

Goat meat consumption patterns and preferences in three provinces of Kabylia region in Algeria compared to other meat species: Results of an online survey

Melisa Lamri¹, Djamel Djenane¹, Mohammed Gagaoua^{2*}

Abstract: This study aimed to investigate, using an online survey, the patterns/frequency of meat consumption, and preferences from several meat types in Kabylia region in Algeria and within three provinces (Tizi-Ouzou, Bejaia, and Bouira). Thus, we specifically examined in this work the consumption of goat meat compared to lamb, beef, horse, camel, and chicken. The attempt is to understand the underlying factors of consumer perception and purchasing behaviour/decisions of goat meat through an exploratory survey on a homogenous gender consumer's population. The survey conducted on 665 respondents revealed that 95.6% of them are consumers of meat and meat products ($n = 636$) versus 4.4% ($n = 29$) that never consumed meat. The majority of the respondents never consumed both camel (54.3%, $n = 339$) and horse meats (42.5%, $n = 270$). Of those consuming camel meat, only 14 of them eat it always (1.6%), and the others sometimes (35%) or rarely (9.1%). Chicken is the only meat eaten by a significant number of the respondents ($n = 534$), and 84.0% of them consume it always, followed by beef (56.6%) and lamb (21.2%). Chicken was also found to be the most liked meat compared to other sources, while horse and camel meats were the less appreciated. Goat meat seemed to be intermediate compared to the other species, where it is never consumed by 27.7% of the respondents, and it is mainly consumed sometimes (44.8%, $n = 285$) or rarely (20%, $n = 127$) and, on average, appreciated. This study is the first to highlight in the Kabylia region the trend of meat consumption from several species, revealing that the significantly consumed meat is from chicken, followed by beef and lamb. Goat meat is weakly consumed, while camel and horse are never or rarely. Encouraging the consumption of goat meat as an alternative and valuable source of animal proteins can be seen as a sustainable approach.

Keywords: meat consumption, Algeria, survey, consumer preferences, livestock; online questionnaire.

Introduction

Meat is considered the main food source of protein and nutrients such as vitamins and minerals, making it an integral part of the human diet (Multari et al. 2015; Ahmad et al. 2018). On another hand, the consumers' preoccupations with purchasing meat products are multiple, which are mainly related to safety, nutrition, and health (Bernués et al. 2003; Gagaoua & Picard 2020; Kantonno et al. 2021; Gagaoua et al. 2022). The remarkable worldwide population growth in the past few years led to a significant increase in meat consumption in numerous countries, which also involved a rise in global meat demand and consumption from other species including goat (Kadim & Sahi 2018; Mazhangara et al. 2019). In fact, goat farming plays an integral part in red meat production and is a tool of importance for rural and national econom-

ic development (Webb & Casey, 2010; Chetroiu et al. 2013; Pophiwa et al. 2020). The hardiness of the goat also offers an alternative to red meat that favours the development of food systems adapted to climate change.

Goat meat is consumed in many countries, especially in developing ones, particularly in North Africa and Middle East countries, in Southeast Asia, where it takes an important place, as well as in the Caribbean and other tropical countries (Rodrigues & Teixeira, 2010). Goat meat is not only known for being an excellent high-quality protein source but also for its essential nutritional characteristics compared to other red meats such as beef and lamb (Lee et al. 2008). Goat meat has been established as lean meat with relatively low-fat content, cholesterol intake, and saturated fatty acids (Liu et al. 2013). These nutritional aspects qualify goat meat as a healthy product, especially with the healthy food

¹ Mouloud MAMMERI University, Laboratory of Food Quality and Food Safety, Department of Food Science, BP, 17, 15000, Tizi-Ouzou, Algeria;

² PEGASE, INRAE, Institut Agro, 35590 Saint-Gilles, France.

*Corresponding author: Mohammed Gagaoua, mohammed.gagaoua@inrae.fr

trend, where consumers are becoming more curious and concerned about the nutritional attributes of their food including meat sources (Resurreccion 2004; Mazhangara *et al.* 2019). Moreover, goat meat which is leaner compared to other red meats, has favourable sensory and visual appeal (Webb *et al.* 2005). Youth seemed also to be very aware of the different product values that goat meat provides, for instance among South African consumers (Ngomane *et al.* 2022). However, there is a perception among a certain number of consumers that goat meat is tough and too strongly flavoured (Webb *et al.* 2005; Webb & Casey, 2010; Jacques & Norwood 2017).

In Algeria, goat breeding is practiced in many areas of the country due to the adaptation capacity to harsh environments and climate changes. Goat meat provides for the local populations and consumers important and stable sources of proteins (essential amino acids) and essential nutrients. The number of estimated goats in Algeria is about 4.9 million in 2018 corresponding to 14% of the world ruminant livestock (FAOSTAT, 2018; Ouchene-Khelifi *et al.* 2015). With this very large number, goats occupy then a special place and a significant source of income for about 800,000 small farmers (Dekhili *et al.* 2013). Overall, goat meat is consumed in Algeria as fresh or as traditional meat products (Gaga-

oua & Boudechicha, 2018). Both are considered nutrient-rich products that ensure health and wellness (McAfee *et al.* 2010). Unlike the northern Mediterranean country, which has a more meat-rich diet, the consumption of red meat in Algeria is occasional and generally linked to celebrating traditional or religious events (Chikhi & Bencharif, 2016; Gagaoua & Boudechicha, 2018). However, to the best of our knowledge, there is a scarcity of studies focusing on the consumption pattern and perceptions of different meat sources (including goat) in Algeria and in the Kabylia region. In this context, we aimed by this first study to investigate the consumption trend of different meat sources in Kabylia within three central provinces: Tizi-Ouzou, Bejaia, and Bouira with a focus on goat meat consumption, compared to lamb, beef, horse, camel, and chicken meat types. Therefore, an online survey was conducted to achieve this lofty goal. We further examine in this paper the consumers' preferences towards the six different meat types as well as an evaluation of the perceptions and willingness to consume and buy goat meat. The ultimate objective of this work is to obtain the first overview of meat consumption patterns, consumers' purchase behaviour and preferences towards the targeted meat types in the Kabylia region.

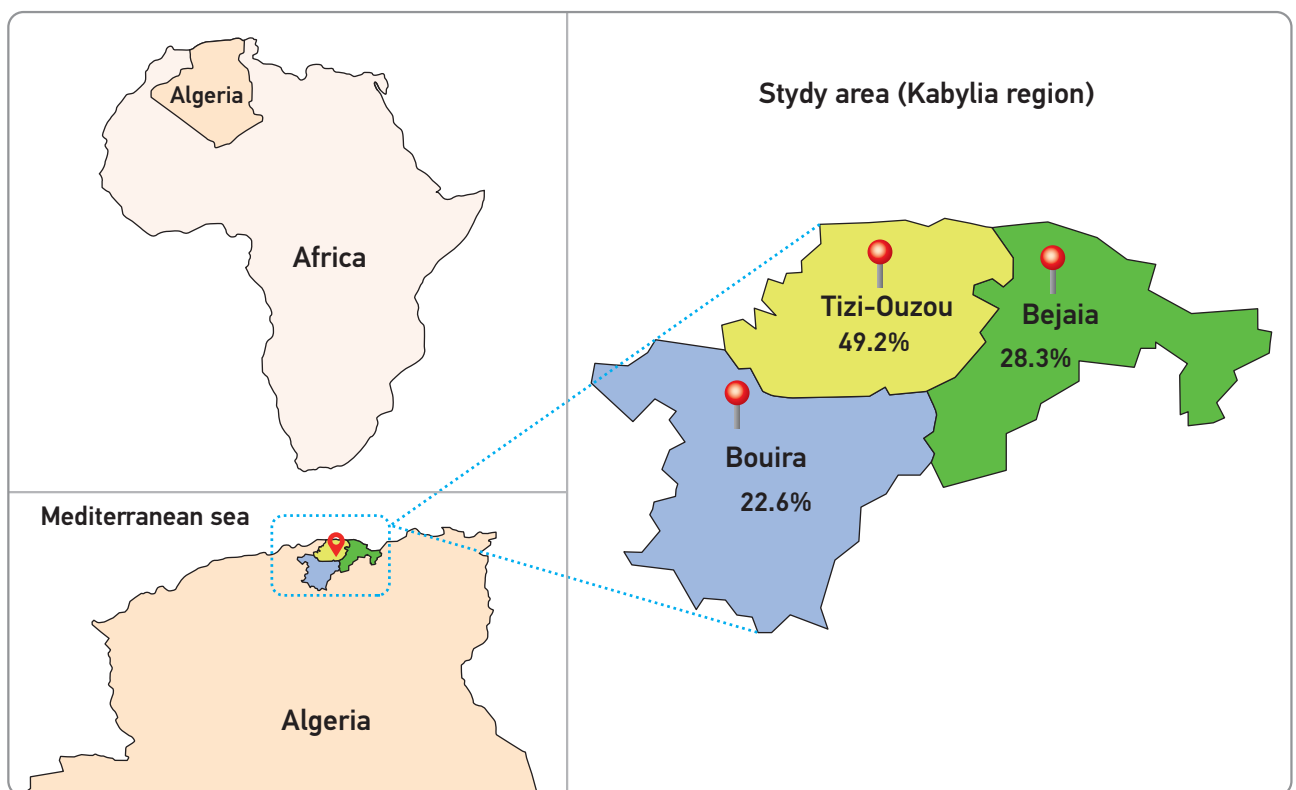


Figure 1. Study area and distribution of the 665 respondents who participated in the online survey from three provinces of the Kabylia region (north of Algeria).

Materials and Methods

Data collection using an online survey

The data of this study were based on a structured online survey at the consumer level, in Kabylia region, related to the consumption of goat meat compared to different other animal meat sources such as lamb, beef, horse, camel, and chicken. The study was conducted online from 31 March – 30 September 2020 using a questionnaire built through the Google forms database that was then shared using online platforms. The survey instruments were adapted from established scales to fit the context of this research that aims a better characterization of overall meat consumption, preferences, and frequencies with a focus on goat meat in Kabylia region, Algeria (Figure 1.). The questionnaire was developed and used in French language.

The data of this online survey were collected by convenience sampling on respondents from Kabylia region in Algeria, grouping three large provinces (Tizi-Ouzou, Bejaia, and Bouira) as illustrated in Figure 1. The survey questionnaire consists of two major sections including consumer experience and meat eating habits. The first section focused on all meat consumers and the second one on goat meat consumers. Among its different items, the first ones enquired the profiles of the respondents and their frequency and preferences of consumption of the six meat sources. We then asked for the i) gender of the respondents, ii) their province, iii) age, iv) employment/occupation, then their v) meat consumption, followed by the vi) frequency (pattern) of meat consumption and vii) preferences among six meat types. Only the participants eating goat meat were allowed to proceed further with the survey questionnaire. Thus, the rest of the questionnaire items were specific to goat consumers; including the i) reasons and frequency of goat meat consumption, ii) how they compare goat meat sensory attributes to other meat sources, iii) consumer experience and eating habits as well as consumer perception and purchasing toward goat meat in comparison to other meat sources. A progress bar was automatically added to stimulate respondents to finish the online survey.

Sample profile and data analyses

From the collected responses, 665 respondents were considered valid and useable. Data quality checks evaluated any outliers from the respondents' response time, thanks to clustering analyses, the respondents who answered to our questionnaire in a static manner were identified and eliminated. The

names and emails of the respondents were further scrutinized in each response to ensure that the same individuals were unable to take the survey more than one time. The data analyses were then all conducted in Microsoft Excel 2016 statistical software (Microsoft Corporation, Microsoft Office Excel 2016, USA). For research item questions, we reported the share of consumers in each item as appropriate using percentages. The graphs were elaborated with Microsoft Excel statistical software.

Results and discussion

The evaluation of consumer perception of goat meat has been the subject of numerous studies around the world, but few studies were conducted in Algeria. The main objective of this study was therefore to investigate for the first time the preferences and attitudes of consumers towards goat meat among other meat species in the Kabylia region of Algeria. Thus, this study aimed to identify the relevant consumer motivations towards goat meat, as well as the barriers to its consumption.

Socio-demographics of the meat consumers who participated in this study

Table 1. summarizes the demographic profile of the 665 respondents by describing their gender, distribution in the three provinces, selected age, occupations, and rather eating meat or not. From the total of respondents, 53.8% (n = 358) of them were male whereas 46.2% (n = 307) were female. The majority of the respondents were from Tizi-Ouzou province (n = 327, 49.2%), followed by 188 (28.3%) from Bejaia and 150 (22.6%) from Bouira (Figure 1.). The socio-demographic characteristics of consumers differed in terms of education and age (Table 1.). In terms of age distribution, the majority of the respondents were young, aged between 20– 30 years (63.5%), from which 24.7% were below 30 years. Around 12% were higher than 40 years. A large proportion of the respondents stated their occupations as employee (43.6%) working in different sectors such as teaching, doctors ...etc. Within this category a significant part was full-time student (40.0%) followed by professional freelance (9.8%). Finally, a minority of the respondents were unemployed (4.7%) or retired (2.0%). Consumption decisions are heavily influenced by one's degree of education and disposable income (Khara et al. 2021) as meat is an expensive commodity in Algeria. The education level of respondents varied from primary school to post-graduate level and majority of them having a minimum undergraduate degree.

Table 1. Description of the socio-demographics of the respondents who participated in the online survey (n = 665) from the Kabylia region.

Variable	Categories	Frequencies	Percentages (%)
Gender	Female	307	46.2
	Male	358	53.8
Province	Bejaia	188	28.3
	Bouira	150	22.6
	Tizi Ouzou	327	49.2
Age	<20	16	2.4
	20-30	406	61.1
	30-40	164	24.7
	40-50	47	7.1
	50-60	22	3.3
	>60	10	1.5
Occupation	Employee	290	43.6
	Full time student	266	40.0
	Freelance (Professional)	65	9.8
	Unemployed	31	4.7
	Retired	13	2.0
Meat consumption	Yes	636	95.6
	No	29	4.4

Participant preferences, attitudes and beliefs towards meat consumption of different species

Meat consumption plays a major role in consumers' daily food intake. Our survey revealed that 4.4% of the respondents (n = 29) never consumed or are not consuming meat and a significant majority of 95.6% (636 responded) are meat eaters (Table 1.), but with divergent frequencies and preferences for the six meat types as discussed below. The trend towards the consumption of meat analogues and substitutes rather than animal proteins in Algeria is not known and cannot yet be considered, or it can be speculated as new. This might reflect the satisfaction of the consumers in eating their traditional meat-based dishes for which preferences are very high (Gagaoua & Boudechicha, 2018). The low number (4.4%) of non-meat eaters observed in this study seems to be in agreement with the current worldwide trends/shifts towards new meat alternatives (Boukid & Gagaoua, 2022), that are mainly from plant-based food products (Onwezen et al. 2021; Anusha Siddiqui et al. 2022). A shift/transition to consider meat alternatives in the diet of consumers offers new interest on vegetables/grains

and numerous surveys reported meat reducers and meat avoiders (Holm & Møhl, 2000; Possidónio et al. 2021). The percentage we identified in this survey is comparable to a recent Canadian survey where approximately 5.1% Canadians identified as vegans (Popoola et al. 2021). Different attributes and drivers can be involved in such decision-making or the shift to other protein sources. Meanwhile, it is worthy to note that fish and rabbit (and other animal protein sources such as eggs) were not considered in our survey to take any conclusion. Thus, further targeted studies in Algeria including in the Kabylia region are needed to better understand on one hand the origin of animal-proteins sources of the consumers and on the other hand, the main reasons and motivations of non-consumption of meat and meat products.

Based on the above results, the following focuses on the consumption pattern (frequencies) and preferences of the six different types of meat using the data collected from the 636 respondents eating at least one of the six meat types (Figure 2.). This question is important to better analyse the consumer profile of each type of meat to adapt the marketing mix to each

one and identify the motivations and beliefs of meat consumers. The results revealed that the respondents have divergent patterns in meat consumption and preferences towards goat, beef, lamb, chicken, horse and camel meats (Figure 2a.). It is known that patterns in meat consumption are unpredictable and changes were described to occur in the way consumers behave towards food (Grunert, 2006). For example, earlier studies reported that the consumption of goat among other meat types is variable and in certain cases households preferred to consume small ruminants' (goat and lamb) meat over beef (Juma et al. 2010).

In this study, chicken was found as the main meat eaten by all respondents, mostly always and highly appreciated (Figure 2b.), followed by beef and lamb meats (Figure 2a,b.). The preference towards chicken meat might be due to several factors likely its superior taste, affordability, health attributes, nutritional quality, and convenience of processing. These

findings align with the political guidelines in Algeria as, since the beginning of the 1980s, the Algerian Ministry of Agriculture oriented meat consumption to white meat as an alternative to beef and lamb for numerous economic and health reasons. Also, chicken contains low cholesterol and fat with very high omega-3 fatty acids (Fletcher, 2002). Furthermore, the high chicken consumption compared to other meat types could be ascribed to the relatively low price (most affordable type of meat available in the market) with typically convenient portions, hence making chicken as the most economical meat if the number of dishes cooked with meat is usually high. In agreement to our findings, Tomasevic et al. (2021) reported for Eastern European consumers that only 2.6 % avoid consumption of chicken meat, while the majority (51.7%) and more than half of them eat it on a fortnightly basis. Similarly, in India the contribution of meat from poultry was found very high (50%)

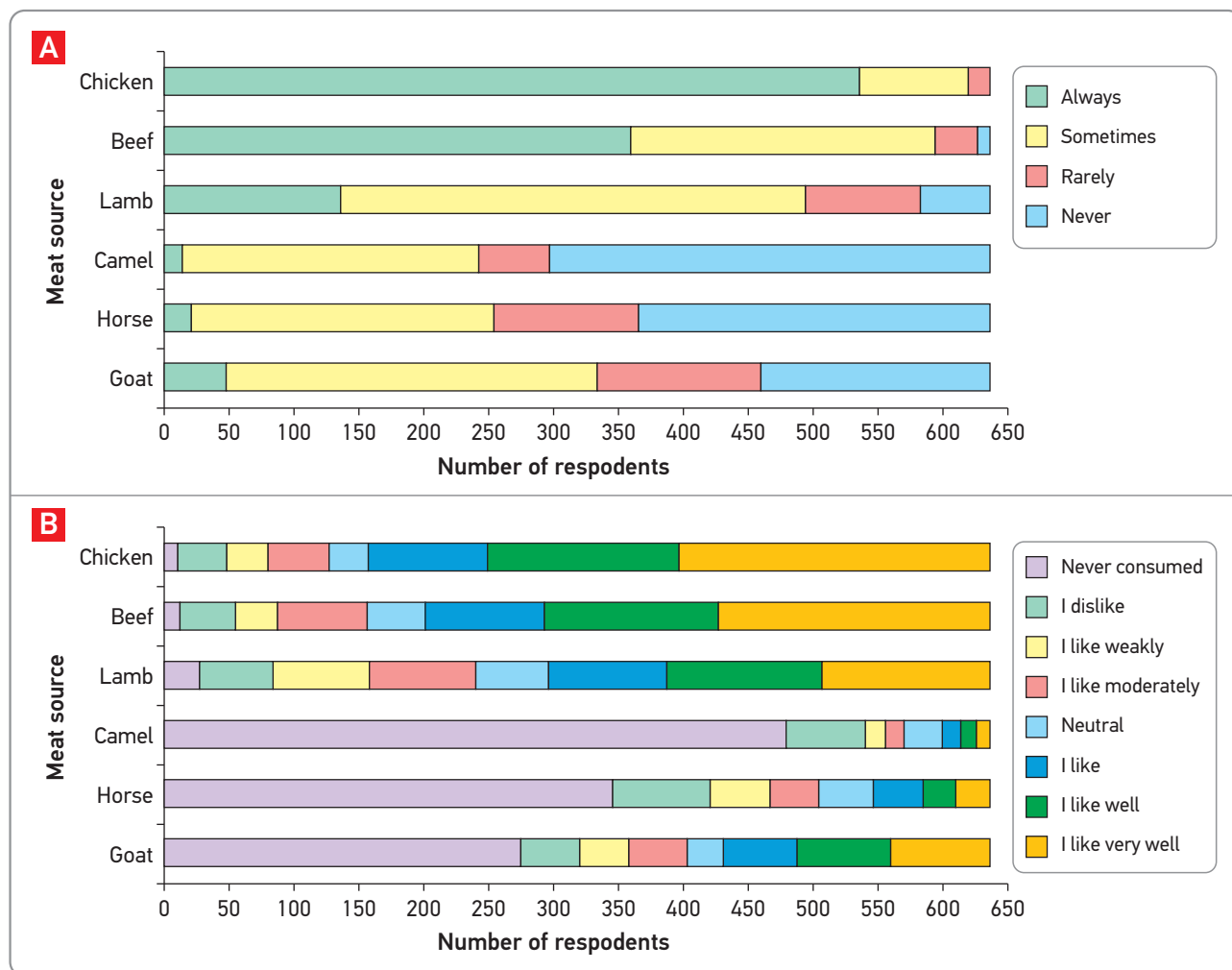


Figure 2. Frequency of consumption (A) and preferences (B) of goat meat compared to the meat sources listed in the online survey likely camel, lamb, beef, horse and chicken from the three provinces (Tizi-Ouzou, Béjaia and Bouira) in Kabylia region.

followed by buffalo (19%), goat (14%), sheep (8%), pig (5%) and cattle (4%) (Mohan *et al.* 2022). Among Canadian consumers, the study by Popoola *et al.* (2021) reported that the most frequently consumed meat was poultry, followed by beef and pork, while only a small proportion of participants consumed lamb frequently. Inversely to these studies including our survey, Australian consumers were described to allocate 44% of the meat expenditure on beef, 24% on pork, 20% on chicken, 12% on lamb, and very little on mutton (Wong *et al.* 2015). A Spanish consumers study reported that beef and turkey meats were associated to the consumers' food-related lifestyle (Escriba-Perez *et al.* 2017).

Horse and camel meats were found as being not well appreciated or eaten by the consumers from Kabylia region (Figure 2b.), hence representing the lowest proportions (Figure 2a). This result may be explained by the meat-eating habits of the consumers of this region towards those meats that are not produced locally or because they are not dominating the main dishes of this region. The limited availability of horse and camel meats may have contributed to lower familiarity scores as the per capita consumption of other meats in Algeria and the disparity that might exist for camel meat availability and consumption between the North and South of country (camel is more dominant in the South) with different tradition, cultures, lifestyles and habits. In fact, culture, traditions, and taboos all play an important role in determining how much or which type of meat can be eaten in a society (Bernués *et al.* 2012; della Malva *et al.* 2022), especially in rural areas such as Kabylia. Food neophobia (reluctance to try or avoidance of new food) and food variety seeking (tendency to seek variety in food choice) (Pliner & Hobden, 1992) impact behaviour towards unfamiliar meat products that can be the case of horse and camel meats. However, it is important to mention that research on Algerian consumers' perception of horse and camel meat is limited and, to the best of our knowledge, none of the few available studies has focused on understanding consumers' perception of these meats. On another hand, consumers have perceptions about a food, which influence their decision to accept or reject it. Consumers' tendency to avoid unfamiliar meat products can be attributed to a distaste for their sensory attributes, fear of the negative consequences of their consumption, a sense of repulsion for the source of the food, and the mental classification of the food as inappropriate (Derinalp Çanakçı & Birdir, 2020). This was recently described in a survey among Canadian consumers for which horse meat was unfamiliar to 80% of the participants

(Popoola *et al.* 2021). In fact, the horse was perceived as a companion animal and the dominant perception of its meat was then judged unacceptable for eating. According to Belaunzaran *et al.* (2015), the consumption of horse meat has been mainly interrupted throughout history due to three major reasons related to religion, social and/or culture.

Finally, goat meat seemed to be intermediate compared to the other meat types (species), where it is never consumed by 27.7% of the respondents, and it is mostly consumed sometimes (44.8%, $n = 285$) or rarely (20%, $n = 127$) and on average, it is well appreciated. These data allow an initial concept of the behaviour of consumers concerning goat meat consumption. Compared to the other species namely chicken, beef and lamb, less scientific investment has been made towards improving the productivity of goats (Dhanda *et al.* 2003). This maybe one major reason that relegated goats to low economic value, hence driving the preference of consumers for other meat types. Compared to other studies, our findings are in line to European consumers of goat meat consumptions that were significantly lower than for other types of meat likely chicken and beef (Mandolesi *et al.* 2020). On another hand, it is worthy to mention that in Africa including in Algeria, the demand for goat meat consumption is very much linked to household income and the market price of this meat (Dubeuf *et al.* 2004; Juma *et al.* 2010; Teixeira *et al.* 2020).

Goat meat consumption and consumer purchase behaviour

Based on the 636 meat consumers, only 362 respondents (56.9%) declared consuming goat meat (Table 2.). Thus, the rest of our survey focused on goat meat consumers only. Surprisingly, goat meat consumption was found to be very low in Kabylia region with about 45% of respondents consuming it only once a year and 44.2% consuming it monthly or seasonally (combined), and only less than 10% declared consuming it once every two weeks or weekly (Table 2.). Our results are globally in line with the goat meat consumption rate of Turkish households based on several surveys (Kosum *et al.* 2019). Available research suggests also that the demand for goat meat is influenced by consumers' age, gender, household sized, and marital status (Nelson *et al.* 1999; McLean-Meynsse, 2003). The familiarity to goat products would be another important reason of low goat meat consumptions. Accordingly, the perception of goat meat quality amongst American consumers was found to differ

Table 2. Characteristics, perception and behaviour of goat meat consumption by the respondents who eat meat (n = 636) from the Kabylia region.

Variable	Categories	Frequencies	Percentages (%)
Goat meat consumers	Yes	362	56.9
	No	274	43.1
Frequency of goat meat consumption	Once per week	21	5.8
	Once per 2 weeks	18	5.0
	Once per month	60	16.6
	Once per season	100	27.6
	Once a year	163	45.0
Raisons of goat meat consumption	No specific raison	274	43.1
	Price	47	13.0
	Taste	188	51.9
	Nutritional values	230	63.5
	Safety	114	31.5
Which of these sensory attributes do you judge different in cooked goat meat comparable to other species?	Others ¹	34	9.4
	Colour	64	17.7
	Taste	294	81.2
	Texture (tenderness)	207	57.2
	Flavour	112	30.9
Reasons of goat meat consumption	Traditional and religious events	180	49.7
	Restaurant	111	30.7
	Cooking at home	7	1.9
How do you judge the frequency of goat meat consumption?	No specific raison	189	52.2
	Low	143	39.5
	Medium	169	46.7
	High	45	12.4
Reasons for the weak goat meat consumption	Very high	5	1.4
	Strong taste	89	24.6
	High price	98	27.1
	Availability	183	50.6
How do you judge the price of goat meat?	Culinary habits	186	51.4
	Ignorance of its nutritional values	198	54.7
	Low	19	5.2
	Acceptable	180	49.7
	High	163	45

Legend: ¹ The main other reasons were for curiosity, the only meat available, familial traditions.

based on product familiarity, with consumers that grew up eating goat meat holding positive perceptions and neophobia being experienced by those that were unfamiliar (Ekanem *et al.* 2013). These percentages further highlight that goat meat is underutilised, which can be the consequence of the low societal awareness on the beneficial nutritional value of this meat as previously evidenced (Marandure *et al.* 2020). In support of this, Melody and Amit Kumar (2021) confirmed that the nutrient content of goat meat is undervalued by many consumers and suggested that educating consumers about this added value should be emphasized in marketing communication to encourage them to increase their frequency of consumption. In agreement to this and from the respondents consuming goat meat, our survey reported that the main reasons of purchase/consumption are for its nutritional values (63.5%), followed by taste (51.9%) and other reasons (43.1%): such as the curiosity, the only meat available and for familial traditions. The study carried out by Ekanem *et al.* (2013), reported a percentage of 56% of the respondents considered the nutritional value of goat meat when buying it. Moreover, the study reported that 60% of the participants are willing to buy more goat meat if additional information on its nutritional value was made available. Another study confirmed the motivation of consumers to pay a premium for goat meat for which they had a guarantee of its nutritional and food safety (Ibrahim *et al.* 2018). Based

on these aspects, we can suppose that the major reasons for poor goat meat familiarity and consumption are related to marketing, lack of organized production, and consumption pattern. Thus, raising awareness of the constructive and beneficial effects of goat meat through direct or indirect means can be considered the first step toward improving the supply of such a valuable animal protein source.

In agreement to earlier studies (Webb *et al.* 2005), respondents declared that the most significant differences of goat meat compared from other types of cooked meat were related to the sensory attributes: taste (81.2%), tenderness (57.2%), flavour (30.9%) and weakly in terms of colour (17.7%). In comparison to lamb meat, an earlier study reported that goat meat was tougher with high connective tissue amounts (Schönfeldt *et al.* 1993). However, it is important to note that such differences are depending on the animal type, breed, age at slaughter and production system (Gagaoua *et al.*, 2016; Pophiwa *et al.* 2020; Teixeira *et al.* 2020; Gagaoua *et al.*, 2022). A total of 49.7% of the respondents declared that they mostly consume goat meat during religious and socio-cultural events (Table 2.) such as family celebrations, or religious feasts of the sacrifice “*Aid Al Adha*”, birth of a child, circumcisions and for welcoming visitors. This is in agreement to the habits and practices related to the consumption of meat and traditional meat products in several African countries including Algeria (Gagaoua & Boudechicha 2018; Marius *et al.*

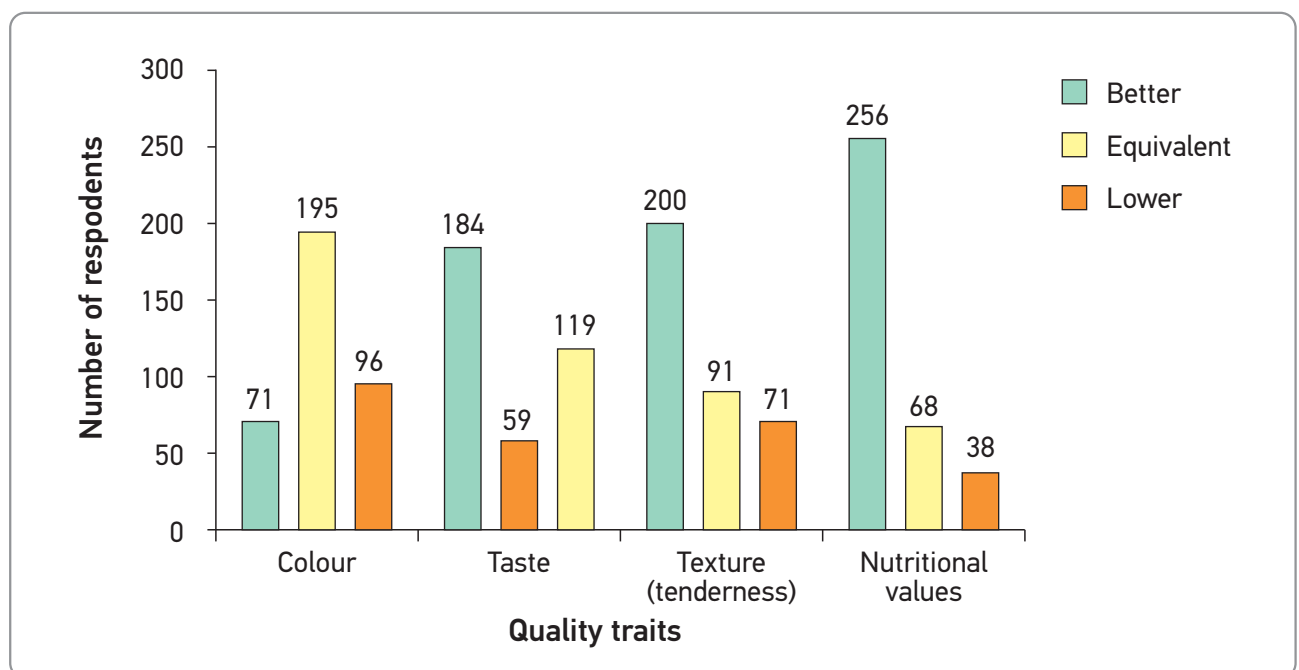


Figure 3. Comparison of the evaluation and appreciation of goat meat sensory and nutritional attributes from the surveyed respondents eating goat meat (n = 362) to beef meat.

2020). Further, this is maybe because Algerian people like to eat and share food with family and eating goat meat at this event could enhance the relationships and enjoy better the celebrations. Overall, the respondents judged low to medium the consumption of goat meat, explaining this trend by several reasons, likely culinary habits (51.4%), its non-availability (50.6%), high price and the fact that most consumers are not aware of its nutritional value importance.

Evaluation of goat meat quality by the respondents and consumers purchase behaviour

The determinants of goat meat purchase, consumption, and meat quality attributes evaluation are multiple and the analysis of the consumer perceptions is critical for understanding and forecasting consumer behaviour (Grunert et al. 2004). Therefore, for a better understanding on how respondents evaluate goat meat in relation to certain intrinsic qualities of meat (nutritional and sensory attributes) compared to other types of meat, we focused on beef as an example (Figure 3.). It appears that the majority of the respondents rate the colour of goat meat as equivalent to beef, but better in terms of tenderness and taste, and as expected significantly better in terms of nutritional attributes related to goat (Res-

urreccion, 2004; Liu et al. 2013; Mazhangara et al. 2019). Nevertheless, a number of consumers consider goat meat to being inferior in colour, texture and taste compared to beef (Figure 3.). A general belief that goat meat is inferior to beef sensory qualities was reported in earlier studies (Babiker et al. 1990). In another study, goat meat was reported to be equivalent in flavour but less tender and overall less palatable than beef when samples of comparable maturity and fatness were compared (Smith et al. 1974). Consumers judge that a better satisfaction of their needs by adding goat meat to their diets for its nutritional value and the lowest fat content, hence making it a healthy choice compared to other meat sources (Mandolesi et al. 2020). The health aspect is a common reason for changing consumption habits and seemed in this study of significant role to consumers from Kabylia region. Overall, it is known that consumers tend to view meat as a healthy and important part of the diet to provide them with needed nutrients such as proteins and vitamins (Verbeke et al. 2010).

The decisions to purchase meat by consumers are influenced by meat consumption properties and quality attributes (Font-i-Furnols & Guerrero, 2014). The purchase criteria described in this survey by the respondents for goat meat were in the following order: freshness and tenderness in the first place, followed

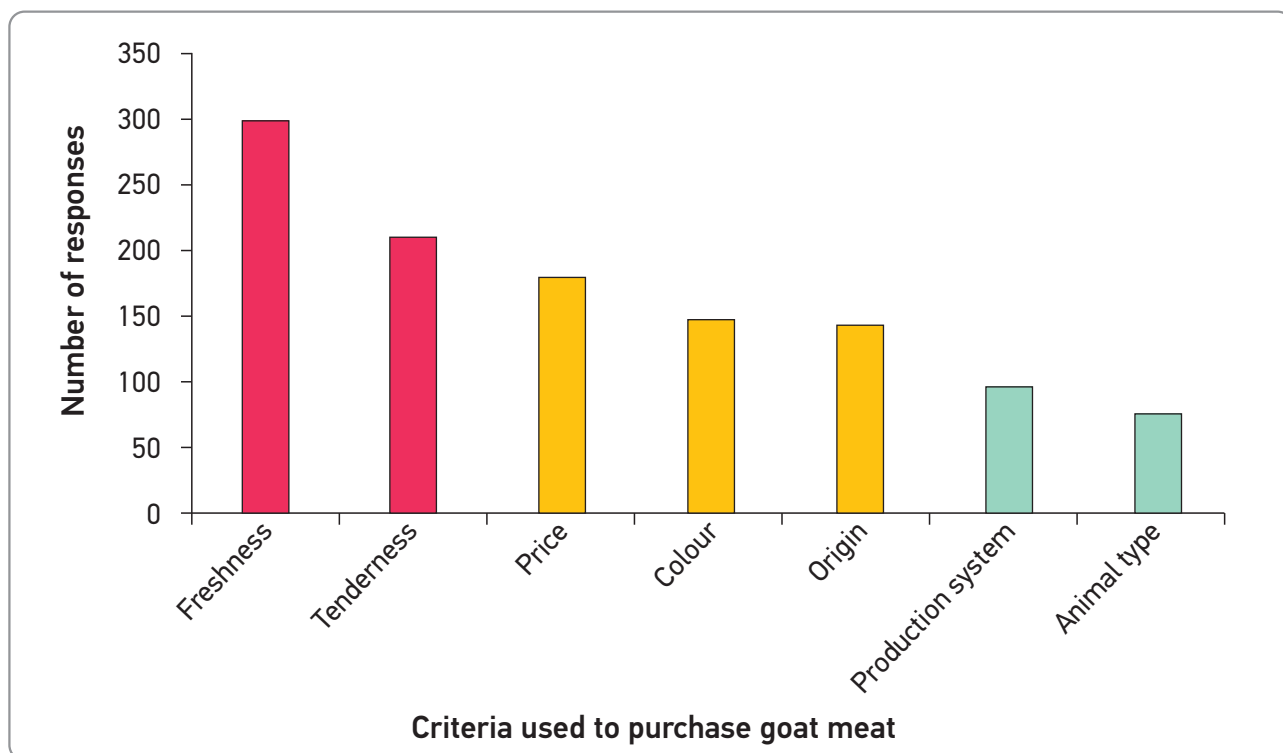


Figure 4. The main criteria used by the surveyed respondents to purchase goat meat. The criteria were ranked based on the number of responses, knowing that the respondents were given the liberty to score more than one parameter.

by price, colour and origin, and finally the production system and information on the animal type (Figure 4.). According to a recent study, Chinese consumers consider freshness not only as one of the most crucial factors in buying red meat, but also as a primary safety criterion, hence allowing to evaluate its quality and safety (Kantono *et al.* 2021). Consumers also relate freshness (product credibility or ‘credence’) to colour, which indicates deterioration and freshness loss, hence ranking colour as an essential driver of meat purchases (Mancini & Hunt 2005; Gracia & de-Magistris, 2013). Among Indian consumers, freshness of meat would be decided mainly by tenderness and colour (Mohan *et al.* 2022). Respondents also revealed in our survey that tenderness is another major cue influencing their purchase decision of goat meat. In fact, tenderness is the leading indicator of meat quality and the main factor worldwide described to influence meat product processing and consumer acceptance (Gagaoua *et al.* 2019; Gagaoua *et al.* 2021). Regardless of all sensory and nutritional attributes, price remains a critical parameter and was ranked by respondents in third place with a significant number (45%) rating prices as very high and not affordable and very few as low (Table 2.). Indeed, price is known as a key factor to consumers for purchasing meat including that from small ruminants (Ward *et al.* 1995; Hoffman *et al.* 2005). Finally, the comparison of the major intrinsic sensory quality traits (colour, tenderness, taste and flavour) of goat meat to other meat types in terms of

their importance is given in Figure 5. The respondents seemed to compare similar/equivalent the quality attributes of goat meat to those of lamb. However, colour was the only trait identified by the consumers to be similar to that of beef. This can be related to the type of muscle, mostly characterized as red.

Conclusions

This study is the first to highlight in Kabylia region and within its three provinces (Tizi-Ouzou, Bejaia, and Bouira) the trend of meat consumption from several species, revealing that the main consumed meat is chicken followed by beef and lamb. Goat meat, which is the focus of our study, is consumed to a small extent, while horse and camel meats are never or rarely consumed. Overall, it was found that the purchase and/or consumption of meat is done where it is produced, which is the case in our study area. Consumers’ perception and purchase behaviour of goat meat in Kabylia region was then investigated in a sub-population of the survey. Further studies are needed to confirm our findings and to explore the antecedents of these attitudes in larger samples and on special populations looking for special attributes. Encouraging the consumption of goat meat as an alternative and valuable source of animal proteins can be seen as a sustainable approach. In fact, goats can contribute to sustainable and productive use of water resources if their efficiency is

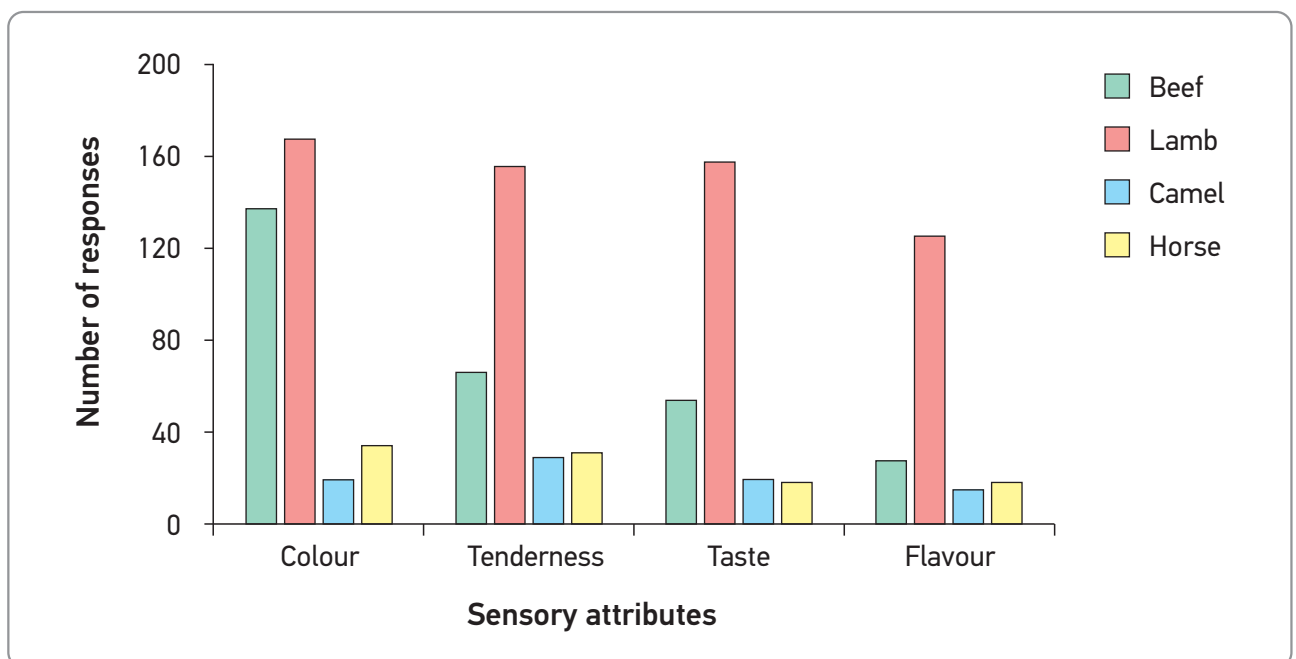


Figure 5. Comparison of the major intrinsic sensory quality traits of goat meat to red meat species in terms of their importance.

improved by better adapted research and more efficient extension service. Therefore, the Algerian goat industry has great potential to grow in the market. Additionally, goat production entails lower methane emissions compared to other domestic ruminants, therefore this could contribute to the mitigation of

climate change in red meat production. However, few strategies are needed to increase the consumption of goat meat. For example, a better communication on the benefits related to the healthiness of goat meat and the provision of more detailed information on its characteristics would be very helpful.

Obrasci potrošnje kozjeg mesa i preference u tri provincije regiona Kabilija u Alžiru, u poređenju sa drugim vrstama mesa: rezultati onlajn ankete

Melisa Lamri, Djamel Djenane, Mohammed Gagaoua

A p s t r a k t: Ova studija je imala za cilj da, koristeći onlajn anketu, istraži obrasce/učestalost konzumacije mesa i preference nekoliko vrsta mesa u regionu Kabilija u Alžiru, i unutar tri provincije (Tizi-Ouzou, Bejaia i Bouira). U ovom radu je posebno ispitana potrošnja kozjeg mesa u odnosu na jagnjeće, goveđe, konjsko meso, kao i kamilje meso i piletinu. Korišćenjem istraživačke ankete na homogenoj populaciji potrošača po polu, pokušali smo da objasnimo/razumemo osnovne faktore percepcije potrošača i kupovnog ponašanja/odluka pri kupovini kozjeg mesa. Istraživanje sprovedeno na 665 ispitanika pokazalo je da su 95,6% ispitanika potrošači mesa i mesnih prerađevina ($n = 636$), a da 4,4% ($n = 29$) nikada nisu konzumirali meso. Većina ispitanika nikada nije konzumirala meso kamile (54,3%, $n = 339$), kao ni konjsko meso (42,5%, $n = 270$). Od onih koji konzumiraju kamilje meso, samo 14 ga stalno konzumira (1,6%), a ostali ponekad (35%) ili retko (9,1%). Piletina je jedino meso koje jede značajan broj ispitanika ($n = 534$), od kojih 84,0% ga stalno konzumira, zatim goveđe (56,6%) i jagnjeće (21,2%). Piletina je takođe bila najomiljenije meso u poređenju sa drugim vrstama, dok su konjsko i kamilje meso manje cenjeno. Kozje meso je bilo srednje, u odnosu na ostale vrste, 27,7% ispitanika ga nikada ne konzumira, i uglavnom se konzumira ponekad (44,8%, $n = 285$) ili retko (20%, $n = 127$) i, prosečno je cenjeno. Ova studija je prva koja je u regionu Kabilija istakla trend potrošnje mesa nekoliko vrsta, otkrivajući da se značajno konzumira piletina, a zatim goveđe i jagnjeće meso. Kozje meso se slabo konzumira, a kamilje i konjsko meso, nikad ili retko. Podsticanje konzumiranja kozjeg mesa kao alternativnog i vrednog izvora životinjskih proteina može se posmatrati kao održiv pristup.

Ključne reči: potrošnja mesa, Alžir, anketa, preference potrošača, stoka, online upitnik.

Disclosure statement: No potential conflict of interest was reported by the authors.

Funding: This research did not receive any funding from the public, commercial or not-for-profit sectors. The study was exclusively conducted under the PhD thesis of the first author Melisa Lamri who as a PhD scholar is supported by Université Mouloud Mammeri. This study does not belong to any project.

Acknowledgements: The authors would like to thank the survey respondents for generously giving their time and sharing their experiences on meat consumption.

References

- Ahmad, R. S., Imran A. & Hussain, M. B. (2018). Nutritional composition of meat. *Meat science and nutrition* 61, <http://dx.doi.org/10.5772/intechopen.71954>.
- Anusha Siddiqui, S., Bahmid, N. A., Mahmud, C. M. M., Boukid, F., Lamri, M. & Gagaoua M. (2022). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: a critical compilation of a decade of research. *Critical Reviews in Food Science and Nutrition*, 1–22, DOI: 10.1080/10408398.2022.2036096.
- Babiker, S. A., El Khider, I. A. & Shafie, S. A. (1990). Chemical composition and quality attributes of goat meat and lamb. *Meat Science*, 28, 273–277.
- Belaunzaran, X., Bessa, R. J. B., Lavín, P., Mantecón, A. R., Kramer, J. K. G. & Aldai, N. (2015). Horse-meat for human consumption — Current research and future opportunities. *Meat Science*, 108, 74–81.
- Bernués, A., Olaizola, A. & Corcoran, K. (2003). Labelling information demanded by European consumers and relationships with purchasing motives, quality and safety of meat. *Meat Science* 65, 1095–106.
- Bernués, A., Ripoll, G. & Panea, B. (2012). Consumer segmentation based on convenience orientation and attitudes towards quality attributes of lamb meat. *Food Quality and Preference*, 26, 211–220.

- Boukid, F. & Gagaoua, M. (2022).** Chapter Seven - Meat alternatives: A proofed commodity? In: *Advances in Food and Nutrition Research* (ed. by J. Wu), pp. 213–36. Academic Press.
- Chetroiu, R., Călin, I. & Niculescu, C. G. (2013).** World-wide trends and orientations of raising goats. In: *Agrarian Economy and Rural Development-Realities and Perspectives for Romania. 4th Edition of the International Symposium, November 2013, Bucharest*, pp. 100–6. Bucharest: The Research Institute for Agricultural Economy and Rural.
- Chikhi, K. & Bencharif, A. (2016).** La consommation de produits carnés en Méditerranée: quelles perspectives pour l'Algérie? In: *The value chains of Mediterranean sheep and goat products. Organisation of the industry, marketing strategies, feeding and production systems* (ed. by H. Ben Salem, J.P. Boutonnet, D. Gabiña, A. López-Francos & M. Napoléone), pp. 435–40. Zaragoza : CIHEAM.
- Dekhili, M., Bounechada, M. & Mannalah, I. (2013).** Multivariate analyses of morphological traits in Algerian goats, Sétif, north-eastern Algeria. *Animal Genetic Resources/Recursos genéticos animales/Recursos genéticos animales*, 52, 51–57.
- della Malva, A., Gagaoua, M., Santillo, A., De Palo, P., Sevi, A. & Albenzio, M. (2022).** First insights about the underlying mechanisms of Martina Franca donkey meat tenderization during aging: A proteomic approach. *Meat Science*, 193, 108925.
- Derinalp Çanakçı, S. & Birdir, K. (2020).** The relation among food involvement, food variety seeking and food neophobia: A study on foreign tourists visiting Turkey. *Current Issues in Tourism*, 23, 917–28.
- Dhanda, J. S., Taylor, D. G., Murray, P. J., Pegg, R. B. & Shand, P. J. (2003).** Goat Meat Production: Present Status and Future Possibilities. *Asian-Australas Journal of Animal Science*, 16, 1842–1852.
- Dubeuf, J. P., Morand-Fehr, P. & Rubino, R. (2004).** Situation, changes and future of goat industry around the world. *Small Ruminant Research*, 51, 165–73.
- Ekanem, E., Mafuyai-Ekanem, M., Taguegne, F., Singh, S. & Favors, D. (2013).** Goat meat consumer preferences: implications for goat meat marketing in metropolitan Nashville, Tennessee area. *Journal of Food Distribution Research*, 44, 1–9.
- Escriba-Perez, C., Baviera-Puig, A., Buitrago-Vera, J. & Montero-Vicente, L. (2017).** Consumer profile analysis for different types of meat in Spain. *Meat Science*, 129, 120–126.
- Fletcher, D. L. (2002).** Poultry meat quality. *World's Poultry Science Journal*, 58, 131–145.
- Font-i-Furnols, M. & Guerrero, L. (2014).** Consumer preference, behavior and perception about meat and meat products: an overview. *Meat Science*, 98, 361–371.
- Gagaoua, M., Terlouw, E. M. C., Micol, D., Hocquette, J. F., Moloney, A. P., Nuernberg, K., Bauchart, D., Boudjellal, A., Scollan, N. D., Richardson, R. I. & Picard, B. (2016).** Sensory quality of meat from eight different types of cattle in relation with their biochemical characteristics. *Journal of Integrative Agriculture*, 15, 1550–1563.
- Gagaoua, M. & Boudechicha, H.-R. (2018).** Ethnic meat products of the North African and Mediterranean countries: An overview. *Journal of Ethnic Foods*, 5, 83–98.
- Gagaoua, M., Duffy, G., Álvarez García, C., Burgess, C., Hamill, R., Crofton, E. C., Botinestean, C., Ferragina, A., Cafferky, J., Mullen, A. M. & Troy, D. (2022).** Current research and emerging tools to improve fresh red meat quality. *Irish Journal of Agricultural and Food Research*, 1–23. DOI: 10.15212/ijafr-2020-0141
- Gagaoua, M., Monteils, V., Couvreur S. & Picard, B. (2019).** Beef Tenderness Prediction by a Combination of Statistical Methods: Chemometrics and Supervised Learning to Manage Integrative Farm-To-Meat Continuum Data. *Foods*, 8, 274.
- Gagaoua, M. & Picard, B. (2020).** Current Advances in Meat Nutritional, Sensory and Physical Quality Improvement. *Foods*, 9, 321.
- Gagaoua, M., Terlouw, E. M. C., Mullen, A. M., Franco, D., Warner, R. D., Lorenzo, J. M., Purslow, P. P., Gerrard, D., Hopkins, D. L., Troy, D. & Picard, B. (2021).** Molecular signatures of beef tenderness: Underlying mechanisms based on integromics of protein biomarkers from multi-platform proteomics studies. *Meat Science*, 172, 108311.
- Gracia, A. & de-Magistris, T. (2013).** Preferences for lamb meat: A choice experiment for Spanish consumers. *Meat science*, 95, 396–402.
- Grunert, K. G. (2006)** Future trends and consumer lifestyles with regard to meat consumption. *Meat Science*, 74, 149–60.
- Grunert, K.G., Bredahl, L. & Brunsø, K. (2004).** Consumer perception of meat quality and implications for product development in the meat sector—a review. *Meat Science*, 66, 259–272.
- Hoffman, L., Muller, M., Schutte, D.W., Calitz, F. & Crafford, K. (2005).** Consumer expectations, perceptions and purchasing of South African game meat. *South African Journal of Wildlife Research-24-month delayed open access*, 35, 33–42.
- Holm, L. & Möhl, M. (2000).** The role of meat in everyday food culture: an analysis of an interview study in Copenhagen. *Appetite*, 34, 277–283.
- Ibrahim, M., Onyango, B. M., Pattanaik, N. & Liu, X. (2018).** Current Trends, US Immigration Policies, and Marketing Strategies for Goat Meat. *Journal of Food Distribution Research*, 49, 70–77.
- Jacques, K. & Norwood, F. B. (2017).** Consumer preference for goat meat in a blind sensory analysis. *Sheep & Goat Research Journal*, 32, 28–35.
- Juma, G. P., Ngigi, M., Baltenweck, I. & Drucker, A. G. (2010).** Consumer demand for sheep and goat meat in Kenya. *Small Ruminant Research*, 90, 135–138.
- Kadim, I. T. & Sahi, A. B. A. (2018).** Health aspects of camel meat: a review of literature. *Advances in Animal and Veterinary Sciences*, 6, 271–272.
- Kantono, K., Hamid, N., Ma Q., Chadha, D. & Oey, I. (2021).** Consumers' perception and purchase behaviour of meat in China. *Meat Science*, 179, 108548.
- Khara, T., Riedy, C. & Ruby, M. B. (2021).** A cross cultural meat paradox: A qualitative study of Australia and India. *Appetite*, 164, 105227.
- Kosum, N., Taskin, T., Engindeniz, S. & Kandemir, Ç. (2019).** Goat meat production and evaluation of its sustainability in Turkey. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 56, 395–407.
- Lee, J., Kouakou, B. & Kannan, G. (2008).** Chemical composition and quality characteristics of chevon from goats fed three different post-weaning diets. *Small Ruminant Research*, 75, 177–184.

- Liu, X., Nelson, M. & Styles, E. (2013). Validating the demand for goat meat in the US meat market. *Agricultural Sciences*, 4, 549.
- Mancini, R. & Hunt, M. (2005). Current research in meat color. *Meat science*, 71, 100–21.
- Mandolesi, S., Naspetti, S., Arsenos, G., Caramelle-Holtz, E., Latvala, T., Martin-Collado, D., Orsini, S., Ozturk, E. & Zanoli, R. (2020). Motivations and Barriers for Sheep and Goat Meat Consumption in Europe: A Means–End Chain Study. *Animals*, 10, 1105.
- Marandure, T., Dzama, K., Bennett, J., Makombe, G., Chikwanha, O. & Mapiye, C. (2020). Farmer challenge-derived indicators for assessing sustainability of low-input ruminant production systems in sub-Saharan Africa. *Environmental and Sustainability Indicators*, 8, 100060.
- Marius, L. N., Shipandeni, M. N. T. & Togarepi, C. (2020). Review on the status of goat production, marketing, challenges and opportunities in Namibia. *Tropical Animal Health and Production*, 53, 30, <https://doi.org/10.1007/s11250-020-02468-3>.
- Mazhangara, I. R., Chivandi, E., Mupangwa, J. F. & Muchenje, V. (2019). The Potential of Goat Meat in the Red Meat Industry. *Sustainability*, 11, 3671.
- McAfee, A.J., McSorley, E.M., Cuskelly, G. J., Moss B.W., Wallace J. M., Bonham M. P. & Fearon A. M. (2010). Red meat consumption: An overview of the risks and benefits. *Meat Science* 84, 1–13.
- McLean-Meynsse, P. E. (2003). Factors influencing consumption or willingness to consume a variety of goat-meat products. *Journal of Food Distribution Research*, 34, 72–79.
- Melody, L. & Amit, Kumar S. (2021). Goat Meat: No Less Source of Protein in Comparison to Other Meat for Human Consumption. In: *Goat Science - Environment, Health and Economy* (ed. by K. Dr. Sándor), p. Ch. 13. IntechOpen, Rijeka.
- Mohan, K., Maheswarappa, N. B. & Banerjee, R. (2022). Exploring the dynamics of women consumer preference, attitude and behaviour towards meat and meat products consumption in India. *Meat Science*, 193, 108926.
- Multari, S., Stewart, D. & Russell, W. R. (2015). Potential of fava bean as future protein supply to partially replace meat intake in the human diet. *Comprehensive Reviews in Food Science and Food Safety*, 14, 511–522.
- Nelson, M. C., Brown, Jr N., Mobini, S., Gelaye, S. & Leak, S. (1999). Production and Marketing Challenges for Goat Producers: Implication for Supply and Demand. In: *Professional Ag Workers Conference (PAWC)*.
- Ngomane, M., Tsvakirai, C. Z. & Mlambo, V. (2022). Improving the marketing of goat meat to youths in South Africa. *Small Ruminant Research*, 214, 106760.
- Onwezen, M.C., Bouwman, E. P., Reinders, M. J. & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, 159, 105058.
- Ouchene-Khelifi, N.-A., Ouchene, N., Maftah, A., Da Silva, A. B. & Lafri, M. (2015). Assessing admixture by multivariate analyses of phenotypic differentiation in the Algerian goat livestock. *Tropical Animal Health and Production*, 47, 1343–1350.
- Pliner, P. & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19, 105–120.
- Pophiwa, P., Webb, E. C. & Frylinck, L. (2020). A review of factors affecting goat meat quality and mitigating strategies. *Small Ruminant Research*, 183, 106035.
- Popoola, I. O., Anders, S., Feureisen, M. M., Savarese, M. & Wismer, W. V. (2021). Free word association perceptions of red meats; beef is ‘yummy’, bison is ‘lean game meat’, horse is ‘off limits’. *Food Research International*, 148, 110608.
- Possidónio C., Prada M., Graça J. & Piazza J. (2021). Consumer perceptions of conventional and alternative protein sources: A mixed-methods approach with meal and product framing. *Appetite*, 156, 104860.
- Resurreccion, A. (2004). Sensory aspects of consumer choices for meat and meat products. *Meat science*, 66, 11–20.
- Rodrigues, S. & Teixeira, A. (2010). Consumers’ preferences for meat of Cabrito Transmontano. Effects of sex and carcass weight. *Spanish Journal of Agricultural Research*, 8, 936–945.
- Schönfeldt, H. C., Naudé, R. T., Bok, W., van Heerden, S. M., Smit, R. & Boshoff, E. (1993). Flavour- and tenderness-related quality characteristics of goat and sheep meat. *Meat Science*, 34, 363-79.
- Smith, G. C., Pike, M. I. & Carpenter Z. L. (1974). Comparison of the palatability of goat meat and meat from four other animal species. *Journal of Food Science*, 39, 1145–1146.
- Teixeira, A., Silva, S., Guedes, C. & Rodrigues, S. (2020). Sheep and Goat Meat Processed Products Quality: A Review. *Foods*, 9, 960.
- Tomasevic, I., Solowiej, B. G., Djordjevic, V., Vujadinovic, D. & Djekic, I. (2021). Attitudes and beliefs of Eastern European meat consumers—a review. *IOP Conference Series: Earth and Environmental Science*, 854, 012098.
- Verbeke, W., Van Wezemael, L., de Barcellos, M. D., Kugler, J. O., Hocquette, J. F., Ueland, O. & Grunert, K. G. (2010). European beef consumers’ interest in a beef eating-quality guarantee Insights from a qualitative study in four EU countries. *Appetite*, 54, 289–296.
- Ward, C. E., Trent, A. & Hildebrand, J. L. (1995). Consumer perceptions of lamb compared with other meats. *Sheep and goat research journal (USA)*.
- Webb E. C. & Casey N. H. (2010). Physiological limits to growth and the related effects on meat quality. *Livestock Science*, 130, 33–40.
- Webb, E. C., Casey N. H. & Simela L. (2005). Goat meat quality. *Small Ruminant Research*, 60, 153–166.
- Wong, L., Selvanathan, E. A. & Selvanathan, S. (2015). Modelling the meat consumption patterns in Australia. *Economic Modelling*, 49, 1–10.

Paper received: September 28th 2022.

Paper corrected: October 31st 2022.

Paper accepted: November 11th 2022.