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RABBIT MEAT IN THE EAST OF ALGERIA: MOTIVATION AND OBSTACLES TO CONSUMPTION

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Abstract: In Algeria, rabbit meat consumption is insufficiently anchored in culinary traditions compared to other types of meat that are widely consumed, namely sheep and chicken. The purpose of this research is to investigate the influence of sociogeographic variables, both intrinsic and extrinsic quality cues, on consumption frequency, purchasing decision, motivations and the main deterrents to rabbit meat consumption. A survey is conducted with 360 consumers across 15 *wilayas* (districts) in Eastern Algeria. The results help us draw a conclusion that rabbit meat is consumed in all surveyed *wilayas* with a low frequency of consumption for the majority of respondents (79%). On the one hand, the causes of consumption are mainly: good taste (59%) and nutritional value (27%). On the other hand, the limiting factors are different: scarcity of rabbit meat on the market (42%), price (22%), eating habits (17%), lack of information on nutritional value (13%), bad taste (3%) and its resemblance to cat meat (3%). Regarding purchasing criteria, tenderness (58%) and freshness (14%) were chosen by most consumers. Although most consumers recognise the nutritional benefits of rabbit meat, it is poorly ranked in the choice of its consumers, placing it fourth after sheep, beef and poultry. Cross tabulation results show that gender, employment status and geographical areas are three variables that significantly affect the consumer's perception and behaviour towards rabbit meat. This study is the first to analyse the Algerian consumer profile and sheds light on factors encouraging and hindering rabbit meat consumption.

Key Words: meat rabbit, consumer profile, consumption frequency, purchasing, Algeria.

INTRODUCTION

Meat is an essential part of the everyday diet of a significant proportion of any society, as it is considered a valuable food (Fayemi, 2012). According to the statistics presented by Soare and Chiurciu (2017), its consumption is a crucial indicator of the living standard. Moreover, in developing countries, the growth of meat consumption is likely to increase. The average annual consumption of meat in developed countries is 75.5 kg/capita year, whereas consumption estimation in developing countries is of 33.9 kg/capita year. Worldwide, the levels of meat consumption are projected to increase by 72% in 2030 compared to the situation in 2000 (Fiala, 2008; Udomkun *et al.,* 2018).

The increase in meat consumption is a sign of a better future with regard to malnutrition levels among people with lower income in most African countries, which also suffer from micronutrient deficiency (Neumann *et al.,* 2003).

The meat consumption model adopted in Southern Mediterranean countries is focused on sheep and poultry meat (FAO, 2014). In Algeria, the diet consists of poultry, eggs, sheep, and beef, whereas the consumption of goat and camel meat is much lower. The kinds of red meat consumed by Algerians are primarily sheep meat 55% and beef 34%, with an average consumption of 10.5 kg/capita year, whereas the average consumption of white meat is 15 kg/capita year. Statistically, despite the increase in meat consumption, particularly of white meat, Algerians

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consume the lowest amount of meat in the Maghreb, due to the low production rate. Comparably, Moroccans consume 15.9 kg/capita year and the Tunisians 18.6 kg/capita year (Sadoud, 2011; Chikhi and Bencharif, 2016).

Algeria produces more than 26 million sheep, 2 million cattle and an average production of 300 000 t of white meat per year (MADR, 2017). Meat importing is a means of regulating the market during periods of high demand, i.e. Ramadhan and several other religious holidays. Imported meat is mainly frozen beef (ONS, 2014a). Algeria imports almost 40 000 t of frozen meat every year, in addition to live cattle and chickens. Furthermore, in 2013, Algeria imported 19 784 t of live bovine animals from France, 20 000 t of fresh or chilled bovine meat from Brazil and 40 199 t from India (ONS, 2014b).

In Algeria, there is a pressing need for increased animal production to meet the ever-growing demand for animal proteins (Zerrouki *et al.,* 2004; Lounaouci *et al.,* 2008). In order to diversify Algeria's animal protein supplies and fulfil the food needs of the population, the authorities have implemented a series of measures, such as the growth of micro-livestock production, in particular for the processing of white meat, i.e. poultry, rabbits and turkey (Zerrouki *et al.,* 2005). Those programmes are designated the National Agricultural Development Plan (PNDA), initiated in 2000, and National Fund for Regulating Agricultural Development (FNRDA) launched in 2008.

Their main objectives are to support agricultural activities and increase animal production in order to modernise, renovating the livestock infrastructures, and to ensure a good income for farmers, slaughterhouse owners and converters. Other policies have been introduced in certain Algerian regions including, for example, the coaching of young breeders prior to the creation of a rabbit unit, the setting up of facilities with local materials and the allocation of 16 females + 2 males for each unit.

Moreover, new strategies have been proposed in the rabbit genetic improvement programmes in hot climate countries like Egypt and Saudi Arabia (Youssef *et al.,* 2008). In this regard, a synthetic rabbit line has been created in Algeria since 2003 through crossbreeding. The females are from the local population, while the males are from the French strain INRA 2666. This is considered a new approach to improve rabbit production. In addition, the new line has showed 20% more litter size and higher growth rate and weight than the local population (Zerrouki *et al.,* 2014). Worldwide, the use of the rabbit is justified by its different attributes, as it has a short reproductive cycle, of around 30 to 32 d of gestation. They are particularly prolific, with up to 40 to 60 kits per year, i.e. about 8 to 12 kits per litter (Dalle Zotte, 2014).

Additionally, according to Bodnar and Horvath (2008), rabbit meat is a nourishing alternative for people. It has well known nutritious characteristics such as low cholesterol and high protein. It also has high and balanced contents of essential amino acids along with easy digestibility, which gives rabbit meat proteins that increase their biological value (Hernández and Dalle Zotte, 2010). Relatedly, the rabbit also has a great capacity to add value to the by-products of the Agri-Food industries (Bolet *et al.,* 2012; Petrescu and Petrescu-Mag, 2018). According to FAO (2018), Algeria is ranked tenth in the world, with an estimated production of 8468 t in 2018, which represents 0.6% of global world production, i.e. 1 393 899 t in 2018. This is a slight increase compared to 2017, which represents 8406 t. As a matter of fact, there is still little research into the determinants of the level of meat consumption among consumers (Laestadius *et al.,* 2013). Only a few studies focus on the African context, where food quality and malnutrition remain huge challenges (Onifade *et al.,* 2010; Mailu *et al.,* 2012; Mailu *et al.,* 2017; Adanguidi, 2020).

Most of the research conducted on rabbits in Algeria to date has often focused on carcass production, fertility and yield (Zerrouki *et al.,* 2014; Belabbas *et al.,* 2016; Kadi *et al.,* 2018; Belabbas, 2019). To the best of our knowledge, in Algeria, studies about rabbit meat production are scarcely reported. However, those focusing on consumers' preferences, perceptions or motivation related to rabbit meat are non-existent. This study is believed to be the starting point for investigating and reporting Algerian consumers' perceptions and behaviours related to rabbit meat. Uncovering the consumers' perceptions on specific product is considered a success factor in today's competitive market (McEachern and Schröder, 2004; Groot and Albisu, 2015; Montero Vicente *et al.,* 2018). Consequently, this situation encouraged us to question factors that influence consumers' consumption and purchase of rabbit meat. Is it related to sociogeographic factors, to some meat quality cues or both of them? In this context, the study's objectives are to assess the extent to which sociogeographic factors and both intrinsic and extrinsic quality cues influence consumers' frequency of consumption, purchasing decision related to rabbit meat, motivation and obstacles underlying low consumption.

MATERIAL AND METHODS

Study area and sample selection

Our Fieldwork was carried out in 15 *wilayas*, i.e. 15 geopolitical districts. More than 47 municipalities were visited in the Eastern part of Algeria (Figure 1) during a period that lasted from October 2016 to March 2017. The selected participants agreed to voluntarily participate only within the criteria of rabbit consumption and belonging to our target areas of study. The sample size encompassed 360 interviews, yielding an error of ±5.16% and a confidence level of 95%. The percentage of population with the feature studied (p) and without the feature studied (q) were considered 0.5. Petrescu and Petrescu-Mag (2018) used an error of 6.65% in a study on Romanian consumer behaviour related to rabbit meat as a functional food; they also reported that even though the usually accepted error in social science is 4-5% (Cea, 2010), higher levels are used and accepted as long as their level is acknowledged. Additionally, our sample error was acceptable as long as there are numerous studies in social sciences that focused on food or other topics with results associated with higher error. For example, an error of 7% was accepted in a study on consumers' willingness to pay for nutritional claims (Rhormens *et al.,* 2017). Likewise, an investigation on perceptions regarding Community Based Marine Ecotourism relied on results with an error of 7% (De-Magistris and Lopéz-Galán, 2016) and in a study by Pérez López *et al*. (2005) on organisational learning, an error of 6.9% was used.

The survey was conducted face-to-face and each of the questionnaires took about five to ten minutes to complete. This method allowed us to avoid missing cases, as all questionnaires were verified after each interview. Before carrying out the actual survey, an initial phase of our fieldwork was based primarily on gathering information on rabbit breeding units that are located in different *wilayas*. We used the findings reported in the literature review. The second step revolved around gathering contact details and addresses of rabbit breeders and butchers from technical institute of animal production, some producer organisations and researchers. Afterwards, 30 members of the breeders and butchers' families, work colleague, friends, and neighbours volunteered to form small groups, where each group included one or two consumers from each *wilaya*. Participants were explicitly asked to comment on the clarity of the questions. Thereafter, some questions were reformulated for the sake of enhanced precision and clarity. After being tested, our sample of consumers was selected in the same way, i.e. using the contact details and addresses of families and individuals of rabbit breeders and butchers. After each respondent agreed to participate in the survey, the interview appointment was planned according to the respondent's free time.

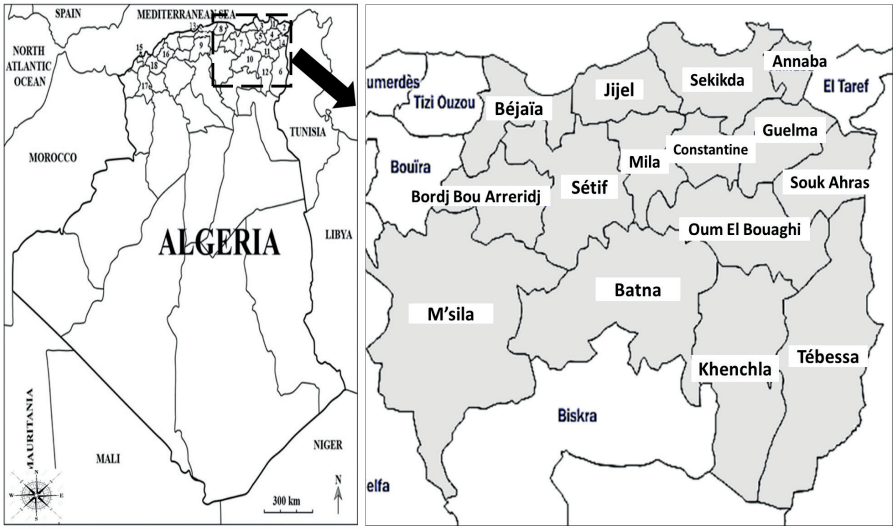

Figure 1: Geographical map showing the distribution of the *wilayas* surveyed (The study area).

Our questionnaire consisted of 12 questions divided into three parts, including information focusing on rabbit meat consumption frequency, motivation and obstacles to consumption, the purchase and selling price, preferences and nutritional benefits. The questionnaire encompassed different types of questions, i.e. closed questions with multiple choice, semi-enclosed, and open questions that allow the interviewer to choose a specific answer or give their opinion freely.

Attributes and variables

To investigate the factors that influence consumer's consumption and purchasing of rabbit meat and the reasons for low consumption, five sociogeographic variables were applied as main control variables, as follows: Age: the ranks considered were 18-29, 30-39, 40-49, 50-59, and older than 60. Gender: male or female. Marital status: single or married. Employment status: unemployed, employed, farmer or breeders, trade, student, retired, housekeepers, and others. Finally, geographical location, i.e. the case study where interviews took place, which are 15 *wilayas* from Eastern part of Algeria. *Wilayas* in the case study are: Bordj Bou Arreridj, Mila, Sétif, Batna, Béjaïa, Constantine, Oum El Bouaghi, Guelma, Souk Ahras, Sekikda, Jijel, Tebessa, Annba, Khenchla, and M'sila.

The choice of the previous five sociogeographic variables was based on several studies focusing on meat consumption, particularly rabbit consumption (Mailu *et al.,* 2017; Schmid *et al.,* 2017; Escribá-Pérez *et al.,* 2017; Islam *et al.,* 2018; Montero Vicente *et al.,* 2018; Adanguidi, 2020; Szendrő *et al.,* 2020). In order to understand the factors affecting consumer behaviour, motivation, perception, attitudes and expectation towards the different types of meat, generally the scientific approach included attributes that refer to both extrinsic and intrinsic quality indicators. Intrinsic quality cues are those which are physically part of the product itself, e.g. texture, tenderness, colour, flavour, freshness and visible drip and visible fat. Whereas extrinsic cues are not physically part of the product, e.g. price, promotion, designation of origin, quality labelling and presentation (Acebrón and Dopico, 2000; Glitsch, 2000; Becker *et al.,* 2000; Grunert *et al.,* 2004; Grunert, 2006). Some authors suggest other indicators as psychological cues, such as beliefs, attitudes and expectations, along with major background cues, for instance safety, nutrition, sustainability and ethics (Troy and Kerry, 2010; Font-i-Furnols and Guerrero, 2014). Considering the findings from the literature review, the choice of meat attributes was made without using a scale. We simply asked the respondents to choose the attributes which mainly motivate good taste and tenderness etc., or hinder their consumption, such as availability, price etc., or those related to their purchasing decision, like colour, freshness and breed.

Statistical analysis

The statistical data analysis techniques used in this study were as follows: (i) Univariate analysis describing the data using basic statistics and frequency distributions. Descriptive statistics were used to get an overview of the data and information about its distributions and frequencies of answers. (ii) Bivariate analysis, specifically, cross tabulations and factor analysis. Chi-square contingency tests were used to determine whether meat quality attributes were independent from sociogeographic characteristics. Factor analysis was used to have a global image of the associations between the various variables and factors. Two software packages were used for statistical processing, namely Epi-Info software version 7 and STATGRAPHICS (2009). Differences were considered statistically significant at a level of $P<0.05$. Examples of this methodology can be found in (Beal *et al.,* 2004; Mailu *et al.,* 2017; Islam *et al.,* 2018; Montero Vicente *et al.,* 2018; Szendrő *et al.,* 2020).

RESULTS AND DISCUSSION

Sociogeographic profile of consumers

First of all, to give a better picture of the sample, some sociogeographic characteristics of the respondents are described. The majority (59%) of respondents are men, with 212 compared to 148 female respondents (41%) (Table 1). Moreover, the predominant presence of males in our sample is similar to the Algerian reality, which has 49.4% women and 50.6% men (ONS, 2012). The average age of consumers is 40 yr. Some 53% of consumers belong to the younger age categories (18-29 and 30-39 yr), i.e., the economically active population. According to data from the national statistical office (2012), these percentages represent the characterisation of the age of the Algerian people, as 75%

of them are less than 25 yr old (ONS, 2012; Chikhi and Padilla, 2014). The two studies carried out by Sadoud (2019) in the Tiaret region of Algeria, on perception of lamb meat, and the one conducted by Adanguidi (2020) in Benin focused on consumer preference for rabbit meat, show age percentages very close to those observed in this study.

Concerning employment status, most respondents are public sector employees (24%), farmers and breeders (18%), housekeepers (10%). There are also a few students (8%), traders (8%), retired public servants (6%) and unemployed persons (5%), whereas 16% of them have other activities i.e. doctor, teacher, builder etc. In 56% of cases, rabbit meat consumers are married. Looking at the geographic distribution, the majority of consumers (180; 59%) belonged to six main *wilayas*: Bordj Bou Arreridj, Mila, Sétif, Batna, Béjaïa, and Constantine. These are the main areas where rabbit breeding units are present; other areas presented a low number of consumers, such as the following *wilayas*: Oum El Bouaghi, Guelma, Souk Ahras, Sekikda, and Jijel etc.

Consumption frequency according to sociogeographic variables

Table 2 shows the cross tabulations for consumption frequency and sociogeographic characteristics of rabbit meat consumers with statistically significant coefficients. According to the table, the majority of consumers represented (79%) rarely eat rabbit meat, only two to three times a year, while the others (21%) eat rabbit meat once a week. It seems that rabbit meat is not consumed by the population in this research. The potential consumers of rabbit meat are likely to be men, those who are employed in the public sector, who represent (24%), and those whose main activity is farming or breeding, especially rabbit breeders who reach (18%). These consumers are mainly located in Bordj Bou Arreridj, Mila, Sétif, Batna, Béjaïa, and Constantine, whereas in the remaining regions a weak level of consumption is found, such as in Oum El Bouaghi, Guelma, Souk Ahras, Sekikda, Jijel etc.

Chi-square test confirms that consumption frequency has a significant association with two sociogeographic variables: employment status (χ^2=15.99; P=0.02) and geographical location (χ^2=52.28; P<0.0001). In contrast, rabbit meat consumption frequency is invariant to age (χ^2=6.40; P=0.17), gender (χ^2=2.66; P=0.10) and marital status (χ^2=0.02; P=0.86).

On the one hand, the variation in consumption frequency according to geographical areas may, therefore, be related to consumer behaviours, habits, or the availability

Table 1: Sociogeoographic profile of rabbit meat consumers (N=360).

Variable	Frequency	%
Total respondents	360	100
Gender		
Male	212	58.88
Female	148	41.11
Age, year		
18–29	88	24.44
30–39	105	29.16
40–49	89	24.72
50–59	51	14.16
>60	27	7.50
Marital status		
Single	158	43.88
Married	202	56.11
Employment status		
Unemployed	21	5.83
Employed	89	24.72
Farmer & breeders	68	18.88
Trade	29	8.05
Student	31	8.61
Retired	25	6.94
Housekeepers	38	10.55
Others (Teacher, Doctor, Electrician, Builder.…)	59	16.38
Wilaya (districts)		
Bordj Bou Arreridj	42	11.66
Mila	39	10.83
Sétif	34	9.44
Batna	33	9.16
Béjaïa	33	9.16
Constantine	32	8.88
Oum El Bouaghi	26	7.22
Guelma	22	6.11
Souk Ahras	20	5.55
Sekikda	19	5.27
Jijel	16	4.44
Tebessa	15	4.16
Annba	11	3.05
Khenchla	9	2.50
M'sila	9	2.50

Table 2: Cross tabulations of rabbit meat consumption frequency and reasons of consumption according to sociogeographic characteristics.

	Consumption Frequency				Reasons of consumption				
Variable	Once a week	2-3 times/ year	χ^2	*P*-value	Good taste	Nutritional value	Tenderness and easy digestibility	χ^2	*P*-value
Total respondents (%)	21	79			59	27	14		
Gender									
Male	52	165	2.66	0.10	162	25	30	70.38	<0.0001
Female	24	119			51	72	20		
Age (yr)									
18–29	11	77			52	23	13		
30–39	26	79			66	23	16		
40–49	18	71	6.40	0.17	50	28	11	3.88	0.86
50–59	14	37			31	15	5		
>60	7	20			14	8	5		
Marital status									
Single	34	124	0.02	0.86	99	37	22	1.88	0.39
Married	42	160			114	60	28		
Employment status									
Unemployed	1	20			4	12	5		
Employed	17	72			46	26	17		
Farmer & breeders	24	44			58	6	4		
Trade	2	29			16	3	10		
Student	5	20	15.99	0.02	19	9	3	73.67	<0.0001
Retired	6	23			13	9	3		
Housekeepers	9	29			12	21	5		
Others (Teacher, Doctor, Builder...)	12	47			45	11	3		
Wilayas(districts)									
Bordj Bou Arreridj	9	33			34	7	1		
Mila	0	22			22	13	4		
Sétif	3	23			33	0	1		
Batna	0	11			32	1	0		
Béjaïa	14	19			13	18	2		
Constantine	12	21			25	3	4		
Oum El Bouaghi	5	27			10	7	9	274.43	<0.0001
Guelma	1	15	52.28	<0.0001	0	22	0		
Souk Ahras	0	9			6	2	12		
Sekikda	0	9			6	13	0		
Jijel	14	25			10	2	4		
Tebessa	3	16			2	0	13		
Annba	0	20			11	0	0		
Khenchla	14	20			5	4	0		
M'sila	1	14			4	5	0		

of rabbit meat in local markets. In this context, previous research has shown that rabbit meat is consumed in all areas of Algeria, and particularly in the Central and Eastern regions, by the farmers and their families, i.e., self-consumption (Gacem and Lebas, 2000). On the other hand, the consumer's work affects consumption frequency. Hence, it is generally higher among public sector employees (89), farmers and breeders (68), and those who have an activity such as doctor or teacher (59). Logically, most of those respondents who had the lowest income buy rabbit

meat less frequently compared to higher income groups. The connection between income and meat consumption is well documented. There is a very close connection between income and meat consumption (Brunner *et al.,* 2010). Escribá-Pérez *et al.* (2017) examined the rabbit meat consumption habits of different social groups. As a result, a linear increasing tendency was observed in consumption frequency between low and upper class. Moreover, a similar observation was made by Szendrő (2016) in a former study. As pointed out by Delport *et al.* (2017) in South Africa, as meat is a normal or luxurious good for the majority of people, a rise in real disposable income will lead to an increase in meat consumption. These results confirm those of previous studies in other geographical contexts, which show that there is a relationship between rabbit meat consumption and age, gender and occupational status (McLean-Meyinsse, 2000; Beal *et al.,* 2004; González-Redondo, 2010). In contrast to our findings, in a recent study on consumers' attitude to rabbit meat consumption in eight countries, Szendrő *et al.* (2020) found a statistically significant coefficient between consumption frequency, age and gender

Our findings are in line with the results obtained by Bodnar and Horvath (2008) in Hungary, where 46% of the interviewees bought rabbit meat only once or twice a year. In a similar study with Spanish consumers, Buitrago-Vera *et al.* (2016) indicated that 39.4% of respondents purchase rabbit meat, at most, once a year. Another recent study by Petrescu and Petrescu-Mag (2018) found that the dominant consumption frequency of Romanian consumers was less than one day per month (56% of the sample). Similar findings were produced in Spain by Escribá-Pérez *et al.* (2019), who analysed the consumption of rabbit meat by children and reported that the average consumption frequency for rabbit meat is between once a month and once every 2 or 3 mo.

Cullere and Dalle Zotte (2018) state that rabbit meat consumption is not popular worldwide; it is mainly limited to the Mediterranean region, in countries like Algeria. They added that official data on rabbit meat consumption are scarce and very heterogeneous, but it accounts for less than 3% of all meats consumed in the European Union. In Africa, where Egypt is considered the foremost producer of rabbit, the share of rabbit meat in household meat consumption was estimated as a mere 3.3% (Alboghdady and Alashry, 2010). A similar situation has been observed in Kenya, where the frequency of rabbit meat consumption is still low, even among rabbit keepers (Mailu *et al.,* 2017).

To our knowledge, in Algeria, only one study is available in the literature that has come up with this issue. This study found that Algerian people consume around 0.86 kg/capita year i.e. 1.52 kg in rural and 0.39 kg in urban areas (Gacem and Lebas, 2000). Those values are lower than those estimated by Guarro (1991), as the Spanish consume 4.1 kg/capita year in rural areas, 2.2 kg/capita year in big cities, and higher than those indicated by Galal and Khalil (1994) in Egypt, where rabbit meat consumption was estimated at 0.7 kg/capita in 1992.

Reasons for rabbit meat consumption according to sociogeographic variables

Considering the reasons for consumption of rabbit meat, the answers obtained can be divided into three groups: 59% of consumers appreciated rabbit meat because of its good taste, 27% of them because of its nutritional value, and 14% because of its tenderness and easy digestibility.

Cross tabulations in the second part of Table 2 using chi-square test showed high significant differences among the different reasons for consumption according to gender (χ^2=70.38; P<0.0001), employment status (χ^2=73.67; P<0.0001) and geographic distribution variable (χ^2=274.43; P<0.0001), while no significant differences were found with age (χ^2=3.88; $P=0.86$) and marital status variable (χ^2=1.88; $P=0.39$).

For men, good taste, tenderness and easy digestibility are the most important reasons for consumption, whereas women generally consume rabbit meat for its nutritional value. Our results indicate that men seem to appreciate rabbit meat more than women. Petrescu and Petrescu-Mag (2018) reported in their research that taste is the main driver of food consumption. Through various studies, taste was proven to be a very important factor for food choice, dietary behaviours and intake; for example, 82% of tested Australian consumers rated taste as a very/extremely important factor for food choice (Kourouniotis *et al.,* 2016). Our findings coincide with those obtained by González-Redondo *et al.* (2010) in their study of the factors affecting rabbit meat consumption among Spanish university students. The study showed that rabbit meat was perceived more negatively by females than by males, which is based on emotional and moral reasons. Likewise, recent research in Spain on consumer segmentation based on food-related lifestyles has shown similar findings, where 72.4% of consumers find rabbit meat tasty and 35.9% of them consider it healthy (Buitrago-Vera *et al.,* 2016). Similarly, Adanguidi (2020), in his research in Benin, found that the attraction of rabbit

meat to the majority of consumers is due to its taste (97% of respondents). About 88% of consumers said that rabbit meat is good for their health. The ranking of preference criteria indicates that pleasure and good taste are the main reasons why respondents consume rabbits.

Food consumption can be influenced by a great variety of motives. People may choose meat because they like the taste, because they think it is healthy, because it is sold for a good price, or simply because they are used to eating meat. These are all imaginable and valid reasons that can determine an individual's motivation to consume meat products or not. Usually, it is not simply one motive that determines the consumer's decision but the interplay between several (Hoek *et al.,* 2011; Renner *et al.,* 2012).

It should be noted that in Algeria, rabbit meat consumption is related to certain periods of the year or events. Our study shows that rabbit meat consumption peaks are mostly in winter and during the month of Ramadhan. Nevertheless, periods of low consumption are the religious festivals such as Aïd El Fitre, the year-end holidays, or during the summer season (Table 3). However, in Benin, the consumption peaks during holiday seasons such as Easter, end of the year, etc. (Adanguidi, 2020).

It also appears that most consumers (61%) recognise the nutritional benefits of rabbit meat, namely its low cholesterol and fat content and high protein and vitamin content. It was recommended to introduce this type of meat into the diet in certain circumstances, for example for pregnant women, as well as in certain cases of chronic illnesses such as diabetes, cardiovascular diseases and anaemia.

Reasons for low consumption according to sociogeographic variables

The same statement was observed when analysing the relationship between reasons for low consumption according to sociogeographic characteristics (Table 4). Chi-square test confirmed that age (χ^2=15.33; P=0.75) and marital status (χ^2=4.42; P=0.49) did not show any association with low consumption of rabbit meat. However, gender (χ^2=19.51; P=0.002), consumer's occupation (χ^2=75.74; P=0.49) and geographical location (χ^2=462.81; P=0.49) presented significant differences.

Considering the main causes of low consumption of rabbit meat, the answers are varied: the most frequently advanced reason is the scarcity of rabbit meat in the market (42%), the purchase price (22%), eating habits (17%), lack of information on nutritional value (13%), and finally the bad taste, alongside its resemblance to cat meat with the same frequency (3%). Generally, according to consumer's occupation, there are three obstacles: availability of rabbit meat, price and eating habits, which are mostly chosen by employees, farmers and breeders, and others such as doctors and teachers, etc. The remaining obstacles are chosen differently by the rest of the consumers. Looking at geographical areas, the main hindering factors, such as scarcity of rabbit meat in the market, purchase price and eating habits, are chosen especially by consumers in *wilayas* which have a large number of consumers, such as Bordj Bou Arreridj, Mila, Sétif, Batna and Béjaïa. By gender, the availability of rabbit meat, price and eating habits are the main obstacles advanced by men. In addition to those factors, in contrast, women have cited other factors such as lack of information, resemblance to cat meat and bad taste.

Several authors have tried to analyse the factors hindering rabbit meat consumption in many countries. In Algeria, for instance, a survey conducted with butchers, restaurant owners and hotels in Tizi Ouzou showed that the low consumption of rabbit meat is not due to low consumer demand, but mainly due to its unavailability in the markets (Kadi *et al.,* 2008).

Table 3: Consumer's distribution according to the period of consumption of rabbit meat.

Consumption period	Frequency	Proportion (%)
Winter season	144	40
Month of Ramadhan	94	26
Winter season + month of Ramadhan	94	26
Religious festivals / year-end holidays	14	4
Summer season	14	4
Total	360	100

Table 4: Cross tabulations of low consumption reasons according to sociogeographic characteristics.

	Reasons of low consumption							
Variable	Scarcity of rabbit meat	Purchase price	Eating habits	Lack of information	Its resemblance to cat	Bad taste	χ^2	*P*-value
Total respondents (%)	42	22	17	13	3	3		
Gender								
Male	80	56	41	21	1	2	19.51	0.002
Female	71	23	20	26	10	9		
Age (yr)								
18-29	42	13	15	12	2	4		
30-39	41	27	19	11	4	3		
40-49	40	14	16	14	4	1	15.33	0.75
50-59	18	16	7	7	1	2		
>60	10	9	4	3	0	1		
Marital status								
Single	71	32	30	15	5	5	4.42	0.49
Married	80	47	31	32	6	6		
Consumer's work								
Unemployed	8	3	4	4	2	0		
Employed	33	23	15	9	7	2		
Farmer & breeders	31	12	22	2	0	1		
Trade	9	4	2	9	1	4		
Student	19	3	1	6	1	1	75.74	<0.0001
Retired	9	8	2	5	0	1		
Housekeepers	15	9	5	8	0	1		
Others (Teacher, Doctor, Builder...)	27	17	10	4	0	1		
Wilayas (districts)								
Bordj Bou Arreridj	12	22	8	0	0	0		
Mila	18	0	19	2	0	0		
Sétif	23	10	1	0	0	0		
Batna	24	9	0	0	0	0		
Béjaïa	27	4	0	2	0	0		
Constantine	12	12	8	0	0	0		
Oum El Bouaghi	4	5	9	8	0	0		
Guelma	1	3	15	3	0	0	462.81	<0.0001
Souk Ahras	1	0	0	8	7	4		
Sekikda	3	2	1	10	1	2		
Jijel	13	3	0	0	0	0		
Tebessa	4	0	0	3	3	5		
Annba	0	5	0	6	0	0		
Khenchla	5	4	0	0	0	0		
M'sila	4	0	0	5	0	0		

In Tunisia, this observation correlates with those reported by Bergaoui and Kriaa (2001), where the Tunisian does not eat rabbit meat because it is unknown, but because it is insufficiently present in markets or supermarkets, as well as the fact that people do not have the reflex of thinking about it and buying it.

In Lebanon, according to Chalah and Hajj (1996), the most advanced reason is the scarcity of meat in the markets, while other causes have been divided between the ignorance of how to cook it, the high cost of meat and the lack of desire. It should also be noted that the Shia in Lebanon do not consume rabbits because of the existence of a religious ban in the Hadith. In Hungary, a study carried out by Bodnor (2009) showed that 46% of respondents found rabbit meat too expensive in shops and they only buy it once or twice a year. In Australia, an ethical obstacle to meat eating was also mentioned by Bastian *et al.* (2012) for consumers who showed that many people liked eating meat; however, in order to maintain their eating habits, they denied that the animals they consumed had minds, thus reducing the dissonance between love of eating meat and caring about animals. In Spain, Petrescu and Petrescu-Mag (2018) indicated that the most important obstacles to rabbit meat consumption stated by the interviewees were high price and disgust (31.9%), lack of availability on the market (30.6%), empathy with another living creature which is deprived of freedom and then slaughtered (26.4%) and the fact that the rabbit is perceived as a pet and as a cute animal (25.5%).

According to Buitrago-Vera *et al.* (2016), a similar situation is present among Spanish consumers, who declared that the main obstacles facing rabbit meat consumption were the fact that they were not used to it (28.3%) and that they disliked the taste (26.7%). In Benin, the survey conducted by Adanguidi, (2020) showed that there were several factors which limit rabbit consumption. The first factor according to 56% of the respondents is the purchase price, which seems to be relatively high compared to that of chicken or small ruminant meat. The second factor according to 38% of the respondents is the low availability of rabbit meat during certain periods of the year. Other limiting factors mentioned by respondents are distance from points of sale, storage difficulties and product quality.

Cullere and Dalle Zotte (2018) have cited another important point concerning the visible characteristics of the meat which also play a key role in consumer's choice. They considered that selling rabbit meat as a whole carcass, i.e., resembling a cat or a human infant, can discourage most consumers, especially young consumers whose choices are particularly driven by product presentation, which is the case in Algeria's butchers. They added that appearance has a great impact on consumption, so improving the image of rabbit meat and promoting it to both traditional and new customers would be a key step to stimulate consumption. In addition to this, the taste of meat could also be a deciding factor influencing consumption (Dalle Zotte, 2002).

The influence of gender on rabbit meat consumption is widely studied. Petrescu and Petrescu-Mag, (2018) have found significant differences between men and women. Their results indicate that men appreciate rabbit meat more than women. For the latter category, disgust and ethical concerns were stronger. Similarly, women in a Spanish study showed a stronger perception of rabbit as a companion animal compared to men (González-Redondo and Contreras-Chacón, 2012). French women also mentioned disgust as a generator of low meat consumption, regardless of its type (Rousset *et al.,* 2005).

Respondents were also asked to indicate the principal motives that could increase their consumption. Three proposals were recorded, involving the availability in the market (53%), lowering the price (36%) and improving the way of preparation (11%). These results coincide with those obtained by Szendrő (2016), whose study reported that most of the respondents would increase the amount of meat they consumed if it were available in more outlets. It would then be easier for them to access it, followed by cheaper price and better-known nutritional and health benefits. However, 23.4% of Hungarian consumers would not have changed their consumption for any reason.

As a general rule, concerning the way of preparation, it should be remembered that rabbit meat does not require long cooking (Djago and Kpodékon, 2000). To eat a rabbit, consumers in Eastern Algeria usually cook it by roasting alone or accompanied with vegetables, grilled, fried in oil with potatoes, or even with pasta or soups.

In Tunisia, Bergaoui and Kriaa (2001) reported that the rabbit lends itself well to preparation and can adapt very well to spicy Tunisian cuisine. The rabbit is often prepared in Kamounia, which is a very spicy cumin stew or with spaghetti. Consumers in Benin prepare it in different sauces: tomato sauce, peanut sauce, sesame sauce etc. (Djago and Kpodékon, 2000). Rabbits in Nigeria are processed by roasting or removal of skin, and cutting into parts. Consumers

prefer smoked rabbit, probably because it reflects the traditional preparation of game animals (Abu *et al.,* 2008). It seems important to note that in some European countries the culture of rabbit meat cooking is very poor. A survey was carried out in Hungarian regions showed that only 14% of the people surveyed could list more than two rabbit recipes (Bodnar and Horvath, 2008). Rabbit meat consumption is still based on home preparation. Moreover, rabbit meat-based dishes are mainly prepared following traditional recipes, often demanding long preparation time and the knowledge of specific culinary skills which do not meet the present ease of preparation requirement (Cullere and Dalle Zotte, 2018). Currently, very few processed rabbit meat products are sold, such as burgers, fresh sausages, filled rolls and baby food. In recent years, these products have gained some ground in the market compared to conventional variants made with beef and pork (Mancini *et al.,* 2017).

Rabbit sources of provisioning and selling price

It was found that the consumer has several sources of rabbit provisioning (Table 5). It is clear that the purchase price of the living rabbit is cheaper than the price of the carcass at the butcher. A survey carried out by Gacem and Lebas (2000) through 48 *wilayas* in Algeria found that rabbit meat (carcasses) is available in the urban markets of Constantine and Algiers; however, in the centre and south of the country it is more difficult to buy rabbit carcasses in local markets. Our results can be related to those reported by Bodnar and Horvath (2008) in Hungary. These authors found that the majority of consumers buy rabbit directly from farmers (70%), and they declare themselves unsatisfied with the distribution of rabbit meat in supermarkets. Hence, 46% of the surveyed consumers found that rabbit meat is too expensive in the shops, and they buy it only one or two times a year.

Szendrő (2016), in his research, also stated that the primary source was breeders for (75.2%) of respondents, with other sources of rabbit supply, where 14.8, 14.8, 12.4, 1.4, and 1.4% were purchased from a market, a butcher, a hyper-/super market, a convenience store or a discount store, respectively, while 12.9% indicate that it is received from friends and family members, purchased from a slaughterhouse or hunted. Similarly, in Benin, the consumers surveyed obtain their supplies as living rabbits (50% of respondents) and rabbit carcasses (29% of respondents) (Adanguidi, 2020). Unlike Hungarians and Beninese people, in Romania, consumers prefer to buy already slaughtered animals, whole, from small Romanian producers. However, most of them prefer to buy them from supermarkets (32.9%) (Petrescu and Petrescu-Mag, 2018).

Our analysis shows that the average price of rabbit meat is (750.14±150.18) DA/kg, (1 Euro=145.53 DA). Only two studies in Algeria have focused on price. In 2000, Gacem and Lebas reported a price between 360 to 380 DA/kg (2.47 to 2.61 €) in Constantine and Algiers i.e. two *wilayas* in Algeria.

However, Kadi *et al.* (2008) have cited an average price per kg equal to 470±62 DA (3.23 €) in the *wilaya* of Tizi Ouzou. The price of one kg of this meat in butchers increases over the years, thus making rabbit a luxurious meat, with selective consumers. Additionally, in 1994, the ratio between the average market price of 1 kg of rabbit and 1 kg of chicken was 2.14, but in 1996 it was only 1.78. In 1998, it increased to 2.07 (Gacem and Lebas, 2000). As indicated above, in 2016, the average price of 1 kg of rabbit was 750 DA (5.15 €) and that of chicken was 280 DA (1.92 €), which means the ratio was 2.67. It should be noted that in Algeria, the meat that is mostly sold for consumption and the easiest to know is that of chicken. Dalle Zotte (2002) reported that in underdeveloped countries, rabbit meat is generally twice as expensive as chicken meat, as well as for other white meat. This explains its low consumption, in particular for low-income families. Another study carried out on rabbit meat preference in Catalonia revealed that price was the main limiting factor for rabbit meat consumption among non-traditional or new consumers (Kallas and Gil, 2012). Our results are also similar to those obtained by Bergaoui and Kriaa (2001), which reported that rabbit is actually a little more expensive than chicken, but much less than sheep and beef.

Table 5: Distribution of consumers by rabbit supply sources.

Rabbit supply sources	Frequency	Proportion (%)
Breeders (rabbit on foot)	202	56
Local markets (rabbit on foot)	108	30
Butchers (carcass)	50	14
Total	360	100

Three recent studies have found a similar situation. In Kenya, Mailu *et al.* (2012) showed that the relatively high price of farmed rabbits makes them less competitive compared to chicken. Spanish consumers declared that chicken was the most frequently consumed because they considered it the most economical fresh meat (Montero Vicente *et al.,* 2018). This result is also confirmed by Petrescu and Petrescu-Mag (2018) in a study carried out in Romania, where they found that rabbit meat is perceived as low cholesterol and leaner, tastier and healthier than other meat, but is so expensive that its consumption is low, being 2.2 times lower than chicken and 1.8 times lower than pork.

Rabbit meat purchasing criteria

As regards the purchasing criteria for rabbit meat, tenderness was chosen by most consumers (58%) as the first purchasing criterion, followed by freshness (14%), price (12%), breed (10%) and colour (6%). It should be noted that visual appearance characteristics of meat, such as tenderness, freshness and colour, which constitute the intrinsic quality cues, are highly related with Algerian consumers' choice at the point of purchase. In turn, 22% of respondents are interested in extrinsic cues such as price or breed (origin). Specifically for rabbit, Kallas and Gil (2012) noted that for rabbit meat consumers in Spain, the price is considered less important that other factors such as local origin, certified quality brand and boneless rabbit meat format. However, non-consumers identified the economic factor as the main limiting factor for purchasing this kind of meat. Although the price seems not to be the most important attribute when purchasing, usually lower prices are preferred and are likely important for a segment of consumers with low purchasing power or those for whom meat characteristics or type is not an important issue (Font-i-Furnols and Guerrero, 2014).

Place of rabbit meat in consumer's choice

Regarding the question of favourite meat, rabbit meat is chosen by 14% of its consumers, thus coming in fourth position behind sheep meat, beef and poultry. Consumption of goat meat remains very marginal (Figure 2). The same results were obtained in Nigeria, where Dario *et al.* (2012) reported that rabbit meat is ranked the fourth after beef, bush meat and chevon and just ahead of poultry in terms of preference. In Spain, the different types of fresh meat are consumed from highest to lowest frequency in the following order: chicken, beef, pork, turkey, rabbit and lamb, with fresh chicken meat the most often consumed. Among the six meat types that are studied, rabbit meat is the fifth most consumed by

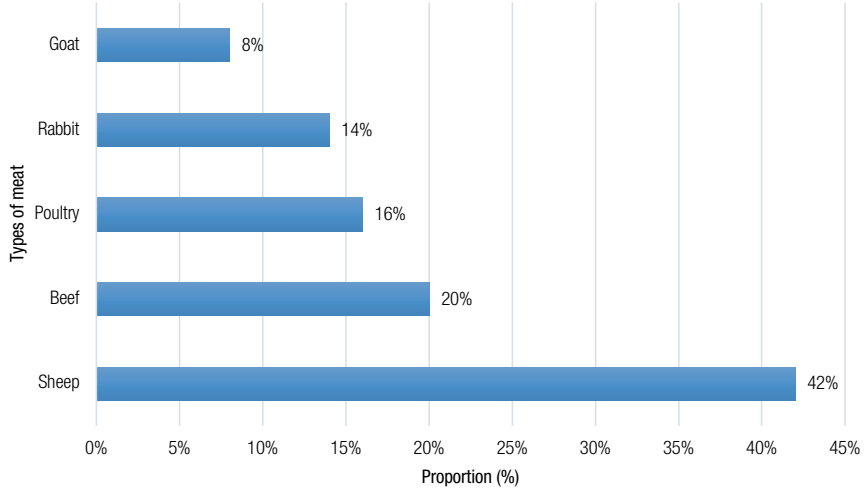

Figure 2: Distribution of the surveyed consumers according to the type of meat preferred (N=360).

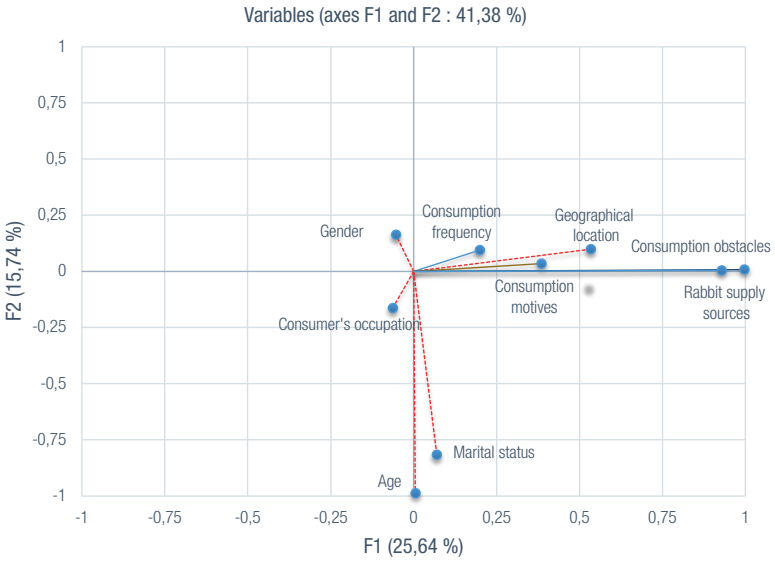

Figure 3: Sociogeographic variables association with the different factors (consumption frequency, motives, obstacles, and rabbit supply sources).

frequency (Escribá-Pérez *et al.,* 2017). In Benin, Adanguidi, (2020) analysed the positioning of rabbit meat among meat products consumed by the respondents. The data collected show that fish is in first place in terms of expenditure, while rabbits are in fourth place. In terms of preference, rabbits come in second place after local chicken. Although rabbit is more popular than fish and goats, consumers spend less money on it. Bear in mind that sheep and poultry are the most available meats in all regions of Algeria. Lamb is the main source of red meat for Algerian consumers, at a rate of 55% of the proportion of meat consumed, ahead of beef (34%), whereas poultry is the most frequently consumed among white meats (Nejraoui, 2012). Despite the fact that lamb meat has the highest price (130 DA, 0.89 €) compared to the others types of meat, i.e. red and white, it is still the most frequently consumed. This is in agreement with the results of a recent study on sheep meat consumption in Algeria, where the author showed that approximately 50% of the respondents buy sheep meat once a week, while 18.62% buy it between 2 and 4 times a week. However, 32.35% of households buy sheep meat only once a month (Sadoud, 2019). As the previous paragraphs have shown, the availability of rabbit meat is the major barrier that reduces its consumption.

Regarding the question: *What kind of meat do you think rabbit meat looks like?* The results obtained indicate that 37% of consumers consider rabbit meat to be similar to poultry meat, 17% compared it to goats, 7 and 4% of the surveys compared it to cattle and sheep, respectively, while 35% of consumers say it does not resemble any type of meat. Concerning the organoleptic qualities of rabbit meat, most consumers consider that the latter has a smell, shape and tenderness similar to chicken meat, whereas, taste and colour are closer to goat meat.

In order to give a global picture of our study, the factorial analysis was carried out (Figure 3), which resulted in two different axes. The first axis explained that 25.64% of the variance was mainly characterised by consumption obstacles, motives, frequency, rabbit supply sources and geographical location, whereas the second one explained 15.74% of the variability that is represented mainly by age and marital status. The two axes together explained 41.38% of the variance. In this figure, we can see the distribution of five sociogeographic characteristics between two axes and the different factors, i.e. consumption frequency, motives, obstacles, and rabbit supply sources. It clearly shows that among the five sociogeographic variables, geographical areas, employment status, and gender were strongly associated with consumption motives, obstacles and frequency, despite the fact that age and marital status were weakly associated. Other remarkable findings with regard to factor analysis showed another factor which is

strongly correlated with consumption barriers: rabbit supply sources can be considered among the factors that hinder consumption, as it is related with the availability of rabbit meat.

CONCLUSION

The results presented above reveal a number of important points about rabbit meat consumption. The results show that consumers of rabbit in Eastern regions of Algeria tend to generally be people with an average age of 40 years, married, public sector employees, farmers or breeders, geographically located in the *wilayas* where rabbit-farming units are the most present. Interestingly, gender, employment status and geographic location are the most important variables that significantly affect consumption frequency and factors encouraging or limiting rabbit meat consumption. In contrast, other variables like age and marital status did not have any influence.

In fact, rabbit meat consumption is still low and its consumption continues to be negligible. The majority of respondents consume it two or three times a year. Generally, this meat is consumed especially in rural regions by farmers and their families. The consumption is mainly increased during the month of Ramadhan and the winter season or is linked to special events.

Factors that influence rabbit meat consumption are highly complex, heterogeneous and depend not only on the sensory properties of the meat, but also on psychological and sociogeographic factors. Good taste and nutritional value are intrinsic quality cues that encourage people to eat rabbit. When purchasing the meat, the consumer will be interested in other qualities such as tenderness, freshness and price.

The availability of rabbit meat and its price may be the major determinants of rabbit meat consumption. By supporting the breeders, rabbit meat would replace chicken and turkey in most of the cases, as it could be produced very easily if its price became less expensive, with a good distribution in markets associated with more information about its benefits via communication tools like television, newspapers and online social networking services such as Facebook. All this can be very effective in changing people's attitudes. Concerning people who reject consumption for emotional reasons, such as its resemblance to a cat or human infant, enhancing product appearance in terms of good presentation with suitable and attractive packaging may solve the problem.

This study has contributed to creating the profile of Algerian consumers of rabbit meat. The results obtained can help guide decision makers such as governments, planners, institutes and academics in the promotion of rabbit meat production or the development of new marketing strategies to raise consumers' interest in rabbit meat. In order to gain a better understanding of the obstacles to rabbit meat consumption in Algeria, this study must be supplemented by surveys focused on other participants in this sector, namely farmers and butchers.

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