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Sensory Attributes of Snail's Meat Prepared in Different Ways

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Abstract: Snails are used in human nutrition daily in some regions of the world. The acceptability of snail meat affected by many different factors (habits, customs, etc.) but the most important is way of preparing. This paper describes sensory attributes of snail's meat quality, prepared in two ways, French and Mediterranean. During meals preparation with snail's meat, various supplements and spices can greatly enhance the sensory properties, especially smell and taste. Results of overall acceptability in this paper show that the Mediterranean way of prepared snails are statistically significant ($p<0.05$) more acceptable.

Key words: snail meat, quality, sensory attributes

Introduction

In human diet snails are used since prehistoric times. Some species of snails (such as Helix spp., Achatina spp.) are currently being used in the nutrition of the population in the U.S., Europe and the Far East (Yildirim, 2003; Mašić, 2004; Dragićević and Baltić, 2005;). France is the country with the highest consumption of snails, prepared in different ways. France is also a major exporter of processed snails, which are mostly sold as preserved snails and ready meals. The greatest amount of snail meat in France is obtained by collecting snail meat from natural habitats (only 3% of the meat is obtained from breeding). On the other hand, in Italy the share of snail meat that is derived from farming is growing (Elmslie, 1982; Cheney, 1988; Novelli et al., 2005). In Serbia, in early 2005 the over 400 farms were registered for snails breeding (Pećanac, 2005). Situation was similar in Bosnia and Herzegovina, but the production has not found favorable ground on our fields (Sando et al. 2012). Similar reflections exist in other parts of the world (Zymantiene et al., 2005; Adeola et al., 2010).

Snail's meat is tender, juicy and tasty, good digestible (about 96%) and can be compared with fish meat and casein (Čaklovica, 1987; Novelli et al., 2002). Furthermore, it is an important source of vitamins and minerals, has a fine structure, specific smell, taste, rich in protein, low in fat, (Cheney, 1988). Zymantiene et al. (2005), citing the results of different authors, who believe that the snail meat has a nutritional value equal to the value of the conventional types of meat.

By the content of histidine, glutamic acid, aspartic acid and threonine, snail meat is ahead of chicken, beef and fish. It can be argued that the snail meat in content of essential amino acids is at a satisfactory level (Avanjina, 2004; Yildirim, 2003). In the diet of population now three amino acids are largely missing: tryptophan, lysine and methionine. They represent a limiting factor for conversion of food, therefore it is necessary that the sources of protein in human nutrition are correctly distributed (Grujić, 2000).

For the production of meat and meat products, can be used: a large Vineyard snail and related snails which have white meat, the Bosnian snail that has gray meat and Macedonian snail that has dark brown meat (Sando et al. 2012).

Vineyard snail meat and related snail has a softer texture and firm consistency, the pH of the meat is 6.75 (Čaklovica, 1983). Aroma and taste are typical, and color is light grayish, with yellow and light brown shades (Yildirim, 2003).

On usable part of snail remains 20-38%, it depends on market demand, and separation procedure of foot from shell. (Ajayi et al., 1978; Martin, 1984; Novelli et al., 2002).

Materials and Methods

Method of sampling

Snail samples for sensory analysis are originate from snails collected from nature and farmed. After grading and processing two sub-groups were formed from each of these (calibration P-6 and P-12) to determine the sensory properties (smell, juiciness, softness, taste, overall acceptability). Within each of the two subgroups sensory tests were performed for evaluation differences in acceptability.

Sensory analysis

For use in sensory analysis snails are prepared in different ways (cooking in Mediterranean and French way).

Preparing snails by cooking

The snails are cooked in water without the addition of salt and spices. Heat treatment has lasted 15 minutes.

Preparing snails at the Mediterranean way

Pre-cooked snails are fried for three to four minutes in olive oil along with the chopped onion in the addition of parsley, garlic and rosemary powder. Then, all topped with white wine and water, also a little bit seasoning was added, white pepper and cooked tomatoes.

Preparing snails at the French way

Pre-cooked snails are fried in olive oil with onions and finely chopped ham, with the addition of parsley and garlic. After frying all topped with cognac and white wine. Then added, "Dutch sauce", white pepper, seasoning and parsley.

Sensory evaluation

In the sensory evaluation of snails were participated selected and trained evaluators. Selection of evaluators were carried out by BAS ISO 5497.

For sensory evaluation used a quantitative descriptive analysis (BAS ISO 6564) and rank test (BAS ISO 8587).

Sensory evaluation of selected properties of snails with different sizes of shell, prepared in three ways, was carried out by the evaluation list, which included evaluation of five parameters.

On the evaluation sheet (Table 1) is given a scale with scores from 1 to 5 for each feature. Ratings are related to the assessment of expression of features intensity (smell, juiciness) and the assessment of all properties (tenderness, flavor, overall acceptability).

Table 1: An example of the evaluation sheet

SHELL SIZE P-6 / P-12: **Method of preparation:**	
smell	**1 2 3 4 5**
juiciness	**1 2 3 4 5**
softness	**1 2 3 4 5**
taste	**1 2 3 4 5**
overall acceptability	**1 2 3 4 5**
Name of evaluators: _____	Date: _____

Statisitcs and data analysis

The experiment was a completely randomized design with four replications. Data were subjected to analysis of variance (ANOVA) and means were separated by Duncan's multiple range test at $p<0.05$; $p<0.01$ and $p<0.001$ significance levels.

Results and Discussion

Snails sensory evaluation with different shell sizes prepared in different ways

In this section, shows the results of sensory evaluation of snails from the nature with different shell sizes prepared by cooking, on the French and Mediterranean way.

Snails sensory evaluation with different shell sizes prepared by cooking

Results of sensory evaluation of snails with various shell sizes prepared by cooking shows Table 2 to 6. Average rating of smell (4.69 ± 0.26) snail sizes P-6, were significantly higher ($p <0.001$) than average rating of smell (3.75 ± 0.27) snail sizes P-12. Average ratings of softness and juiciness (4.75 ± 0.27, 4.69 ± 0.26) snail sizes P-6, were significantly higher ($p <0.001$) than the average ratings of softness and juiciness (4.06 ± 0.18, 4.06 ± 0.50) snail sizes P-12. Average ratings of taste and overall acceptability (4.69 ± 0.26; 4.56 ± 0.18) snail sizes P-6, were significantly higher ($p <0.001$) than the average ratings of taste and overall acceptability (3.94 ± 0.50, 3.81 ± 0.37) snail sizes P-12.

Table 2: Average sensory ratings of smell, snails with various shell sizes prepared by cooking

Sample	$\overline{X}$	**Variation factors**				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	3.75 $^{\alpha}$	0.27	0.09	4	3.5	7.13
B	4.69 $^{\beta}$	0.26	0.09	5	4.5	5.52

Table 3: Average sensory ratings of softness, snails with various shell sizes prepared by cooking

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.06 $^{\alpha}$	0.18	0.06	4.5	4	4.35
B	4.75 $^{\beta}$	0.27	0.09	5	4.5	5.63

Table 4: Average sensory ratings of juiciness, snails with various shell sizes prepared by cooking

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.06 ^{x}	0.50	0.18	5	3.5	12.20
B	4.69 ^{y}	0.26	0.09	5	4.5	5.52

Table 5: Average sensory ratings of taste, snails with various shell sizes prepared by cooking

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	3.94 ^{x}	0.50	0.18	5	3.5	12.59
B	4.69 ^{y}	0.26	0.09	5	4.5	5.52

Table 6: Average sensory ratings of overall acceptability, snails with various shell sizes prepared by cooking

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	3.81 $^{\alpha}$	0.37	0.13	4.5	3.5	9.76
B	4.56 $^{\beta}$	0.18	0.06	5	4.5	3.88

Sensory evaluation of snails with various shell sizes prepared on French way

Results of sensory evaluation of snails with various shell sizes prepared in a French manner shows tables 7 to 11. The average rating of smell (4.88 ± 0.23), snail sizes P-6, were not significantly different ($p < 0.05$) than the average ratings of smell (4.81 ± 0.26) snail sizes P-12. The average ratings of softness and juiciness (4.75 ± 0.27, 4.75 ± 0.27) snail sizes P-6, were significantly higher ($p < 0.001$, $p < 0.01$) than the average ratings of softness and juiciness (4.13 ± 0.44, 3.94 ± 0.32) snail sizes P-12. The average ratings of taste and overall acceptability (4.75 ± 0.27; 4.63 ± 0.23), snail size P-6 were not significantly different ($p < 0.05$) than the average ratings of taste and overall acceptability (4.63 ± 0.44, 4.19 ± 0.26) snail sizes P-12.

Table 7: Average sensory ratings of smell, snails with various shell sizes prepared on French way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.81	0.26	0.09	5	4.5	5.38
B	4.88	0.23	0.08	5	4.5	4.75

Table 8: Average sensory ratings of softness, snails with various shell sizes prepared on French way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.13 ^{x}	0.44	0.16	5	3.5	10.74
B	4.75 ^{y}	0.27	0.09	5	4.5	5.63

Table 9: Average sensory ratings of juiciness, snails with various shell sizes prepared on French way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	3.94 $^{\alpha}$	0.32	0.11	4.5	3.5	8.14
B	4.75 $^{\beta}$	0.27	0.09	5	4.5	5.63

Table 10: Average sensory ratings of taste, snails with various shell sizes prepared on French way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.63	0.44	0.16	5	4	9.58
B	4.75	0.27	0.09	5	4.5	5.63

Table 11: Average sensory ratings of overall acceptability, snails with various shell sizes prepared on French way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.19^{x}	0.26	0.09	4.5	4	6.18
B	4.63^{y}	0.23	0.08	5	4.5	5.00

Sensory evaluation of snails with various shell sizes prepared on Mediterranean way

Results of sensory evaluation of snails with various shell sizes prepared in a Mediterranean manner shows tables 12 to 16. The average ratings of smell, juiciness, tenderness, flavor and overall acceptability (4.88 ± 0.23; 4.50 ± 0.38, 4.44 ± 0.50, 4.81 ± 0.26; 4.69 ± 0.26) were not significantly different ($p < 0.05$) than the average ratings of smell, juiciness , tenderness, flavor and overall acceptability (4.88 ± 0.23; 4.43 ± 0.32, 4.56 ± 0.32, 4.75 ± 0.27, 4.63 ± 0.23), snail sizes P-12.

Table 12: Average sensory ratings of smell, snails with various shell sizes prepared on Mediterranean way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.88	0.23	0.08	5	4.5	4.75
B	4.88	0.23	0.08	5	4.5	4.75

Table 13: Average sensory ratings of softness, snails with various shell sizes prepared on Mediterranean way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.43	0.32	0.11	5	4	7.22
B	4.5	0.38	0.13	5	4	8.40

Table 14: Average sensory ratings of juiciness, snails with various shell sizes prepared on Mediterranean way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.56	0.32	0.11	5	4	7.02
B	4.44	0.50	0.18	5	4	11.17

Table 15: Average sensory ratings of taste, snails with various shell sizes prepared on Mediterranean way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.75	0.27	0.09	5	5	5.63
B	4.81	0.26	0.09	4.5	4.5	5.38

Table 16: Average sensory ratings of overall acceptability, snails with various shell sizes prepared on Mediterranean way

Sample	$\overline{X}$	Variation factors				
		S_d	S_e	I_v		C_v %
				X_{max}	X_{min}	
A	4.63	0.23	0.08	5	4.5	5.00
B	4.69	0.26	0.09	5	4.5	5.52

Discussion

Snails as a specialty can be prepared in different ways. Hence, there are various culinary specialties of this type of meat. Even with the same recipe, can be prepared a specialty that is different, as known that quality of the prepared dishes can be affected by many different factors, especially those related to the experience of the cook, and his skill and knowledge.

As with all other types of meat, the acceptability of snail meat affected by many different factors (habits, customs, etc.) but the most important is way of preparing. This is confirmed by our results. The results of acceptance of large and small-sized snails feet are more pronounced differences in the snails, which were prepared only by cooking, than at the snails, which were prepared with different additives and spices. By using various additives and spices enhance the sensory properties of snails, especially smell and taste that the most contribute to the acceptability of food (Tables 2 to 16). Our results of overall acceptability of snails prepared on Mediterranean, show that this way of preparing for our evaluators are the best way and it can be explained with familiarity of assessors in the Mediterranean dietary and spices.

From the aspect of preparation methods, as well as use of additives and spices, results that were obtained in this paper are in agreement with the results obtained by Masic (2004) and Adeola et al., (2010).

Conclusion

The average sensory assessment of the total acceptability of snails prepared by cooking or in the French way with higher foot mass, were significantly higher ($p < 0.001$) than the average sensory ratings of snails with less massive feet. The average ratings of overall sensory acceptability of snails prepared in Mediterranean style with higher mass of foot was not significantly different ($p < 0.05$) than the average sensory acceptability of snails with less massive feet.

Literature

Ajayi, S. S., Tewe, O. O., Moritary, C., Awesu, M. O. (1978). Observations on the biology and value of the African giant snails (Archachantia mrginata), E. Afr. Wild. J., Vol. 16, pp. 85-89.

Adeola, AJ., Adeyemo, AI., Ogunjobi, JA., Aleye, SE., Adelakun, KM. (2010): Effects of natural and concentrate diets on proximate composition and sensory propertities of Giant landsnail meat, Journal of Aplplies sciences in Environmental sanitation, Vol.5, pp. 175-179.

Avanjina, Đ., 2004. Gajenje puževa, Nolin, Maxplant.

BAS ISO/IEC 27002:2007

Cheney, S. (1988). Raising Snails. Special Reference Briefs (National Agricultural Library SRB 88-04). Beltsville, Maryland, USA: United States Department of Agriculture (USDA), pp 1-15.

Čaklovica, F. (1987). Istraživanje sastava i svojstava mesa puževa i njihove kontaminacije potencijalno toksičnim materijama iz okoline, Disertacija, Veterinarski fakultet, Sarajevo.

Čaklovica, F. (1983). Prilog istraživanjima iskorištenja, higijenske ispravnosti i održivosti mesa puževa (H. pomatia), Magistarski rad, Veterinarski fakultet, Sarajevo.

Dragićević, O., Baltić, Ž. M. (2005). Meso puževa- značaj i potrošnja, Veterinarski glasnik, Vol. 59, No. 3-4, pp. 345-502.

Elmslie, L. I. (1982). Snails and snails farming, World animal review, Vol.41, pp. 20-26.

Grujić, R. (2000). Nauka o ishrani čovjeka, Univerzitet u BL, Tehnološki fkultet Banja Luka, pp. 380-382.

Martin, G.H.G. (1984). Carcass composition and palatability of some wild animals commonly used as a food, World animal review, Vol.53, pp.40-45.

Mašić, M. (2004). Meso puža u ljudskoj ishrani, Meso, No. 3, pp. 53-57.

Novelli, E., Giaccone, V., Balzan, S., Ghidini, S., Bracchi, P.,G. (2002). Indagine sulvalore dietetico nutrizinale della lumaca confronto fra specie e fra soggetti ra nutura ed allevatti, Ann.Fac. Medic. Vet. di Parma, Vol. 12, pp 49-56.

Pećanac, B. (2005). Uticaj ambijentalnih faktora na nutritivnu vrijednost mesa puževa, Magistarski rad, Tehnološki fakultet, Banja Luka.

Sando, D., Grujić, R., Bašić, M., Lisickov, K., Vujadinović, D., (2012). Quality Indicators of Snail Meat Grown in Different Conditions, Quality of Life, Vol.3, Issue 3-4, pp 55-64.

Yildirim, M. Z. (2003). Edible Snails (Terrestrial) Turky, Turk. J. Zool., Vol.28, pp.329-335.

Zymantiene J., Jukna V., Jukna C., Zecvyte R., Oberauskas V. (2005): Comparation of meat quality characteristics between commertial pigs and snails, Polish Journal of Food and Nutrition Science, Vol.58, No. 1, pp. 23-26.

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