



Sheep meat consumers in Mexico: Understanding their perceptions, habits, preferences and market segments

P.J. Alanís^a, G.C. Miranda-de la Lama^b, M.A. Mariezcurrena-Berasain^a, A. Barbabosa-Pliego^a,
A.A. Rayas-Amor^c, L.X. Estévez-Moreno^{b,*}

^a Faculty of Veterinary Medicine and Animal Husbandry, Autonomous University of the State of Mexico UAEM, Toluca, Mexico

^b Department of Animal Production and Food Science, Agrifood Institute of Aragon (IA2), University of Zaragoza, Zaragoza, Spain

^c Department of Food Science, Metropolitan Autonomous University Lerma Unit, Lerma de Villada, Mexico

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ABSTRACT

Sheep meat is an essential element within the multicultural mosaic of Mexican agri-food traditions. A total of 332 consumers were surveyed face-to-face in restaurants specializing in selling traditional sheep meat products. Our results showed that consumers could be segmented based on their perceptions, habits, and preferences towards sheep meat. For consumers, sheep meat is perceived as food with unique sensory attributes, coming from healthier animals than other species and traditional characters. Their willingness to pay extra is subject to the guarantee that the meat is safe, free of hormones and antibiotics, and to a lesser extent, certified organic. The multivariate analysis suggested three clusters or consumer profiles named passive, wholehearted, and deep-rooted, which explained the associations among attitudes, some demographic variables, and consumption frequency. The nascent national sheep meat industry needs to consider these concerns in developing marketing and trust strategies to attract, maintain, and build loyalty among Mexican consumers.

1. Introduction

Sheep production in Mexico has historically been destined to satisfy domestic demand, closely linked to traditional cuisine (Thomé-Ortiz, 2018). National consumption of sheep meat has ranged during the last 25 years between 500 and 950 g/year/*per capita*, participating moderately in the food basket of Mexicans, compared to other animal proteins such as chicken and pork (Partida, Ríos Rincón, Cruz Colín, Domínguez Vara, & Buendía Rodríguez, 2017). However, the demand for sheepmeat has traditionally exceeded the possibilities of national production, of 64,758 tons in 2020 and an inventory of 8.7 million heads (SIAP, 2020). Imports of frozen meat that currently compensate for this deficit come mainly from Australia, New Zealand, and sporadically Uruguay or Chile (Bobadilla-Soto, Ochoa-Ambriz, Flores-Padilla, & Perea-Peña, 2020; Santoyo-Cortés, & Martínez-González, 2021). Although the last ten years have seen a reduction in imports of sheep meat (Santoyo-Cortés & Martínez-González, 2021) and a sustained increase in the size of the national herd (SIAP, 2020), the bulk of the latter still belongs to producers with low economic resources and low technological level (Hernández-Marín et al., 2017). Sheep meat consumption in Mexico is

strongly linked to the *Barbacoa*, a deeply rooted traditional dish mainly prepared in the country's central states. Thus, this is the cooking method for 90% to 95% of the national sheep meat consumption (Hernández-Marín et al., 2017; Partida et al., 2017).

Mexican *Barbacoa* is an example of culinary crossbreeding between traditional pre-Hispanic and Spanish cuisine. Underground steam cooking in shallow stone ovens is a pre-Hispanic technique for game meats such as deer (family *Cervidae*), spotted pacas (*Cuniculus paca*), and peccaries (Family *Tayassuidae*). The Spaniards perfected this technique, with deeper brick ovens underground and incorporating sheep or goat meat. Over time, the *Barbacoa* dish was adapted to the different regions and agro-ecosystems of the country, varying its appearance or color (without or with red chili sauces in the cooking). To prepare *Barbacoa*, the sheep meat and viscera are mixed up with diverse ingredients and placed in a recipient, then covered with maguey leaves (*Agave salmiana*), and placed in a hole dug into the ground (Mondragón-Ancelmo et al., 2014). Its cooking requires three hours to heat the earthen oven and another 6 h to cook the meat and extract a broth called *Consomé* (also has sliced carrots, chickpeas, and a few rice grains) sold as a soup. More than a ritual, its preparation constitutes a culinary technique where the

* Corresponding author.

E-mail address: lestevéz@unizar.es (L.X. Estévez-Moreno).

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quality is associated with physical labor, skillful elaboration, and masterly knowledge of the product (Thomé-Ortiz, 2018).

For this reason, this dish is prepared by specialized cooks and is not usually cooked at home for the daily diet of family members. On the contrary, its consumption is concentrated on weekends, holidays, or special celebrations (Bobadilla-Soto et al., 2020). Thus, *Barbacoa* is sold by the taco (small hand-sized corn or wheat tortilla topped with a filling) or by the kilo to the consumer who attends a restaurant, marketplace street, or highway. Eating *Barbacoa* includes the ritual of eating *Consomé*, making the taco, and adding hot sauce, lemon drops, chopped onion, and chopped cilantro. The sale of *Barbacoa* in central Mexico is atomized in micro, small and medium enterprises (Vélez et al., 2016), whose existence is made viable due to the tradition of domestic slaughter, the possibility of using any category of animal (lamb, cull ewes, or mutttons) as well as its viscera and head, and the immediate consumption of the finished product (Santoyo-Cortés & Martínez-González, 2021). The latter has stimulated the creation of productive regional clusters involving farmers, livestock intermediaries, *Barbacoa* cooks, suppliers of vegetables, spices, and maguey leaves, and manufacturers of ovens, pots, and other utensils. At the same time, some marketing initiatives are emerging for products other than *Barbacoa* (cuts, charcuterie, and other traditional preparations) as an attempt to reach new markets (López-Moreno & Miranda-de la Loma, 2018).

Studies on *Barbacoa* have addressed the social and cultural aspects of its preparation and sale, its role in rural livelihoods (Adapon, 2008; Estévez-Moreno et al., 2019; Ramírez, Vizcarra, & Serrano, 2021), as well as technological processing issues (Estrada-Solís, Figueroa-Rodríguez, Figueroa-Sandoval, Hernández-Rosas & Hernández-Cazares, 2016), and economic and financial aspects of this process (Islas-Moreno, Barrera-Perales, Aguilar-Ávila, & Muñoz-Rodríguez, 2020; Mondragón-Ancelmo et al., 2018; Mondragón-Ancelmo, Domínguez-Vara, Rebollar-Rebollar, Bórquez-Gastélum, & Hernández-Martínez, 2012). However, such studies tangentially address the final consumers of the product. Rubio, Torres, Gutiérrez, and Méndez (2004) compared the sensory characteristics of local and imported lamb carcasses cooked as *Barbacoa* under experimental conditions Thomé-Ortiz (2018) carried on an ethnographic study about the socio-cultural values that, transmitted through generations, have motivated the consumption of *Barbacoa* by urban consumers. The available evidence is not leading yet to an integrated understanding of the possible intrinsic and extrinsic aspects involved in consumer opinion on the quality of sheep meat (Sepúlveda, Maza, & Pardos, 2011; Font-i-Furnols & Guerrero, 2014) in the Mexican case. Nor has there been an in-depth study of the differences in consumer preferences and motivations regarding this product, which could help optimize the productive sector's strategies to serve the different market segments. In fact, in emerging economies such as Mexico, rising incomes, rural-urban migration, an increase in tertiary activities, exposure to international lifestyles and media, access to frequently updated information and telecommunication technologies, and the willingness to pay (WTP) more for differentiated quality traditional food products are all stimulating consumer segmentation (Javalgi & Grossman, 2016). The almost total dependence of sheep meat consumption on a single high-cost traditional dish usually cooked outside the home and of occasional consumption (Adapon, 2008; Partida et al., 2017) makes the study of Mexican consumers a strategic contribution towards the understanding of global trends in sheep meat consumption, and to the development of the national sheepmeat industry. As with other traditional Mexican foods, the perspective from consumers is also interesting towards their valorization and commercialization, given their importance in rural sustainability, social cohesion, and regional and national identity, where consumers are essential to driving their production (Serrano-Cruz, Espinoza-Ortega, Sepúlveda, Vizcarra-Bordi, & Thomé-Ortiz, 2018). Thus, the present study, exploratory in nature, is based on a survey of sheep meat consumers in the consumption context of restaurants specializing in *Barbacoa* preparation. Thus, this study aimed i) to explore the habits and motivation of Mexican consumers towards

sheep meat, and ii) identify and describe consumer profiles according to their perceptions and preferences regarding this product.

2. Material and methods

This study was conducted under the guidelines laid down by the Declaration of Helsinki. All procedures involving human subjects were approved by the Ethics Committee of Veterinary Faculty (CICUAL-DISP) from the Autonomous University of the State of Mexico-UAEM (Protocol ID 4117/2016E, approved in March 2019).

2.1. Study description

Given that 95% of sheep meat consumption in Mexico is as *Barbacoa*, this study was based on the application of surveys in three restaurants specializing (buying context) in the cooked and sale of this traditional dish. Data were collected every weekend (Saturday and Sunday) between October and December 2019. These 3 months coincide with the peak demand season (Partida et al., 2017). The time selected for the application of the surveys was 9 a.m. to 1 p.m., when there is the highest inflow of consumers, as *Barbacoa* is usually eaten as a breakfast or a late breakfast, as a midday snack, or as the main meal at lunchtime (Adapon, 2008; Ávila, Fernández, & Gómez, 2004; Ramírez et al., 2021). A non-probability sampling strategy on a next-to-pass basis was used (Chen, Huang, & Zhang, 2020; Filimonau, Lemmer, Marshall, & Bejjani, 2017). When approaching the potential respondent, the interviewer checked if the selection criteria were met (older than 18 years and consumer of sheep meat), introduced the project to check her/his willingness to participate, and administered the questionnaire face-to-face. When one response was obtained, the next person to pass the survey point was requested to partake. No incentives were offered. From 401 initially applied questionnaires, 332 were kept for subsequent data analysis after discarding those not fully answered (Table 1).

The selected restaurants in our study are strategically located in a tourist-gastronomic corridor in Toluca (State of Mexico, Mexico) on Mexican Federal Highway 55D. In addition to customers coming from the surrounding municipalities, these restaurants receive customers traveling between Mexico City and Toluca to north-central, western and northwestern Mexico, and the highest concentration of customers is on weekends. This corridor is one of the four most important in the country specializing in the selling of *Barbacoa*; the success of these restaurants lies in the fact that the region has an excellent culinary reputation for this product. Additionally, the state of Mexico is the largest producer of sheep in the country and has a high tradition of consuming *Barbacoa*. At the same time, Toluca is a city widely used by food market research, food marketers, and consulting companies since the socio-demographic

Table 1

Socio-demographic characterization of the sample population surveyed regarding gender, age, educational level, and origin (n = 332).

Consumers	Freq.	%
Gender		
Woman	217	65.4
Man	115	34.6
Age		
18–30	201	60.5
31–45	76	22.9
46–60	49	14.8
>60	6	1.8
Education level		
Elementary school	15	4.5
Middle school	55	16.6
High school	106	31.9
University	156	47.0
Origin		
Urban	182	54.8
Rural	150	45.2

profile of this town is a diverse, cosmopolitan area, which adequately reflects the opinion of the general population of the country (Miranda-De La Lama et al., 2017; Rojas-Rivas & Cuffia, 2020).

2.2. Survey structure

The questionnaire contained an introductory section with questions on the social-demographic characteristics of the respondents (gender, age, education level, origin -urban/rural-). The two following sections included only multiple-choice questions with a single answer option. The first one was to describe the respondents' consumption habits of sheep meat (*How often do you eat sheep meat? What is the more frequent preparation for how you consume sheep meat? What is the most frequent place where you consume sheep meat? Based on what criteria do you choose the place where you eat sheep meat? If you eat Barbacoa, do you prefer meat from wool or hair animals? Does the price of meat affect the frequency you purchase it?*). The second section focused on identifying the motivations and concerns about the quality of sheep meat and some related to the willingness of consumers to pay an additional premium (i.e., *What is your main motivation to buy sheep meat? Which attributes would motivate you to pay an additional price for sheep meat? What do you consider the main factor that affects the quality of sheep meat? Which of the following quality attributes would you prefer in the meat? What extra percentage would you be willing to pay for a product that guarantees the quality attribute that is most important to you?*). Finally, the third section aimed to approach the respondents' perception and preferences regarding sheep meat consumption (i.e., *Do you like the smell of sheep meat? Do you like the taste of sheep meat? Do you like the juiciness and tenderness of sheep meat? Do you like the appearance of sheep meat? Would you like to eat pre-cooked sheep meat? Do you think that sheep meat has better properties than other meats? Do you think that sheep meat has more nutrients than other meats? Would you prefer to eat locally produced sheep meat? Do you think sheep meat tastes better than other meats? Would you like to eat pre-cooked sheep meat? Would you prefer to eat locally produced sheep meat? Would you prefer that the sheep meat you eat is prepared traditionally? Do you think that the quality of the sheep meat produced and sold in Mexico is the same as imported?*). All questions of third section were drawn up following a Likert-type scale of five points: 1 = Definitely no; 2 = Probably not; 3 = Neither yes nor no; 4 = Probably yes; 5 = Definitely yes.

2.3. Statistical analysis

Univariate analyses were carried out with data of 332 valid questionnaires to describe the demographic features of participants. Significant associations (P -value < 0.050) between the distribution of categorical variables of Sections 1 and 2, and the socio-demographic characteristics of respondents, including frequency of consumption of sheep meat, were tested using the Chi-square or Likelihood ratio Chi-square tests, according to the expected cell frequencies of the contingency tables. Additionally, factor analysis was performed to understand the correlational structure and summarize the data from Section 3. The Principal Components Method was used as an extraction model, and the Kaiser-Meyer-Olkin (KMO) index and Bartlett test of sphericity were used to measure the high correlation between variables. Variables in the final model reported communalities > 0.5, and final factors were retained when their eigenvalues were > 1. A Varimax rotation was carried out to simplify the interpretation of factors (factor loadings > 0.5). A hierarchical cluster analysis was performed to profile meat consumers based on the factors obtained in the previous analysis. The distance measure was Squared Euclidean Distance, and Ward's method was the agglomeration criterion. The final number of clusters was defined based on the observation of the dendrogram. In the last step, each cluster was characterized by how they differed with Kruskal-Wallis and respective U-Mann Withney post-hoc tests for continuous variables, with Chi-square test and the respective standardized residual analysis (using a cut-off point of ± 1.96) for categorical variables. All statistical analysis

was performed with the IBM®-SPSS® software 22 version.

3. Results

3.1. Consumption habits

Most of the respondents consume sheep meat less than three times/month (41.3% 1–2 times/month, and 39.8% less than once a month), 13.3% consume it 3–4 times/month, and only 5.7% do it more than four times/month. No significant associations were found ($P > 0.05$) between the frequency of sheep meat consumption and the socio-demographic variables (age, sex, origin, and education level). *Barbacoa* is the primary way sheep meat is consumed, being chosen by 80.4% of respondents. It was followed by other traditional preparations as *birria* (5.1%) (soup or stew made from meat seasoned with a mixture of chilies, onion, garlic, cinnamon, vinegar, and several spices, and cooked at low heat in a pot) and *al pastor* (4.2%) (pieces of meat skewered on bars and roasted at a low temperature over a wood fire for several hours), which together were chosen by 9.3% of those surveyed. Finally, other preparations that were referred to as the primary way of consuming this meat included *en ataúd* (2.4%) (the open carcass or pieces of meat are cooked for several hours inside a wooden box with an interior metal lining covered with a box over which firewood is placed and heated. It is seasoned with wine or butter, salt, pepper, and a mixture of *chiles*), several preparations as a substitute for goat kid (2.7%), fine cuts (1.85), *mixiotes* (1.2%) (small pieces of meat marinated in a mixture of *chiles* and spices, which are placed inside a square of dried *maguey* stalk, which is then tied and steamed), processed products (1.5%), and others (0.6%). Sheep meat is consumed predominantly (85.5% of respondents) out of home in weekend stalls, marketplaces, specialized restaurants, and tourist corridors, where the predominant form of preparation is *Barbacoa*. The main feature used by respondents to choose the place to consume sheep meat is the flavor (49.7%), followed by hygiene (14.2%) and preparation or style (12.7%). Other criteria that were chosen less frequently included price (6.7%), tradition (6.7%), the origin of the animal (3.6%), closeness (3.0%), and other criteria (3.6%). However, 57.5% of the total respondents recognize that price is a factor that affects the frequency with which they buy this product. The majority (78.0%) of respondents prefer to eat *Barbacoa* prepared from wool breeds, compared to those who prefer hair breeds (19.0%) and those who know or are not sure (3.0%).

3.2. Preferences and willingness to pay for specific product attributes

Sensorial characteristics (smell, taste, color, appearance) are the main characteristic for respondents to buy sheep meat products instead of other meats (39.2% of consumers) (Table 2). Additionally, significant associations ($P < 0.05$) were observed between educational level and reasons for preferring sheep meat. Sensory attributes and animal welfare were associated with higher education of respondents; the health of animals was associated with those with high school education. Most consumers with elementary school education chose the criteria that sheep meat is better for human health. Additionally, it is highlighted that 20% of the people who have this educational level also reported that they do not buy sheep meat, which is markedly higher than observed in the other consumer groups.

Most respondents considered the general farm breeding/fattening conditions and the animal diseases as the main factors that affect sheep meat quality (53.0%), while manipulation of meat by operators and the slaughterhouse processes were the less mentioned (Table 3). A significant association was found between factors affecting the quality of sheep meat and the urban/rural origin of respondents, where those from rural settings prioritize farm breeding/fattening more frequently. At the same time, markets and products transport were more frequent concerns for urban consumers.

Sheep meat "free from antibiotics and hormones" was the most

Table 2

Main reason to buy sheep meat instead of other meats according to the education level of consumers surveyed (n = 332).

Attributes	Freq.	%	Education level (%)				P
			Elementary school	Middle School	High School	University	
Sensorial attributes	130	39.2	20.0	37.0	33.0	45.9 ⁽⁺⁾	<0.001*
Healthier animals	59	17.8	13.3	22.2	24.5 ⁽⁺⁾	12.1 ⁽⁻⁾	
Tradition	40	12.0	6.7	16.7	8.5	13.4	
Better for health	36	10.8	26.7 ⁽⁺⁾	5.6	15.1	8.3	
Environmentally friendly	23	6.9	6.7	11.1	6.6	5.7	
Animal welfare	19	5.7	0.0 ⁽⁻⁾	0.0 ⁽⁻⁾	2.8	10.2 ⁽⁺⁾	
Gourmet product	13	3.9	6.7	3.7	4.7	3.2	
I don't buy	8	2.4	20.0 ⁽⁺⁾	0.0	4.7	0.0 ⁽⁻⁾	
Other	4	1.2	0.0	3.7	0.0	1.3	

* Significance level established at *P*-value < 0.001 according to Likelihood-Ratio test. (+) Adjusted standardized residuals >1.96, indicating that the subcategory was observed more frequently than expected. (-) Adjusted standardized residuals <-1.96, indicating that the subcategory was observed less frequently than expected.

Table 3

Main process that affect sheep meat quality according to consumers' perception (n = 332).

Processes	Total		Origin		P
	Freq.	%	Urban	Rural	
Farm breeding/fattening conditions	108	32.5	26.4 ⁽⁻⁾	40.0 ⁽⁺⁾	<0.05*
Animal diseases	68	20.5	22.0	18.7	
Packaging/packing	44	13.3	11.5	15.3	
Transport, loading/unloading	34	10.2	13.2 ⁽⁺⁾	6.7 ⁽⁻⁾	
Preparing of sheep meat	34	10.2	8.8	12.0	
Livestock markets	10	3.0	4.9 ⁽⁺⁾	0.7 ⁽⁻⁾	
Meat workers	14	4.2	4.9	3.3	
Slaughter/processing at the abattoir	13	3.9	4.9	2.7	
Other	7	2.1	3.3	0.7	

* Significance level established at *P* < 0.05 according to Likelihood-Ratio test. (+) Adjusted standardized residuals >1.96, indicating that the subcategory was observed more frequently than expected. (-) Adjusted standardized residuals <-1.96, indicating that the subcategory was observed less frequently than expected.

chosen extrinsic quality attribute preferred for consumers, while "animal welfare" and "others" were the least chosen (Table 4). Significant associations were observed between this variable and the gender and age of respondents. Ecologic/organic products and biodegradable packing were associated with men's attitudes, while women preferred a product free from pathogens and diseases. Regarding age, the attribute "free from antibiotics and hormones" was preferred by consumers older than 29 years. Most respondents (67.2%) were WTP an extra price for a product that guarantees the quality attribute they consider most important (Table 5). The extra price of 4% to 5% was the most chosen category, while only 5.7% of consumers could pay more than 10%. However, it was found that respondents with high school education are WTP more (6.8% to 10%) and that those with the elementary school are less

Table 4

Main attribute that consumers would prefer in the sheep meat (n = 332).

Attributes	Total		Gender* (%)		Age** (years) (%)		
	Freq.	%	Woman	Man	18–30	30–45	>46
Free from pathogens and diseases	108	32.5	36.6 ⁽⁺⁾	25.2 ⁽⁻⁾	36.3	28.9	23.6
Free from antibiotics and hormones	92	27.7	30.6	22.6	19.9 ⁽⁻⁾	38.2 ⁽⁺⁾	41.8 ⁽⁺⁾
Organic/ecologic production	46	13.9	11.1 ⁽⁻⁾	19.1 ⁽⁺⁾	13.9	14.5	12.7
Local origin	32	9.6	10.2	8.7	10.9	9.20	5.60
Biodegradable packaging	24	7.2	4.6 ⁽⁻⁾	12.2 ⁽⁺⁾	8.5	2.6	9.1
Animal welfare	21	6.3	6.0	7.0	8.0	5.3	1.8
Type of animal: wool or hair	9	2.7	0.9 ⁽⁻⁾	5.2 ⁽⁺⁾	2.5	1.3	5.5

Significance level established at **P*-value < 0.01 and ***P*-value < 0.05 according to Chi-square test. (+) Adjusted standardized residuals >1.96, indicating that the subcategory was observed more frequently than expected. (-) Adjusted standardized residuals <-1.96, indicating that the subcategory was observed less frequently than expected.

interested in paying more for that attribute.

3.3. Consumers' segmentation

According to the factor analysis, perceptions and preferences that underlie the consumption of sheep meat can be grouped into four factors (Table 6): the first factor, called "preference for sensory attributes," which brings together the consumer's preference for the taste, juiciness and tenderness, appearance and smell of sheep meat. The factor "preference over other meats" groups the general properties, nutrients, and taste of sheep meat with others. The third factor, "appreciation of traditional/local attributes," brings together two questions regarding consumer preference for the local origin and traditional preparation of sheep meat. Questions grouped in the fourth factor, called "willingness to change," refer to consumers' willingness to eat sheep meat in a non-traditional preparation and their opinion about imported quality compared to the Mexican-produced sheep meat.

Cluster analysis identified three consumer profiles according to their perceptions and preferences towards sheep meat (Table 7; Fig. 1). "Passive consumers" or PC (n = 122) are the ones who least value the sensory attributes of sheep meat, which is considered no better or worse than other meats. They tend to be neutral consumers regarding the traditional attributes of sheep meat consumption, and they are not interested in the non-traditional ones. Although this group includes people with all education levels, it has significantly higher proportions of those with elementary and middle school and lower proportions of those with higher school education. "Wholehearted consumers" or WC (n = 126) are those who most value the sensory attributes of sheep meat, which is preferred over meat from other animals. While they appreciate the local origin of sheep and traditional preparation, they are also the most open to non-traditional sheep meat production and preparation features and tend to consume sheep meat more regularly than the remaining groups.

Regarding their socio-demographics, there is a significantly higher proportion of consumers with 21–45 years. "Deep-rooted consumers" or

Table 5

Willingness to pay a premium price for a sheep meat product guarantees the quality attribute that consumers consider most important (n = 332).

WTP (%)	Total		Education level				P
	Freq	%	Elementary school	Middle school	High school	University	
0	109	32.8	60.0 ⁽⁺⁾	38.2	23.8 ⁽⁻⁾	34.0	<0.05*
1–3	48	14.5	20.0	20.0	15.2	11.5	
4–5	82	24.7	20.0	25.5	17.1 ⁽⁻⁾	30.1 ⁽⁺⁾	
6–8	40	12.0	0.0	5.5	20.0 ⁽⁺⁾	10.3	
9–10	34	10.2	0.0	3.6	15.2 ⁽⁺⁾	10.3	
>10	19	5.7	0.0	7.3	8.6	3.8	

WTP indicates the percentage premium in the range of 0% to >10% that consumers were willing to pay for the quality attribute that consumers consider the most important. Significance level established at P-value >0.05 *according to Chi-square test, **according to Likelihood Ratio test. (+) Adjusted standardized residuals >1.96, indicating that the subcategory was observed more frequently than expected. (–) Adjusted standardized residuals <-1.96, indicating that the subcategory was observed less frequently than expected.

Table 6

Factorial analysis: classes of sheep meat consumers' preferences.

Variables	Median	Factor loadings	Explained variance
Factor 1. Preference for sensory attributes			
- Do you like the taste of sheep meat?	5.0	0.861	25.131
- Do you like the juiciness and tenderness of sheep meat?	5.0	0.824	
- Do you like the appearance of sheep meat?	5.0	0.817	
- Do you like the smell of sheep meat?	4.0	0.744	
Factor 2. Preference over other meats			
- Do you think that sheep meat has better properties than other meats?	3.0	0.821	18.325
- Do you think that sheep meat has more nutrients than other meats?	3.0	0.787	
- Do you think sheep meat tastes better than other meats?	3.0	0.761	
Factor 3. Appreciation of traditional attributes			
- Would you prefer to eat locally produced sheep meat?	4.0	0.833	13.494
- Would you prefer that the sheep meat you eat was prepared traditionally?	4.0	0.802	
Factor 4. Willingness to change			
- Would you like to eat pre-cooked sheep meat?	2.0	0.797	11.768
- Do you think that the quality of the sheep meat produced and sold in Mexico is the same as imported?		0.785	

Median: Median of consumers' responses to each question in a scale of 1 to 5, where 1 = "Definitely no" and 5 = "Definitely yes". Cronbach α = 0.759; KMO = 0.797; P- value of Bartlett's Test of Sphericity <0.001; Total explained variance = 68.719.

DC (n = 84) appreciate traditional-local attributes, in line with their lower willingness to consume pre-cooked meat or value foreign better than Mexican meat. These consumers like the sensory features of sheep meat, but they do not prefer it over other meats. Most consumers in this group have a higher education level and are 18–30 years.

4. Discussion

Consumers in all markets demand enjoyable, safe, and healthy food products that are of high quality. However, quality from a consumer's perspective is subjective, and thus assessments of meat quality can vary across individuals, societies, and cultures (Henchion, McCarthy, Resconi, & Troy, 2014). Sheep meat products are popular in many countries because of their unique nutritional properties, physicochemical composition, sensory attributes, and distinct flavors compared to other red meats (Teixeira, Silva, & Rodrigues, 2019). However, despite the deep roots and growing demand for traditional products made with sheep meat in Mexico (Parsons & Nicholson, 2017), scientific

information on consumer perceptions of this type of meat is still minimal. From this perspective, our study is one of the first to address consumers' perceptions towards sheep meat quality, and the findings could have implications on schemes of labeling, commercialization, and sale strategies of coked sheep meat products.

4.1. Consumption habits

Our results reveal some crucial elements linked to the consumption and potential of sheep meat in Mexico. In the first place, it is a product that depends significantly on a single form of preparation, the *Barbacoa*. This dish is one of Mexico's most emblematic traditional foods (Rojas-Rivas, Rendón-Domínguez, Felipe-Salinas, & Cuffia, 2020), and their artisanal production still prevails over the industrial one and is a symbol of contemporary Mexican culinary identity (Pilcher, 2014). Nevertheless, no one has suggested that *Barbacoa* is deserving of cultural protection (Brulotte & Starkman, 2014). Secondly, the purchase of sheep meat is closely related to foodservice *Barbacoa* establishments due to the complexity of its preparation and its festive or symbolic nature. Thirdly, the above is also linked to the high price of sheep meat compared to other commonly consumed meats, making the final price high, fluctuating between 20 and 40 USD/kg (Thomé-Ortiz, 2018).

Consequently, some charismatic food heritage products tend, due to their price, to become of occasional consumption and to be intended primarily for important celebrations (Batat, 2020). A relevant finding of this study is that although the price is a determining factor in the frequency of consumption of *Barbacoa*, the main criterion for choosing the food establishment is determined mainly by the taste of the product, and not necessarily by hygiene, style of preparation or price, among other factors. A particularity of *Barbacoa* is that its preparation does not distinguish between commercial categories of animals, so lamb, adult, or discarded sheep can be used. Usually, this is not communicated to the consumer, although the price of *Barbacoa* per kilo can indicate what type of animal was used. The consumer may demand to be informed of such details in the future. Finally, consumers prefer *barbacoa* from wool rather than hair sheep breeds because the tradition originated with wool animals (Rambouillet, Hampshire, Dorset, Suffolk, and Creole). However, in the last 20 years, the Mexican sheep herd has been progressively reconverted towards producing hair sheep breeds (Pelibuey, Katahdin, Dorper, and Blackbelly), as these have extended breeding season and high fertility (Hernández-Cruz et al., 2009). The latter is likely to constitute a consumer confidence problem for food establishments in the future because consumers often perceive the hair sheep as a goat. Although *Barbacoa* made with goat meat has roots in some populations in Mexico, the inclusion of goat in *Barbacoa* can be considered an adulteration of the product in the collective imagination.

4.2. Preferences and willingness to pay for specific product attributes

Eating quality in sensory perception is one of the key factors influencing red meat demand, determining and reinforcing consumers' food

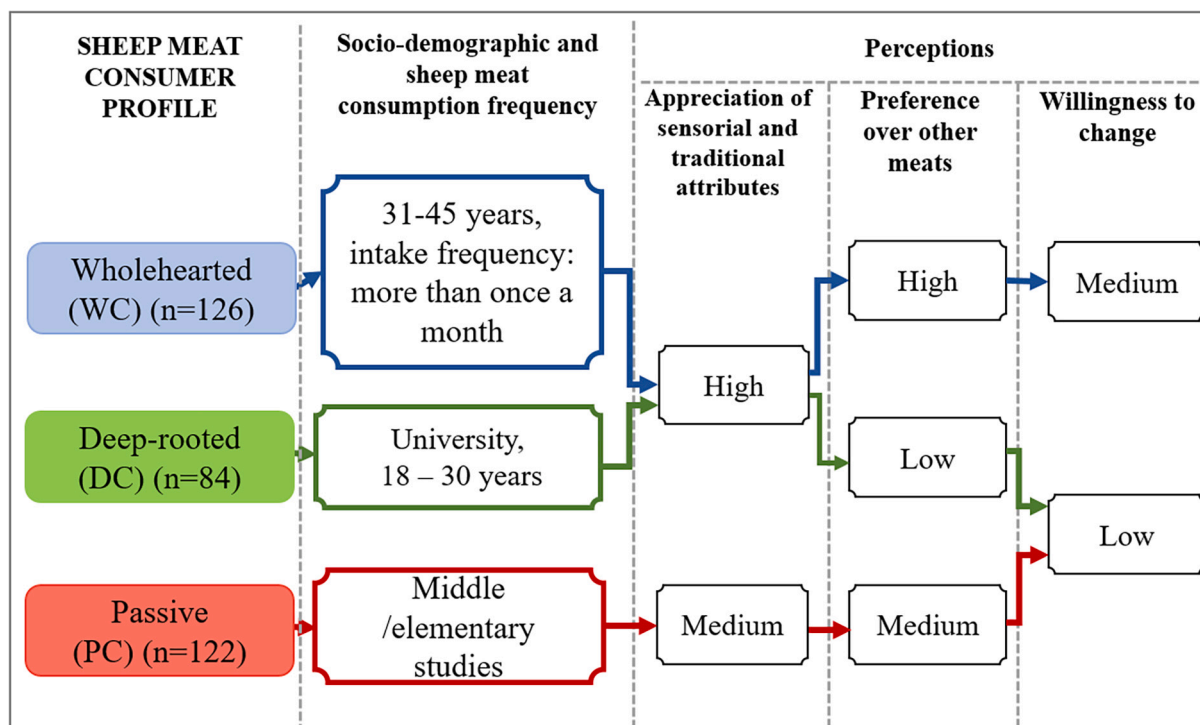


Fig. 1. Simplified illustration of Mexican consumer segments based on their perceptions towards sheep meat (n = 332).

choice and repeat purchase behavior (Pannier, Gardner, O'Reilly, & Pethick, 2018). According to our results, the main reason for buying sheep meat against other meats is that consumers consider it a product with better sensory attributes, from healthier animals, traditional character, and healthier. However, these perceptions are influenced to some extent by educational level. It is striking that consumers with primary education perceive sheep meat as healthier and claim not to buy it regularly. This phenomenon has recently been reported by Espinoza-Ortega et al. (2021), who identified a group of Mexican consumers with a low level of education and low economic perceptions, limiting their ability to purchase products that they consider healthy, such as meat. However, our study indicates that this type of consumer strategy to access sheep meat is to participate in festivities or be invited by other people (i.e., family members or bosses).

On the contrary, consumers with higher educational levels prefer sheep meat for its sensory attributes and relate it to animal welfare. These results are consistent with those reported by Miranda-De la lama et al. (2017) and Estévez-Moreno, María, Sepúlveda, Villarroel, and Miranda-de la Lama (2021), where consumers with higher education exhibit more significant concern for animal welfare is sometimes associated with better organoleptic quality of the meat. The idea that sheep production systems in Mexico are less intensive compared to those of other species (Vázquez-García, 2013) could also support the perception of these consumers about the higher welfare of these animals (Goddard, Waterhouse, Dwyer, & Stott, 2006), as well as the general idea that they are healthier (Coleman, Jongman, Greenfield, & Hemsworth, 2016).

The importance of the different attributes of sheep meat in the formation of consumer preferences has been widely studied, particularly in Europe (Rabadán, Díaz, Brugarolas, & Bernabéu, 2020). Recently, it has been shown that sheep meat consumers tend to apply a more holistic approach during purchase and consider a broader range of factors other than product appearance and their evaluation of the possible eating experience (Ferguson, Schreurs, Kenyon, & Jacob, 2014). In this sense, the processes that most affect the quality of sheep meat, we found that consumers associate it more with *antemortem* than *post-mortem* processes. Our results indicate that consumers' concerns are linked to the

awareness of their familiar processes, according to their rural or urban origin. Thus, while the rural consumers consider the rearing conditions on the farm as an essential factor affecting sheep meat quality, the urban ones identify the transport of live animals and the livestock markets as risk factors. Our results are in line with that described by Buddle, Bray, and Ankeny (2018), who found in Australia that the concern of consumers is focused on the livestock activities that are most visible to them, with transport being a concern in people of cities and farming systems for rural people.

Our results show that consumers would be WTP a premium when buying sheep meat, especially for three attributes: Free from pathogens and diseases, free from antibiotics and hormones, and organic/ecologic production. Mexican consumers' concern for food safety is a constant due to the cultural trend of selling traditional street food such as *Barbacoa* (Alimi, 2016) and distrust of the livestock industry for the alleged use of hormones and growth promoters (Ngapo, Varela, & Lozano, 2017). The WTP more for organic sheep meat is an interesting result, a possible explanation for this result may be related to the tendency for organic labeled foods to carry a 'halo effect,' in which consumers associate meat with higher quality, safer, tastier, or healthier products, this is especially important because of the epidemic of obesity and diabetes that affects the country (Estévez-Moreno et al., 2021). However, WTP a premium is also included by gender and age for some attributes. For example, women are more WTP for guaranteed safe meat, while men would pay for organic meat, meat identified by the type of animal (hair or wool), and meat packaged in biodegradable containers. These results contrast to other studies that indicate that Mexican women are more concerned about organic food and environmental issues (Escobar-López, Espinoza-Ortega, Vizcarra-Bordi, & Thomé-Ortiz, 2017). A possible explanation could be the importance that each gender assigns to informality and the few guarantees consumers have about the quality of the *Barbacoa* they buy, despite the high prices paid for it.

Overall, 67% of consumers agreed to pay a premium price for a sheep meat product that guarantees the quality attribute that matters most to them. The socio-demographic characteristics of the buyers like age, gender, income, and education have been considered important factors

Table 7
Profiles of consumers according to their attitudes and preferences regarding sheep meat (n = 332).

Variables	Passive Consumer (PC) (n = 122)	Wholehearted Consumer (WC) (n = 126)	Deep-rooted Consumer (DC) (n = 84)	P
Factors (F) (median)				
F 1: Taste for sensory attributes	3.75 ^a	5.00 ^b	4.25 ^c	<0.001*
F 2: Preference over other meats	3.00 ^a	4.00 ^b	2.00 ^c	<0.001*
F 3: Appreciation of traditional attributes	3.00 ^a	4.50 ^b	5.00 ^c	<0.001*
F 4: Willingness to change	2.00 ^a	3.00 ^b	1.50 ^c	<0.001*
Gender (% consumers)				
Woman	68.9	60.3	67.9	NS**
Man	31.1	39.7	32.1	
Origin (% consumers)				
Urban	62.3	50.8	50.0	NS**
Rural	37.7	49.2	50.0	
Education level (% consumers)				
Elementary school	7.4 ⁽⁺⁾	4.0	1.2	<0.01**
Middle school	24.6 ⁽⁺⁾	14.3	8.3 ⁽⁻⁾	
High school	32.0	33.3	29.8	
University	36.1 ⁽⁻⁾	48.4	60.7 ⁽⁺⁾	
Age (years) (% consumers)				
18–30	62.3	51.6 ⁽⁻⁾	71.4 ⁽⁺⁾	<0.05***
31–45	22.1	29.4 ⁽⁺⁾	14.3 ⁽⁻⁾	
46–60	13.9	15.9	14.3	
>60	1.6	3.2	0.0	
Frequency of sheep meat consumption (% consumers)				
<1 time/month	44.3	31.0 ⁽⁻⁾	46.4	<0.05**
≥1 time/month	55.7	69.0 ⁽⁺⁾	53.6	

Significance established at $P < 0.05$ according to *Kruskal-Wallis test, ** χ^2 test, and ***Likelihood ratio test. ^{a,b,c} Different letters in each factor (row) indicate significant differences ($P < 0.05$) between clusters according to the Mann-Whitney U test. ⁽⁻⁾ and ⁽⁺⁾ superscripts indicate a Z-score higher (or lower) than ± 1.96 .

that may affect their willingness to pay for food products (Ali & Ali, 2020). Our results reveal that education is the unique demographic variable that may significantly affect the buyers' willingness to pay. Our results regarding WTP for different quality attributes should be understood in the sheep meat market, which is a high-priced product compared to other meats. Therefore, it is understandable that the extra payment percentages that consumers are willing to make are concentrated in ranges below 10% and that consumers with primary education, possibly linked to lower purchasing power, are less willing to make these payments. Our results are in line with considerable evidence that higher educational attainment makes consumers more likely to pay additional amounts while buying food products with attributes related to health and wellness (Ali & Ali, 2020), animal welfare (Miranda-de la Lama et al., 2019) or organic production (Strydom, Burrow, Polkinghorne, & Thompson, 2019), among others. Beyond incomes, this may also be related to the fact that more educated people are likely to be more prone to seek information, which may be reflected in their intention to reward the meat chain that offers the attributes they know and consider valuable.

4.3. Consumers' segmentation

Food consumption behavior is a complex issue influenced by many

factors ranging from biological and psychological to environmental and lifestyle factors (Grasso, Hung, Olthof, Brouwer, & Verbeke, 2021). In our study, four dimensions identified through factor analysis are part of the criteria that have been defined in multiple studies to profile consumers of both traditional and non-traditional products. These include sensory attributes (Sañudo et al., 1998), preference over other meats (Miller, 2020), appreciation of attributes considered part of the food tradition (Mao, Hopkins, Zhang, & Luo, 2016), and willingness to change (Bernués, Ripoll, & Panea, 2012). In addition, the cluster analysis suggested the existence of three clusters or consumer profiles labeled as passive, wholehearted, and deep-rooted. These profiles were determined by the four dimensions obtained from factor analysis.

Our results indicate the existence of a profile that we call "passive consumers." This profile represented 36% of the consumers surveyed and shows a low level of education and interest in the sensory attributes of sheep meat and marked attitudes of indifference concerning the preference of this meat over other meats and a total disagreement to change their preference traditional form of consumption. In other words, this is a consumer who eats sheep meat, especially *Barbacoa* dish, as part of pro-social behavior in a traditional environment, rather than as an innate taste for the product. One possible explanation for this is that Mexican culinary culture is part of the festive and symbolic elements of the collective identity (Pilcher, 2018). This profile may correspond to the diner invited by other consumers more involved in sheep meat consumption in restaurants. Unlike other meats such as beef or pork, various studies show that sheep meat has characteristic flavors that can be difficult for all consumers to accept. During the last ten years, the nascent Mexican sheep meat industry has attempted to diversify sheep meat products by incorporating the supply of fine cuts to select restaurants (Mondragón-Ancelmo et al., 2014). The consumer may be the most difficult to gain loyalty because of his reluctance to eat sheep meat other than *Barbacoa* due to his poor taste for the sensory attributes of the meat.

In contrast, the "Wholehearted consumers," who were 37% of the sample and based on the combination of their perceptions and preferences, and their frequency of consumption, could be considered as the most involved sheep meat consumers (Verbeke & Vackier, 2004). This group significantly concentrates people between 31 and 45 years of age, who are economically active and are part of the regular clientele of *Barbacoa* food establishments. They represent the most loyal consumer segment for this type of meat and are probably the most likely to maintain their consumption in the face of adverse socioeconomic scenarios where the product's high price will be a factor that restricts their demand (Espinoza-Ortega et al., 2021). Likewise, this segment may form part of future trends in sheep meat in Mexico because they are the most willing to incorporate changes in the cooking and origin of the product. In terms of interest in the industry, the value of this type of consumer lies in their innate taste for sheep meat compared to other meats (Ripoll & Panea, 2019).

Finally, "deep-rooted consumers" represent assiduous consumers of traditional products and dishes associated to Mexican gastronomy, and evidence, to some extent, some level of ethnocentrism (Fernández-Ferriñ, Calvo-Turrientes, Bande, Artaraz-Miñón, & Galán-Ladero, 2018). Despite their youth, these consumers are reluctant to accept innovations in food products they consider should be traditional, such as *Barbacoa*, whose sensory attributes they also value positively. The age range of our study frames this profile very close to what is known as the millennial generation. According to various studies, this generation is considered well-informed and more engaged than previous generations (i.e., Generation X, baby boomers; Bergman, Ferrington, Davenport, & Bergman, 2011). This generation is characterized by its interest in traditional and organic foods but is particularly concerned about the authenticity of these products (Molinillo, Vidal-Branco, & Japutra, 2020). Millennials represent 25% of today's consumers, so millennials' attitudes may significantly predict future food choices and drive changes in the food landscape (Young & McCoy, 2016). Possibly the price of *Barbacoa* is one

factor restricting their frequency of consumption, given that a portion of consumers in this group may be university students or are starting their professional careers. In sum, the existence of this group represents an opportunity for the continuity in the consumption of traditional sheep meat products in Mexico, and at the same time, a challenge in the face of technological development in traditional foods, which does not constantly adjust to consumer acceptability (Fibri & Frøst, 2019).

It is important to remark that this study's sample of consumers does not have a uniform distribution in terms of their socio-demographic characteristics, nor does it obey a socio-demographic profile of sheep meat consumers in Mexico, which is yet to be described. Although our study did not seek to identify or describe consumer profiles based on their sociodemographics, further studies on these variables would better understand possible aspects behind current and future consumption trends beyond the evolution of prices. The latter is especially relevant due to the traditional character of sheep meat consumption, closely related to the transmission of values and preferences transmitted and reinforced by generations within households (Thomé-Ortiz, 2018). Different attributes of sheep meat are behind its preference, and the relative importance of the processes that affect its quality from the consumers' perspective deserve further analysis, given their influence on the purchasing behavior of consumers, especially those with ethical concerns. Attending to the possible influence of consumption context in consumers' responses (Jaeger & Porcherot, 2017), additional research is needed to analyze the preferences and motivations of consumers who do not usually consume sheep meat prepared as *Barbacoa* and of those who only do so in establishments other than specialized restaurants. Such studies, together with others involving the perceptions and preferences of people who never consume sheep meat, are crucial for identifying possible bottlenecks that hinder the consumption of this animal protein in Mexico. It would also contribute to designing strategies to reduce its dependence on a single dish consumed outside the home.

Finally, the current expectations of a large part of the national sheep sector are oriented towards the commercialization of fine cuts, which have a presence in restaurants in some of the country's cities. However, our results show that sheep meat is deeply rooted in Mexican gastronomic tradition and suggest that the nascent sheep industry should focus its efforts on enhancing the value of the traditional character of this consumption as a competitive advantage. Consequently, it is necessary to create or promote quality brands or protected geographical indications that provide consumers with guarantees regarding the origin of the animals (domestic vs. imported), breeds (hair vs. wool), production systems (transhumance, grazing, or herding), or type of traditional preparation (regional cooking styles). At the same time, research is needed on the rescue of culinary traditions involving sheep meat, cooking, processing technology, and new methods of marketing and communication with the national consumer.

5. Conclusions

The results showed that Mexican consumers could be segmented based on their perceptions, habits, and preferences towards sheep meat. The multivariate analysis suggested there are three clusters or consumer profiles we named "passive," "wholehearted," and "deep-rooted," which explained the associations among attitudes, some demographic variables, and consume frequency. Our results also conclude that Mexican consumers' perceptions, preferences, and consumption habits are highly related to a charismatic dish of Mexican cuisine such as sheep *Barbacoa*. For consumers, sheep meat is perceived as food with unique sensory attributes, coming from healthier animals than other species and traditional characters. Their willingness to pay extra is subject to the guarantee that the meat is safe, free of hormones and antibiotics, and to a lesser extent, certified organic.

Furthermore, the willingness to pay for sheep meat with unique quality attributes is affected by the educational level of consumers, with university students being willing to pay up to 10% extra for sheep meat

with unique quality attributes. Considering a large Mexican migrant population in Canada and the United States, *Barbacoa* may have great potential for exporting to those countries. Therefore, artisan chefs and the nascent sheep meat industry need to consider these concerns in developing marketing and trust strategies to attract, maintain, and build loyalty among consumers.

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