

Students' sensory assessment of lamb meat taking into account selected consumer considerations

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The aim of the study was to analyse consumer preferences for different types of meat and factors influencing the sensory acceptability of lamb meat among a group of surveyed university students. A survey and sensory analysis of roast leg of lamb was conducted among 202 students (17.8% men and 82.2% women; 33.2% respondents from rural areas and 66.8% from urban areas) from the Poznań University of Life Sciences. All the students had eaten chicken and pork, which were shown to be the most frequently consumed and most preferred meats. Almost 40% had eaten lamb, but only 1% indicated lamb as their favourite kind of meat. The highest ratings for the sensory quality of roast leg of lamb were given by men, by students who favour fried and roasted meat, and by those who declared interest in eating lamb in the future. Over 92% of the students surveyed found lamb acceptable and declared interest in eating lamb in the future. Of these 92%, about 40% of respondents declared interest in eating lamb often and about 50% in eating it occasionally. The high acceptability observed for the sensory traits of lamb may suggest that if lamb was appropriately promoted, distributed and made available, lamb consumption in Poland would increase.

KEY WORDS: lamb meat / lamb acceptability / young consumer preferences

Polish lamb production is mostly influenced by foreign markets and the possibility of exporting lamb carcasses to UE markets, where the supply meets only 80% of the demand [17]. Italy is the main consumer of Polish lamb (89% share of export), which is regarded as a delicacy, with the highest demand observed during Christmas and Easter. Consumption of lamb is generally much lower than that of other meats [2]. Lamb consumption in Poland is very low. This is due to a lack of tradition of eating lamb as well as its high price in comparison to poultry and pork. Other factors contributing to the low popularity of lamb meat among Polish consumers include lack of promotion and low awareness of its nutritional and health benefits. Lamb is known for its high digestibility and nutritional value. It is particularly noteworthy that lamb consumption may prevent cancer and obesity, slow down osteoporosis, stimulate the immune system, and have an anti-atherosclerotic effect [7, 26]. The health-promoting properties of lamb result from its high content of conjugated linoleic acid

[9, 20, 23], which seems to benefit human health. The content of conjugated linoleic acid in lamb ranges from 0.40% to 1.05% [11]. Another important benefit of lamb is its content of micronutrients (iron, zinc and selenium) and vitamins (niacin and riboflavin) [4].

Students are one of the most interesting groups of consumers in terms of consumption patterns and preferences for products from different food groups [25]. The presented research was conducted in order to analyse eating habits and preferences for different meat types among university students. An additional objective of the research was to investigate factors affecting the sensory acceptance of lamb prepared according to a traditional Polish recipe. This type of research can help to support commercial strategies used in meat marketing [2].

Material and Methods

Survey research

The study was conducted among 202 students (17.8% men and 82.2% women; 33.2% respondents from rural areas and 66.8% from urban areas) of Animal Science at the University of Life Sciences in Poznań. The proportion of men and women was a consequence of the structure of the group studying at the University during the study. The students were asked to fill in a questionnaire concerning their preferences for different meat types. Then they took part in a sensory analysis of lamb meat. The questionnaire included questions regarding their gender, place of residence, the kinds of meat they had eaten, and the kinds of meat they ate most frequently and most preferred.

Sensory analysis

The sensory evaluation was made by a group of unqualified consumers (the surveyed students) and aimed to determine the degree to which they liked or disliked the sensory traits of lamb [1]. The evaluation took place in a sensory analysis laboratory, in isolated taste panel booths, at a constant temperature (18-20°C). The sensory evaluation was performed on meat obtained from ten legs of lamb.

The lambs had remained with their mothers until reaching 30 kg body weight and were fed mother's milk. The 14-day-old lambs were additionally given rolled oats and a concentrated mix composed of crushed wheat, crushed barley, wheat middlings, post-extraction rapeseed meal (15.8% crude protein, 6.9 MJ ME/kg), and meadow hay *ad libitum*.

The lamb legs were prepared 24 hours before roasting according to a traditional Polish recipe [6]. The meat was rubbed with seasonings (salt, pepper, herbs and onions), and left in a cold place. Then the legs were roasted for about 1.5 hour at 180°C. The meat was cut into 1 cm thick slices crosswise to the bone (against the grain).

The sensory evaluation included four sensory characteristics: taste, smell, tenderness, and juiciness. The students were asked to assign the meat a score from 1.0 to 5.0, with 1.0 denoting a negative score (not preferred), and 5.0 denoting a very good score (preferred). Additionally, to increase the precision of the results, half-points were used (1.5, 2.5, 3.5 and 4.5), so the evaluation included 9 possible quality scores. After the analysis of quality traits, the respondents declared whether they would like to eat the product in the future – often (once or twice per month), occasionally (during holidays, family meetings or festivals) or not at all (no acceptance of lamb meat).

Statistical analysis

The proportions of respondents with respect to gender, place of residence and consumption preferences were compared using the Z test. The Kruskal-Wallis test was used to analyse the influence of the students' gender, place of residence and culinary preferences on their rating of the roasted leg of lamb. The calculated interactions between the effect of gender and the effect of place of residence, the effect of gender and of lamb consumption to date, the effect of gender and of preferences in meat preparation method, and the effect of gender and of interest in eating lamb in the future were not significant ($P > 0.05$) and were not presented in the tables. Calculations were made using the SAS software package, ver. 9.4 [22].

Results and discussion

Pork and poultry were found to be the most frequently consumed meats by the surveyed group of students (Table 1). This tendency is observed worldwide. World pork consumption is about 15.8 kg/capita/year, which places it highest among all meat types. Poultry consumption ranks second, amounting to 13.6 kg/capita/year (FAOSTAT, 2014). This is also a reflection of the relation between consumption of a meat type and its production level in the internal and external market. The level of pork, poultry, and ovine meat production in the European Union market amounts to 22.8 billion tonnes, 10.6 billion tonnes, and 900,000 kg a year, respectively. This situation affects the internal Polish market. Production of pork and poultry in Poland (2012) was about 1.8 and 1.5 billion tonnes a year, respectively (FAOSTAT, 2014), while ovine meat production (lamb and mutton) was much lower, amounting to about 1,300 kg a year. Consumers seem to value the taste of pork and poultry meat, the possibility of using a variety of methods for pork and poultry preparation, and the availability of these meat types. Price and nutritional value seem to be of less importance [18]. The high level of pork and poultry meat consumption may also be explained by consumers' convenience orientation [3]. The available research shows that consumer convenience depends to a large extent on the time and effort required for food preparation [8]. This dependency results from the busy lifestyles of today's consumers and the necessity of fast preparation of foods. In the case of pork and poultry meat, preparation is neither difficult nor time-consuming [16]. Lamb meat preparation, however, requires much more time and skill; hence it is not popular among consumers who claim to have insufficient time for cooking and planning meals [19].

Among poultry meat types, the most commonly consumed were chicken (100%), turkey (over 90% respondents), duck (over 80%), and goose (over 40%). Of the other meat types, beef had been consumed by almost all the students, veal by over 75%, and rabbit meat by nearly 60%. One in every two students surveyed declared having eaten boar meat. Over one third of the respondents had eaten lamb. Lamb consumption was more popular among men than among women. One third of the students surveyed had eaten venison. Goat meat had low popularity, with only one fifth of the students declaring consumption of this type of meat. The other meat types, i.e. horse, ostrich, coypu, partridge, and pheasant meat, had been eaten by a small portion of the surveyed students.

Table 1

Consumption of different types of meat among respondents, taking into account the influence of gender and place of residence

Type of meat	Total (%)	Gender		Place of residence	
		men (%)	women (%)	rural areas (%)	urban areas (%)
Poultry					
total	100.0	100.0	100.0	100.0	100.0
chicken	100.0	100.0	100.0	100.0	100.0
turkey	93.6	100.0	92.2	92.5	94.1
duck	86.6	83.3	87.4	89.6	85.2
goose	45.1	61.1	41.6	46.3	44.4
Pork	100.0	100.0	100.0	100.0	100.0
Beef	97.0	100.0	96.4	92.5	96.3
Veal	75.3	86.1	72.9	74.6	75.5
Lamb/mutton	39.6	66.7	33.7	38.8	40.0
Goat meat	22.3	41.7	18.1	14.9	25.9
Horse meat	10.9	16.7	9.6	11.9	10.4
Rabbit	58.9	66.7	57.2	67.2	54.8
Wild boar meat	53.9	69.4	50.6	62.7	49.6
Venison	33.2	52.7	28.9	37.3	31.1
Partridge	4.0	11.1	2.4	5.9	2.9
Ostrich	10.3	16.7	9.1	13.4	8.9
Pheasant	2.0	2.8	1.8	1.5	2.2
Coypu meat	7.9	8.3	7.8	10.5	6.7

With regard to the most frequently consumed meat types, chicken placed first, with increased consumption among women and students from urban areas (Table 2). These results, however, were only partially reflected in the consumer preferences (Table 3).

Table 2
The most frequently consumed meat types among respondents

Type of meat	Total (%)	Gender		Place of residence	
		men (%)	women (%)	rural areas (%)	urban areas (%)
Chicken	73.8	69.4	72.3	66.7	75.3
Turkey	1.5	2.8	2.6	1.5	3.6
Pork	22.7	25.0	23.4	31.0	18.7
Beef	2.0	2.8	1.7	0.8	2.4

Following the data presented in Table 3, one can observe the increasing importance of other meat types, such as veal, beef, venison, partridge or turkey, with beef, turkey and partridge being more popular in urban areas and veal and venison in rural areas. With regard to the effect of gender on preferences for different meat types, more men than women were found to prefer red meat, such as beef and veal, while women had a greater preference for turkey.

Among the respondents claiming to have eaten lamb meat, more than two thirds had eaten it once or twice in their lives, most commonly during festivals or events promoting regional and traditional products. Only one percent of consumers indicated lamb meat as their favourite (Table 3). The low level of lamb consumption observed is in agreement with the results of other research on the consumption patterns of young people [3, 12]. These studies report that the main reasons for low lamb consumption are low incomes and lack of cooking skills. However, this does not fully explain the results of the presented research. In the case of the Polish students surveyed, the leading reasons are lack of tradition of lamb consumption, lack of lamb promotion [13], and in consequence, lack of awareness of the sensory attributes of lamb and its beneficial influence on human health.

There was no significant difference ($P > 0.05$) in the lamb assessment made by the students from urban areas and those living in the countryside (Table 4). In contrast, Sañudo et al. [21] found an association between consumers' background and their culinary preferences.

The respondents declaring a preference for roasted and fried meat gave higher ratings to the eating quality of the roast leg of lamb than participants who preferred boiled or braised meat ($P \leq 0.01$) (Table 4). This observation confirms a strong influence of the thermal processing method on the development of the sensory traits of meat [5]. Thermal processing induces a number of chemical reactions known as 'Maillard reactions' and the degradation of fat in meat. These reactions determine the final taste and smell of the product [15], especially on the surface of roasted meat.

Table 3
Most preferred meat types among respondents

Type of meat	Total (%)	Gender		Place of residence	
		men (%)	women (%)	rural areas (%)	urban areas (%)
Chicken	50.4	52.2	51.3	47.2	53.2
Turkey	7.2	1.0	8.7	4.7	8.3
Pork	20.3	21.7	19.3	28.6	17.1
Beef	7.8	12.1	6.9	2.3	10.4
Veal	4.6	8.7	2.9	4.7	3.1
Lamb	1.0	2.8	0.6	1.5	0.6
Venison	5.1	-	6.0	9.5	3.1
Partridge	3.6	-	4.3	1.5	4.2

The university students familiar with lamb meat gave the flavour, smell, and tenderness higher ratings than those who had never eaten it before ($P \leq 0.01$). Lamb juiciness received similar scores in both regular and occasional lamb eaters ($P > 0.05$). The participants who rejected lamb meat and stated that they would not eat it in the future gave the lamb leg the lowest ratings ($P \leq 0.01$) (Table 4). This is due to the distinctive taste and smell of lamb meat [3], which is difficult to accept for consumers used to more delicate and neutral pork and poultry meat. The fact that the sensory traits of lamb were acceptable to consumers familiar with lamb indicates the important role of tradition in the development of consumer consumption patterns [3].

The men surveyed assessed the sensory traits of the lamb by 0.5 points higher than the women ($P \leq 0.01$). This is a result of the effect of gender on consumer culinary preferences. The differences between the sexes in consumption patterns are explained by evolutionary psychology and reflect the different roles of men and women in the societies of our early ancestors [14, 24]. All the men in the present study expressed interest in eating lamb in the future (55.5% often and 44.5% sometimes). Among women, 90.4% expressed interest in eating lamb in the future (37.4% often and 53.0% sometimes). Only 9.6% did not accept the analysed product.

The results indicate that the most frequently consumed types of meat in the surveyed group of students were pork and poultry, reflecting general preferences observed in Poland and worldwide. A large number of the students gave high scores to the sensory traits

Table 4
Results of the sensory analysis of lamb leg (point score)

Factor	N	Sensory characteristics							
		aroma		taste		tenderness		juiciness	
		LSM	SE±	LSM	SE±	LSM	SE±	LSM	SE±
Gender									
Men	36	4.32 ^A	0.22	4.39 ^A	0.21	4.51 ^A	0.19	4.41 ^A	0.18
Women	166	3.88 ^B	0.21	3.81 ^B	0.19	4.02 ^B	0.18	3.94 ^B	0.21
Place of residence									
Rural areas	67	4.01	0.28	4.08	0.26	4.21	0.17	4.12	0.24
Urban areas	135	4.19	0.31	4.16	0.25	4.28	0.21	4.16	0.27
Lamb consumption to date									
Yes	80	4.41 ^A	0.19	4.36 ^A	0.21	4.39 ^A	0.19	4.13	0.25
No	122	3.80 ^B	0.36	3.83 ^B	0.24	4.00 ^B	0.22	4.18	0.26
Preferences in meat preparation method									
Boiled	21	3.87 ^A	0.33	3.91 ^A	0.32	3.62 ^A	0.32	3.88 ^A	0.37
Stewed	22	3.92 ^A	0.29	4.02 ^{Aa}	0.26	3.83 ^A	0.31	3.89 ^A	0.32
Roasted	87	4.41 ^B	0.15	4.41 ^B	0.16	4.56 ^B	0.12	4.47 ^B	0.13
Fried	72	4.39 ^B	0.15	4.39 ^{BAb}	0.15	4.52 ^B	0.13	4.49 ^B	0.13
Interest in eating lamb in future									
Frequently	82	4.53 ^A	0.15	4.52 ^A	0.15	4.62 ^A	0.15	4.56 ^A	0.14
Sometimes	104	4.32 ^A	0.18	4.31 ^A	0.17	4.41 ^A	0.18	4.41 ^A	0.15
Never	16	2.73 ^B	0.98	2.95 ^B	0.91	3.05 ^B	0.91	2.97 ^B	0.99

Means within the same column with different letters (a, b) are significantly different at $P \leq 0.05$

Means within the same column with different letters (A, B) are significantly different at $P \leq 0.01$

of lamb and declared interest in eating lamb in the future. This observation may lead to the conclusion that the low popularity of lamb among young people derives from lack of promotion and limited distribution and availability of lamb, and consequently rare consumption of lamb in households.

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