985). Ranking alternatives. Using fuzzy numbers. *Fuzzy Sets and Systems*, 15(1), 21–31. doi: [10.1016/0165-0114\(85\)90013-2](https://doi.org/10.1016/0165-0114(85)90013-2)
- Chaney, S., & Ryan, C. (2012). Analyzing the evolution of Singapore's World Gourmet Summit: An example of gastronomic tourism. *International journal of hospitality management*, 31(2), 309-318. doi: [10.1016/j.ijhm.2011.04.002](https://doi.org/10.1016/j.ijhm.2011.04.002)
- Chang, R. C. Y., & Mak, A. H. N. (2018). Understanding gastronomic image from tourists' perspective: A repertory grid approach. *Tourism Management*, 68, 89–100. doi: [10.1016/j.tourman.2018.03.004](https://doi.org/10.1016/j.tourman.2018.03.004)
- Chaturvedi, A., Carroll, J. D., Green, P. E., & Rotondo, J. A. (1997). A feature-based approach to market segmentation via overlapping k-centroids clustering. *Journal of Marketing Research*, 34, 370-377. doi: [10.1177/002224379703400306](https://doi.org/10.1177/002224379703400306)
- Chen, S.M. (1996). Evaluating weapon systems using fuzzy arithmetic operations. *Fuzzy Sets and Systems*, 77(3), 265-276. doi: [10.1016/0165-0114\(95\)00096-8](https://doi.org/10.1016/0165-0114(95)00096-8)

- Chang, R., Kivela, J., & Mak, A. (2011). Attributes that influence the evaluation of travel dining experience: When east meets west. *Tourism Management*, 32, 307–316.
- Chiang, W.-Y. (2011). Establishment and application of fuzzy decision rules: an empirical case of the air passenger market in Taiwan. *International Journal of Tourism Research*, 13, 447-456. doi: [10.1002/jtr.819](https://doi.org/10.1002/jtr.819)
- Chou, C. C., Liu, L. J., Huang, S. F., Yih, J. M., & Han, T. C. (2011). An evaluation of airline service quality using the fuzzy weighted SERVQUAL method. *Applied Soft Computing*, 11(2), 2117-2128. doi: [10.1016/j.asoc.2010.07.010](https://doi.org/10.1016/j.asoc.2010.07.010)
- Correia, A., Kozak, M. y Ferradeira, J. (2013). From tourist motivations to tourist satisfaction. *International Journal of Culture, Tourism and Hospitality Research*, 7(4), 411-424. doi: doi.org/10.1108/IJCTHR-05-2012-0022
- Correia, A., Kim, S., & Kozak, M. (2019). Gastronomy experiential traits and their effects on intentions for recommendation: A fuzzy set approach. *International Journal of Tourism Research*. doi: [10.1002/jtr.2340](https://doi.org/10.1002/jtr.2340)
- Cracolici, M. F., Nijkamp, P. y Rietveld, P. (2008). Assessment of tourism competitiveness by analysing destination efficiency. *Tourism Economics*, 14(2), 325-342. doi: [10.5367/000000008784460427](https://doi.org/10.5367/000000008784460427)
- Crespi-Vallbona, M. y Domínguez Pérez, M. & Mascarilla Miró, O. (2019). Urban food markets and their tourist sustainability: the compatibility of traditional and tourist uses. *Current Issues in Tourism*, 22(14), 1723-1743. doi: [10.1080/13683500.2017.1401983](https://doi.org/10.1080/13683500.2017.1401983)
- Dehghani, A., Kheirkhah, A. S., & Ahadi, H. R. (2017). A hierarchical topsis method based on type-2 fuzzy sets to evaluate service quality of public transportation. *International Journal of Industrial Engineering*, 24(5), 505-525
- Dolnicar, S. (2002). A review of data-driven market segmentation in tourism. *Journal of Travel & Tourism Marketing*, 12,1e22.
- Dolnicar, S., & Lazarevski, K. (2009). Methodological reasons for the theory/ practice divide in market segmentation. *Journal of Marketing Management*, 25, 357-373.
- D'Urso, P. (2007). Clustering of fuzzy data. In J. V. De Oliveira, & W. Pedrycz (Eds.), *Advances in fuzzy clustering and its applications* (pp. 155-192). J. Wiley and Sons.
- D'Urso, P., De Giovanni, L., Disegna, M., & Massari, R. (2013). Bagged clustering and its application to tourism market segmentation. *Expert Systems with Applications*, 40, 4944-4956. doi: [10.1016/j.eswa.2013.03.005](https://doi.org/10.1016/j.eswa.2013.03.005)
- D'Urso, P., Disegna, M., Massari, R., & Osti, L. (2016). Fuzzy segmentation of postmodern tourists. *Tourism Management*, 55, 297–308. doi : [10.1016/j.tourman.2016.03.018](https://doi.org/10.1016/j.tourman.2016.03.018)
- D'Urso, P., Disegna, M., Massari, R., & Prayag, G. (2015). Bagged fuzzy clustering for fuzzy data: an application to a tourism market. *Knowledge-Based Systems*, 73, 335-346. doi: [10.1016/j.knosys.2014.10.015](https://doi.org/10.1016/j.knosys.2014.10.015)
- Ellis, A. Park, E., Kim, S. y Yeoman, I. (2018). What is food tourism?. *Tourism Management*, 68, 250-263. doi: [10.1016/j.tourman.2018.03.025](https://doi.org/10.1016/j.tourman.2018.03.025)

- Fox, R. (2007). Reinventing the gastronomic identity of Croatian tourist destinations. *International Journal of Hospitality Management*, 26(3), 546-559. doi: [10.1016/j.ijhm.2006.03.001](https://doi.org/10.1016/j.ijhm.2006.03.001)
- Gupta, V. & Sajnani, M. (2019). A study on the influence of street food authenticity and degree of their variations on the tourists' overall destination experiences. *British Food Journal*, Ahead-of-print. doi: [10.1108/BFJ-08-2019-0598](https://doi.org/10.1108/BFJ-08-2019-0598)
- Hall, M. C., Sharples, L., Mitchell, R., Macionis, N. y Cambourne, B. (2003). Food tourism around the World. Oxford: Butterworth-Heinemann.
- Haven-Tang, C. y Jones, E. (2005). Using local food and drink to differentiate tourism detinations through a sense of place: A stoy from Wales-Dining ar Mommouthshire's Great Table. *Journal of Culinary Science and Technology*, 4 (4), 69-86. doi: [10.1300/J385v04n04_07](https://doi.org/10.1300/J385v04n04_07)
- Hjalager, A.M. (2004). What do tourists eat and why?. Towards a sociology of gastronomy and tourism. *Tourism*, 52(2), 195-201.
- Hsu, C. H., Wolfe, K. & Kang, S. K. (2004). Image assessment for a destination with limited comparative advantages. Great Britain: Elsevier Science B.V., Amsterdam
- Hwang, C. & Yoon, K. (1981). *Multiple attribute decision making: Methods and application*. New York: Springer.
- Kaufmann, A., & Gupta, M. (1988). *Fuzzy mathematical models in engineering and management science*. New York, NY: Elsevier Science.
- Kim, Y. G., Eves, A. & Scarles, C. (2009). Building a model of local food consumption on trips and holidays: a grounded theory approach. *International Journal of Hospitality Management*, 28, 423-431. doi: [10.1016/j.ijhm.2008.11.005](https://doi.org/10.1016/j.ijhm.2008.11.005)
- Kim, Y. G., Eves, A. & Scarles, C. (2013). Empirical verification of a conceptual model of local consumption at a tourist destination. *International Journal of Hospitality Management*, 33, 484-489. doi: [10.1016/j.ijhm.2012.06.005](https://doi.org/10.1016/j.ijhm.2012.06.005)
- Kim, Y.- H., Ducan, J. & Chang, B. W. (2015). Involvement, satisfaction, perceived value, and revisit intention: a case study of a food festival. *Journal of Culinary Science and Technology*, 13, 133-158. doi: [10.1080/15428052.2014.952482](https://doi.org/10.1080/15428052.2014.952482)
- Kivela, J., & Crofts, J. C. (2006). Tourism and gastronomy: Gastronomy's influence on how tourists experience a destination. *Journal of Hospitality & Tourism Research*, 30(3), 354-377. doi: [10.1177/1096348006286797](https://doi.org/10.1177/1096348006286797)
- Ko, S., Kang, kang, H. & Lee, M. (2018). An exploration of foreign tourists' perception of korean food tour: a factor-cluster segmentation approach. *Asia Pacific Journal of Tourism Research*, 23(8), 833-846. doi: [10.1080/10941665.2018.1494613](https://doi.org/10.1080/10941665.2018.1494613)
- Kotler, P. (1988). *Marketing management* (6th ed.). Englewood Cliffs, NJ: Prentice Hall.
- Kruse, R., Döring, C. & Lesot, M.-J. (2007). Fundamentals of fuzzy clustering. In J. V. de Oliveira, & W. Pedrycz (Eds.), *Advances in fuzzy clustering and its applications* (pp. 3-30). John Wiley & Sons.

- Kumar, H. (2017). Some Recent Defuzzification Methods. In D-F Le (Ed.), *Theoretical and Practical Advancements for Fuzzy System Integration* (pp. 31-48). Hershey, PA: IGI Global.
- Lee, K. H., Alexander, A. C., & Kim, D. Y. (2014). A study of geographical distance groups on length of visitors' stay at local food festival destinations. *Journal of Vacation Marketing*, 20(2), 125-136. doi: [10.1177/1356766713502484](https://doi.org/10.1177/1356766713502484)
- Leisch, F. (1999). Bagged clustering. Working paper 51 SFB Adaptive Information Systems and Modelling in Economics and Management Science WU Vienna University of Economics and Business.
- Levitt, J. A., Zhang, P., DiPietro, R. B. y Meng, F. (2019). Food tourist segmentation: Attitude, behavioral intentions and travel planning behavior based on food involvement and motivation. *International Journal of Hospitality & Tourism Administration*, 20(2), 129-155. doi: [10.1080/15256480.2017.1359731](https://doi.org/10.1080/15256480.2017.1359731)
- Li, X., Meng, F., Uysal, M. & Mihalik, B. (2013). Understanding China's long-haul outbound travel market: an overlapped segmentation approach. *Journal of Business Research*, 66, 786-793. doi: [10.1016/j.jbusres.2011.09.019](https://doi.org/10.1016/j.jbusres.2011.09.019)
- López-Guzmán, T., Uribe-Lotero, C.P., Pérez-Gálvez, J.C. & Ríos-Rivera, I. (2017) Gastronomic festivals: attitude, motivation and satisfaction of the tourist. *British Food Journal*, 119(2), 267-283. doi: [10.1108/BFJ-06-2016-0246](https://doi.org/10.1108/BFJ-06-2016-0246)
- Mak, A. H., Lumbers, M., Eves, A., & Chang, R. C. (2012). Factors influencing tourist food consumption. *International Journal of Hospitality Management*, 31(3), 928-936. doi: [10.1016/j.ijhm.2011.10.012](https://doi.org/10.1016/j.ijhm.2011.10.012)
- Martin, J. C., Marrero-Rodríguez, J. R., Moreira, P., Román, C., & Santana, A. (2016). How Access Transport Mode to a World Heritage City Affects Visitors' Experienced Quality. *Tourism Economics*, 22(2), 207-226. doi: [10.5367/te.2016.0550](https://doi.org/10.5367/te.2016.0550)
- Martín, J. C., Román, C. & Gonzaga, C. (2017). Quality of service and segmentation in the MICE industry: An approximation based on fuzzy logic. *Journal of Convention & Event Tourism*, 18, 1-25. doi: [10.1080/15470148.2016.1154808](https://doi.org/10.1080/15470148.2016.1154808)
- Martín, J. C. & Román, C. (2017). Measuring service quality in the hotel industry: The value of user generated content. *Tourism*, 65(4), 390-405.
- Martín, J. C., Martín-Domingo, L., Lohmann, G. & Spasojevic, B. (2019a). The role of travel patterns in airport duty-free shopping satisfaction: A case study from an Australian regional airport. *Journal of Air Transport Management*, 80, 101691. doi: [10.1016/j.jairtraman.2019.101691](https://doi.org/10.1016/j.jairtraman.2019.101691)
- Martín, J. C., Moreira, P. & Román, C. (2019b). A hybrid-fuzzy segmentation analysis of residents' perception towards tourism in Gran Canaria. *Tourism Economics*, 1-23. doi: [10.1177/1354816619873463](https://doi.org/10.1177/1354816619873463)
- Martín, J. C., Mendoza, C., & Román, C. (2019c). Assessing service quality using fuzzy numbers and TOPSIS: an application to self-contained and serviced apartments. *International Journal of Business and Systems Research*, 13(3), 275-296. doi: [10.1504/IJBSR.2019.100373](https://doi.org/10.1504/IJBSR.2019.100373)

- Martin, J. C., Saayman, M., & du Plessis, E. (2019d). Determining satisfaction of international tourist: A different approach. *Journal of Hospitality and Tourism Management*, 40, 1-10. doi: [10.1016/j.jhtm.2019.04.005](https://doi.org/10.1016/j.jhtm.2019.04.005)
- Martín, J.C., & Bustamante-Sánchez, N.S. (2019). A cultural analysis of the secondary housing tourism in Vilcabamba, Ecuador: The satisfaction gap between domestic and international tourists. *International Journal of Housing Markets and Analysis*, 12(4), 604-625. doi: [10.1108/IJHMA-05-2018-0028](https://doi.org/10.1108/IJHMA-05-2018-0028)
- McKercher, B., Okumus, F. & Okumus, B. (2008). Food Tourism as a Viable Market Segment: It's All How You Cook the Numbers!. *Journal of Travel & Tourism Marketing*, 25(2), 137–148. doi: [10.1080/10548400802402404](https://doi.org/10.1080/10548400802402404)
- Okumus, B., & Cetin, G. (2018). Marketing Istanbul as a culinary destination. *Journal of Destination Marketing and Management*, 9(March), 340–346. doi: [10.1016/j.idmm.2018.03.008](https://doi.org/10.1016/j.idmm.2018.03.008)
- Pérez-Gálvez, J.C., Medina-Viruela, M.J., Jara-Alba, C., López-Guzmán, T. (2020). Segmentation of food market visitors in World Heritage Sites. Case study of the city of Córdoba (Spain). *Current Issues in Tourism*. Published online: 26 May 2020
- Pérez-Gálvez, J. C., Muñoz-Fernández, G. A. & López-Guzmán, T. (2015). Motivation and tourist satisfaction in wine festivals: XXXI ed. Wine tasting Montilla-Moriles, Spain. *Tourism & Management Studies*, 11(2), 7-13.
- Pérez-Gálvez, J. C., Jaramillo Granda, M., López-Guzmán, T. & Reinoso Coronel, J. (2017). Local gastronomy, culture and tourist, sustainable cities: the behavior of the American tourist. *Sustainable Cities and Society*, 32, 64-612. doi: [10.1016/j.scs.2017.04.021](https://doi.org/10.1016/j.scs.2017.04.021)
- Pesonen, J., Komppula, R., Kronenberg, C. & Peters, M. (2011). Understanding the relationship between push and pull motivations in rural tourism. *Tourism Review*, 66(3), 32-49. doi: [10.1108/16605371111175311](https://doi.org/10.1108/16605371111175311)
- Ponnam, A., Sahoo, D., & Balaji, M. (2011). Satisfaction-based segmentation: Application of Kano model in Indian fast food industry. *Journal of Targeting, Measurement and Analysis for Marketing*, 19(3-4), 195-205.
- Promsivapallop, P., & Kannaovakun, P. (2019). Destination food image dimensions and their effects on food preference and consumption. *Journal of Destination Marketing and Management*, 11(December 2018), 89–100. doi: [10.1016/j.idmm.2018.12.003](https://doi.org/10.1016/j.idmm.2018.12.003)
- Remoaldo, P. C., Vareiro, L, Ribeiro, J. C. & Santos, J. F. (2014). Does gender affect visiting a World Heritage Site. *Visitor Studies*, 17(1), 89-106. doi: [10.1080/10645578.2014.885362](https://doi.org/10.1080/10645578.2014.885362)
- Robinson, R. N. S., Getz, D., & Dolnicar, S. (2018). Food tourism subsegments: A data-driven analysis. *International Journal of Tourism Research*, 20(3), 367–377. doi: [10.1002/jtr.2188](https://doi.org/10.1002/jtr.2188)
- Saayman, M., Martín, J. C., & Román, C. (2016). There is no fuzziness when it comes to measuring service quality in national parks. *Tourism Economics*, 22(6), 1207-1224. doi: [10.1177/13548166166669036](https://doi.org/10.1177/13548166166669036)

- Saeida Ardakani, S., Nejatian, M., Farhangnejad, M. A., & Nejati, M. (2015). A fuzzy approach to service quality diagnosis. *Marketing Intelligence & Planning*, 33(1), 103-119. doi: [10.1108/MIP-02-2013-0035](https://doi.org/10.1108/MIP-02-2013-0035)
- Sanchez-Cañizares, S., & Castillo-Canalejo, A. M. (2015). A comparative study of tourist attitudes towards culinary tourism in Spain and Slovenia. *British Food Journal*, 117(9), 2387–2411. doi: [10.1108/BFJ-01-2015-0008](https://doi.org/10.1108/BFJ-01-2015-0008)
- Sthapit, E. (2018). The more the merrier: Souvenir shopping, the absence of choice overload and preferred attributes. *Tourism Management Perspectives*, 26, 126–134.
- Sthapit, E., Coudounaris, D., & Björk, P. (2018). The memorable souvenir-shopping experience: Antecedents and outcomes. *Leisure Studies*, 37(5), 628–643.
- Sthapit, E., Coudounaris, D. N., & Björk, P. (2019). Extending the memorable tourism experience construct: an investigation of memories of local food experiences. *Scandinavian Journal of Hospitality and Tourism*, 19(4-5), 333-353.
- Testa, R., Galati, A., Schifani, G., Di Trapani, A. M., & Migliore, G. (2019). Culinary tourism experiences in agri-tourism destinations and sustainable consumption-Understanding Italian tourists' motivations. *Sustainability (Switzerland)*, 11(17), 1–17. doi: [10.3390/su11174588](https://doi.org/10.3390/su11174588)
- Tlig, H., & Rebai, A. (2017). A TOPSIS method based on intuitionistic fuzzy values: a case study of North African airports. *Management Science Letters*, 7(7), 351-358. doi: [10.5267/j.msl.2017.4.002](https://doi.org/10.5267/j.msl.2017.4.002)
- Toudert, D., & Bringas-Rábago, N. L. (2019). Destination food image, satisfaction and outcomes in a border context: tourists vs excursionists. *British Food Journal*, 121(5), 1101–1115. doi: [10.1108/BFJ-03-2019-0148](https://doi.org/10.1108/BFJ-03-2019-0148)
- Tse, P., & Crotts, J. C. (2005). Antecedents of novelty seeking: International visitor's propensity to experiment across Hong Kong's culinary traditions. *Tourism Management*, 26(6), 965–968. doi: [10.1016/j.tourman.2004.07.002](https://doi.org/10.1016/j.tourman.2004.07.002)
- Zeleny, M. (1982). *Multiple Criteria Decision Making*. New York: McGraw-Hill.