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THE EFFECT OF SALT REDUCTION ON CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS AND IMPLICATIONS ON SENSORY QUALITY OF TRADITIONAL SMOKED MEAT "VISOČKA PEČENICA"

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Abstract

Cooking salt (NaCl) is the most important ingredient in meat products thus it affects technological and sensory properties of meat products. Lately there are aims of reducing NaCl in meat products to a level where this reduction will not significantly affect the overall quality. The aim of this research was to determine the chemical, microbiological and sensory effect depending on the amount of salt addition during the technological process of making traditional Bosnian smoked beef - "Visočka pečenica".

Overall 40 samples of "Visočka pečenica" were used, divided into four groups. The first group consisted of samples with the standard amount of NaCl added (4.5%). In the second sample group, the amount of salt added was decreased to 10%, in the third to 30%, and in the fourth to 50%. Using ISO 1442, ISO 1841-1, ISO 937, ISO 1443 and ISO 917, water content/dry matter, chlorides, proteins, fat and pH value were determined. The research also involved analyzing the microbiological parameters (*Salmonella* spp., *Enterobacteriaceae*, coagulase-positive staphylococci, sulfite-reducing bacteria growing under anaerobic conditions and *Listeria monocytogenes*) and sensory quality of ham (external appearance, color, consistency, appearance of cross-section, smell, taste and overall mark). Following methods were used ISO 6579:2005, ISO 21528-2:2013, ISO 6888-1:2005, ISO 15213:2008 and ISO 11290/A1:2005 for microbiological examination, while sensory properties while were determined with sensory- organoleptic evaluation of 18 trained assessors. Statistical testing was performed using descriptive statistical analysis at the significance level $p \leq 0.05$.

Using the Anova test, we found statistically significant differences for the following parameters: chlorine, water, dry matter and proteins. Microbiological analysis of the samples has shown no growth of pathogenic bacteria. Samples with standard and reduced amount of salt on 10% had the best sensory ratings. On the other hand, samples with a reduced amount of added salt to 30 and 50% had poor sensory ratings.

Initial hypothesis that the reduction in the amount of NaCl added during the technological process will affect the chemical characteristics and sensory quality was confirmed.

***Key words**: Traditional smoked meat, Visočka pečenica, Reduction of NaCl, Chemical quality, Sensory properties, Microbiological safety.*

1. Introduction

"Visočka pečenica" is a traditional product of beef meat, produced for centuries in the area of Visoko (Bosnia and Herzegovina). For the production of this traditional product, as a raw material, quality parts of beef meat such as long back muscles and parts of the leg musculature are used [1]. In the production technology only kitchen salt is used. Salted pieces of meat are kept for up to 20 days, then cold smoked to achieve the appropriate consistency and sensory properties. "Visočka pečenica" is characterized by exceptional quality, above all the characteristic color, smell and

taste of the finished product. Compared to other products marketed, only salt is used without nitrite and other ingredients. Also, the technological stages of solting, drying and smoking have completely retained the traditional features that marked the product for centuries. Sodium chloride, kitchen salt, is traditionally used for meat preservation, and is a basic ingredient in the industrial manufacture of meat products. Salt, in meat products, preferably affects sensory and texture characteristics, increases the ability of water to bind, or hydrates the meat, and decreases water activity in the product havinga bacteriostatic effect [2].

In the production of salt cured meat products, the main goal is the: diffusion of salt into the muscle, the separation of meat juice and the reduction of the water activity (a_w), by the action of the salt on the muscle tissue, conservative effect, sensory acceptable salinity, an optimal softness as well as a specific color are achieved [3]. The basic technological function of salt in meat processing is melting of functional myofibreous meat proteins and increasing the ability to bind water. This reduces weight loss in meat products during processing (primarily heat treatment), which improves the softness and uprightness of the product [4]. The average salt content in products depends on traditional habit in different parts of the world [5]. Differences in the content ofsalt may also be due to the mode of production [6].

In addition to the influence on sensory and technological properties, excessive amounts of sodium chloride in food can negatively affect the health of consumers, as evidenced by numerous researchers [7, 8, 9, 10, 11, and 12]. Consequently, trends in the reduction of the quantity of added salt or the replacement of part of NaCl by some other components (Na-lactate, KCl, $MgCl_2$, phosphates, etc.) as well as the application of certain technological solutions have been present, lately. However, it is necessary to take into account the fact that excessive reduction in the amount of salt added in the products may have a negative effect. Barat *et al.,* [13], in their research, pointing to the excess and harmfulness of sodium chloride in food, tried to replace it with a certain amount of magnesium-based compounds. Among other products, research has also been carried out on traditional Spanish cured meat products. The results indicate that magnesium ions cause a bitter product, difficulty in penetrating magnesium into the muscles has been established and the ability to bind water to meat proteins, their solubility and enzymatic activity in a certain way. Reducing the salt content in meat products can negatively affect the water binding ability as well as fat emulsification. In addition, it damages the overall texture, it causes loss of weight during cooking, badly reflects on the sensory quality,particulary the taste [14]. The stability of meat products is of vital importance in case of salt reduction. Reducing the salt concentration below the standard limit without any other conservatives added shortens the product durability. In addition, less salt affects the flavor of the product consumers are used to. Before finding an adequate substitute for salt, the simplest way is, at least initially, to gradually reduce salts in the products. When reducing salt, it is necessary to adjust the composition of raw materials and production technology. Practice has shown that salt reduction up to 25% can be achieved without sensory change of sensory properties of some product groups [4]. A salt reduction guide in the food industry by lowering the sodium intake by preformulation of the product concludes that a daily salt intake of about 400-500 mg is sufficient to provide organic adult function [15].

Although the fact that the consumers are accustomed to the highest quality of the "Visočka pečenica", it is necessary, according to the latest research, to make certain corrections in the technological process. Namely, numerous research results have confirmed that the content of NaCl in this product is often high, and in general, cured and dried meat products from the Bosnian-Herzegovinian market are characterized by high salt content. In some permanent cured products, often, more than 10% of NaCl can be detected. Also, consumers are accustomed in such a high salt level. However, some meat refiners use larger amounts of salt to shorten the time of meat saltening. Given the fact that excessive salt content in the product negatively reflects on the consumer health , the aim of the study was to determine whether the reduction in the amount of NaCl added would significantly affect the chemical, microbiological and sensory quality of the products. Also, research largely fits in the most trends in the world [16], which call for a reduction of sodium levels in food products.

2. Materials and Methods

2.1 Materials

As a material for the samples, the back musculature (*M. longissimus dorsi*) is used (Figure 1). Samples of which "Visočka pečenica" was prepared were formed and then dried salted (Figure 2). The saltening lasted for seven days. The salted pieces are hanged on wooden rods and then inserted into the smokers on (cold) smoking and drying (Figure 3). This phase lasted for 10 days. The first 24 hours of raw meat was not exposed to smoking. In that period, the meat partially desiccates. This makes it easier to apply smoke particles to the product. Also, finished product from which water is previously removed achieves a better color and a more intense smell. Upon completion of the smoking, the product was stored in the maturation room for seven days, and then packed in a vacuum.

Figure 1. Prepared samples

Figure 2. Saltening process

Figure 3. Smoking and drying process

2.2 Methods

2.2.1 Sampling

A total of 40 samples were divided into four groups, depending on the different concentrations of salt added. Each group consists of 10 samples (commercially packed about 350 g). The first group (A) were the samples produced during the production process with the standard salt amounts used by the manufacturer. The mentioned set of samples were used in the study for comparison with the remaining three. In the second (B) group were samples in which the amount of salt added was decreased by 10% compared to the standard amount. The third (C) group consisted of samples in which the amount of added NaCl was reduced by 30% and in the last group (D) of the samples, the amount of added salt was reduced by 50% compared to the standard.

2.2.2 Chemicalanalysis

Using ISO 1442, ISO 1841-1, ISO 937, ISO 1443 and ISO 917 water content/dry matter, chlorides, proteins, fat and pH value were determinated.

2.2.3 Microbiological analysis

The research also involved analyzing the microbiological parameters (*Salmonella* spp., *Enterobacteriaceae*, coagulase-positive staphylococci, sulfite-reducing bacteria growing under anaerobic conditions and *Listeria monocytogenes*). Following methods were used ISO 6579:2005, ISO 21528-2:2013, ISO 6888-1:2005, ISO 15213:2008 and ISO 11290/A1:2005 for microbiological examination.

2.2.4 Sensory analysis

Sensory quality of ham (external appearance, color, consistency, appearance of cross-section, smell, taste and overall mark) were determined with sensory- organoleptic evaluation of 18 trained assessors.

2.2.5 Statistical analysis

Statistical testing was performed using descriptive statistical analysis at the significance level $p \leq 0.05$.

3. Results and Discussion

3.1 Results of chemical analysis

The results of the Anova test showed that there were no statistically significant differences ($p > 0.05$) in the samples of "Visočka pečenica" in terms of pH and fat content. On the other hand, statistically significant differences ($p \leq 0.05$) were established for the presence of chlorides, water, dry matter and proteins.

The mean values of the chemical parameters of the quality of "Visočka pečenica", where statistically significant

Table 1. Results of chemical analysis of samples of "Visočka pečenica" depending on the amount of salt added

Evaluation parameters	Samples with standard amount of NaCl added	Samples with reduced amount of added NaCl by 10%	Samples with reduced amount of added NaCl by 25%	Samples with reduced amount of added NaCl by 50%	Statistical significance
	($\bar{x} \pm SD$)	($\bar{x} \pm SD$)	($\bar{x} \pm SD$)	($\bar{x} \pm SD$)	
pH value	5.97 ± 0.13	5.92 ± 0.1	5.89 ± 0.05	5.85 ± 0.12	NS
Chlorides (%)	9.31 ± 0.37	8.8 ± 0.24	7.35 ± 0.33	5.95 ± 0.69	*
Water (%)	47.63 ± 4.21	51.72 ± 2.1	55.21 ± 1.64	56.55 ± 2.21	*
Dry matter (%)	52.25 ± 4.24	48.28 ± 2.1	44.79 ± 1.64	43.45 ± 2.21	*
Proteins (%)	28.97 ± 1.59	29.6 ± 1.51	30.81 ± 1.42	31.62 ± 1.29	*
Fat (%)	31.37 ± 4.73	32.44 ± 4.51	33.08 ± 4.43	34.01 ± 4.09	NS

Legend: NS - non significant; *$p \leq 0.05$.

differences (water, dry matter and proteins) have been established, are increased by decreasing the amount of NaCl added. By contrast, the chloride content is reduced by decreasing the amount of NaCl added.

3.2 Results of microbiological analysis

Microbiological analysis of "Visočka pečenica" that included *E. coli*, coagulase positive staphylococci and, sulphite reducing clostridium in 0.1 g and *Salmonella* spp. and *Listeria monocytogenes* in 25 g product showed that the use of all four concentrations salts gives microbiologically stable product. Similar results of the microbiological examination of Slovenian "Kraški pršut" was also reported by Višnjevec [17]. Ferreria *et al.,* [18], in their research suggests that the treatment of dried pork ham with 2.5% NaCl increases the number of coagulase positive staphylococci to 5.0×10^3 CFU/g, which is above the limit of eligibility for the microbiological hygiene criteria of the production process, while the reduction of salt concentration did not affect the absence of *Salmonella* spp. According to Desmond [19], it is important to investigate the durability and microbiological safety of meat products prior to NaCl reduction or replacement with other components. Džinleski [21], found a total number of bacteria in the range of 10^2 to 10^3, although, according to Beganović *et al.,* [20], in some permanent cured meat products total aerobic mesophilic bacteria count was 10^7 CFU/ g.

In research by Ferreria *et al.,* [18], Džinleski, [21], Beganović *et al.*, [20], and Joksimović *et al.,* [22], have found significantly higher values of present microorganisms compared to our study.

3.3 Results of sensory analysis

Qualitative sample testing was performed at the Institute for Biomedical Diagnosis and Research "Genom", Travnik. An expert evaluation was conducted by 18 experienced evaluators. There was a nonlinear scoring system for the following sensory properties: appearance (3), color (2), consistency (3), cross sectional shape (4), odor (3) and taste (5 points).

From the Table 2 it is noticeable that the samples with a reduced amount of NaCl compared to standard NaCl samples had poorer sensory ratings. It is indicative that in all samples with reduced content of added, the sensory properties had lower values. This points to the fact that besides the basic, sensory perception of taste (salinity), NaCl had an influence on a number of other parameters that affect the overall sensory impression of the product. Numerous researchers note that NaCl has a very complex effect on certain structural meat components, which, to a lesser or greater extent, affect the overall quality of the product. It is known that salt is directly in association with pH which affects the meats ability to bind water. This property is particularly pronounced in products with a slightly larger content of NaCl (permanent meat products). Thus, in products that have been solved and whose pH value is higher than the isoelectric point (which is practically a regular occurrence), NaCl has a positive influence on the ability to bind water [23]. This phenomenon affects the juiciness and softness of meat products in the most direct manner. Because of this, the samples with reduced content of salt had a lower evaluation mark of the individual sensory indicators. Also, kitchen salt has a significant effect on oxidative processes in meat and fatty tissue, resulting in a red-purple color change in a darker, brownish shade of the product. The characteristic color of dried and smoked meat at the standard amount of NaCl added had a standard brownish shade on the surface (Figureure 4). Also the cross-section ofsamples with the standard amount of salt had a shade of lighter tones. On the other hand, in the samples with reduced salt content, the color of the surface (exterior appearance), and especially the cross-section color, had significantly brighter-red shades (Figureure 4). The explanation should be sought in the fact that in samples with reduced NaCl content the penetration of salt into the interior was reduced both in intensity and dynamics. Therefore, in samples in which the amount of salt added was reduced (especially in the fourth group), the degree of oxido-reduction processes was very low or did not even begin. The evaluators agreed that the color of the „visočka pečenica", especially in

Table 2. Results of sensory evaluation of samples of "Visočka pečenica" depending on the amount of salt added

Evaluation parameters	Samples with standard amount of NaCl added	Samples with reduced amount of added NaCl by 10%	Samples with reduced amount of added NaCl by 25%	Samples with reduced amount of added NaCl by 50%	Statistical significance (*)
	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	$\bar{x} \pm SD$	
Appereance	3 ± 0	2.83 ± 0.38	2.61 ± 0.5	2.22 ± 0.65	*
Color	2 ± 0	1.83 ± 0.38	1.67 ± 0.49	1.44 ± 0.51	*
Consistency	2.83 ± 0.38	2.77 ± 0.43	2.61 ± 0.5	2.05 ± 0.80	*
Appereance of cross section	3.83 ± 0.38	3.77 ± 0.43	3.38 ± 0.7	2.83 ± 0.71	*
Scent	3 ± 0	2.94 ± 0.24	2.78 ± 0.43	2.38 ± 0.5	*
Flavour	4.83 ± 0.38	4.77 ± 0.43	4.11 ± 0.76	2.67 ± 0.77	*

Legend: *$p \leq 0.05$.

the group with reduced salt content by 50%, was more appropriate for meat than for beef ham. Stamenković *et al.,* [24], in their research on beef ham, which determined the NaCl level of 7.74%, stated that the color had dark red tones, and the cross section of the product was extremely red with darker tones. Also, due to insufficient penetration of salt in the interior of the product with reduced salt content, these samples had a lower consistency, which also reflected overall sensory quality. It is well known that the kitchen salt also acts on the structure of the product by affecting the myfibriary changes. These changes are reflected in better mixing and chewing of meat productsin the mouth of the consumer. As in the case of reduced salt samples, the penetration of NaCl into the interior of the product has been reduced, it is natural that no physical changes have occurred in the meat. For this reason, the evaluators noted that in the case of reduced salt content (especially in the third and fourth groups), there was evident toughness and hardness, and difficulty of digestig meat in the mouth. With approximately the same content of NaCl (9.05%) in the samples of "Visočka pečenica" that came from the craft sector, Ganić *et al.,* [1], found similar sensory quality. On the other hand, the same researchers stated that significantly lower salt content was found in samples of "Visočka pečenica" that came from the industrial sector (one in the case of 6.22% and another at 3.7%). In doing so, the evaluation of sensory properties compared to the samples of craftsmanship (which contained significantly more salt) had less value. Also, Ganić *et al.,* [1], in their research on "Visočka pečenica" produced by modified technological processes (using the massagers in the technological process), found a significantly lower salt level in the samples (4.33%). Analyzing the results of the mentioned researchers, there may also be a noticeable decline in sensor sensitivity estimates. Radovanović *et al.,* [25], examined the sensory quality of beef ham. Sensory quality studys of smoked beef ham by Čaušević *et al.,* [26], and Sinanović *et al.,* [27], and Kurćubić *et al.,* [28], stated that the content of NaCl was 5.85% in industrail and in the traditional product 7.6%.

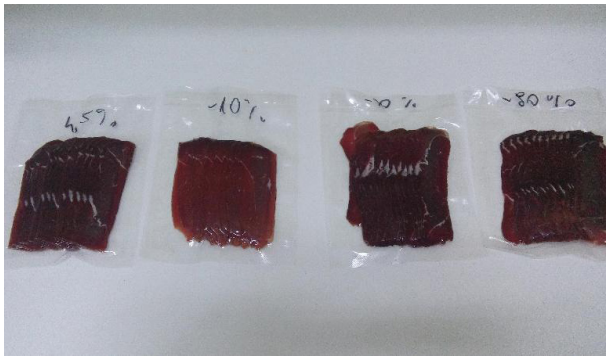

Figure 4. Cross-section ofsamples wit standard and reduced amount of NaCl

4. Conclusions

Based on the results of the conducted research, the following conclusions can be drawn:

- Fresh beef meat was used for production of "Visočka pečenica".

- The technological process of the production, with certain technological corrections, was carried out in industrial conditions.

- Experiments included chemical, microbiological and sensory research.

- One-factor analysis of variables (Anova test) shows that differences in analyzed chemical quality parameters are statistically significant ($p \leq 0.05$) for the following parameters: chloride, water, dry matter and protein content, while ($P > 0.05$) was in the following parameters: pH, fat content.

- In terms of sensory quality assessment, determination of statistically significant differences ($p < 0.05$) for all examined quality parameters was established.

- A group of samples with standard NaCl volumes as well as samples in which the NaCl content is reduced by 10% belogs to extra class meat; Samples with reduced NaCl by 30% to the first, and samples containing 50% NaCl added to the second class meat.

- The microbiological analysis of the samples has shown that there is no presence of patogenic bacteria and the products are in accordance with the provisions of the Rulebook on Microbiological Criteria for Food (Official Gazette of BiH No. 11/13).

- Based on the conducted research, it can be concluded that excessive reduction in the amount of NaCl in meat during preparation of "Visočka pečenica" has negative reflections on certain chemical changes, and thus on the overall quality of the product.

5. References

[1] Ganić A., Lilić S., Krvavica M..Čandek-PotokarM., Pejkovski Z. (2012). *Basic quality qcharacteristics of "Visočina pečenica"* (in Serbian). Tehnologija mesa, 53, (2), pp. 134-139.

[2] Čavoški D., Radovanović R., Perunović M. (1990). *Quality of semi-finished products and parboiled sausages from the Belgrade market - From the aspect of the NaCl and nitrite content* (in Serbian). Tehnologija mesa, 3, pp. 105-109.

[3] Žlender B., Gašperlin L. (2004). *Traditional procedures in meat processing and the possibilities of their application in modern industrial technologies* (in Serbian). Tehnologija mesa, 3-4, pp. 81-88.

[4] Žlender B. (2009). *Reduction of salt concentration in meat products* (in Croatian). Meso, Vol. XI, 3, pp. 189-195.

[5] Gasparik-Reichardt J., Tóth Sz., Cocolin L., Comi G., Drosinos E., Cvrtila Z. (2004). *Reference Intakes for Water, Potassium, Sodium, Shloride and Sulfate*. The National Academies Press, Washington, DC, USA, pp. 185.

[6] Vranić D., Saičić S., Lilić S., Trbović D., Janković S. (2009). *Study of the sodium chloride and sodium content in some meat products from the Serbian market* (in Serbian). Tehnologija mesa, 50, (3-4), pp. 249-255.

[7] Perry I. J., Beevers G. D. (1992). *Salt intake and stroke: A possible direct effect*. Journal of Human Hypertension, 6, pp. 23-25.

[8] Schmieder R. E., Messerli H. F. (2000). *Hypertension and the heart*. Journal of Human Hypertension, 14, pp. 597-604.

[9] MacGregor G. A., de Wardener E. H. (1997). *Idiopathic edema*. In: Schrier R. W., Gottschalk C. W., (Eds.), Diseases of the Kidney, Little Brown and Company, Boston, USA, pp. 2343-2352.

[10] Du Cailar G., Ribstein J., Mimran A. (2002). *Dietary sodium and target organ damage in essential hypertension*. American Journal of Hypertension, 15, pp. 222-229.

[11] Tsugane S., Sasazuki S., Kobayashi M., Sasaki S. (2004). *Salt and salted food intake and subsequent risk of gastric cancer among middle-aged Japanese men and women*. British Journal of Cancer, 90, pp. 128-134.

[12] Mickleborough T. D., Lindley R. M., Ray S. (2005). *Dietary salt, airway inflammation, and diffusion capacity in exerciseinduced asthma*. Medicine & Science in Sports & Exercise, 37, pp. 904-914.

[13] Barat J. M., Pérez-Esteve E., Aristoy C. M., Toldrá F. (2013). *Partial replacement of sodium in meat and fish products by using magnesium salts. A review*. Plant and Soil, 368, (1/2), pp. 179-188.

[14] Ruusunen M., Vainionpaa J., Lyly M., Laahteenmaki L., Niemisto M., Ahvenainen R., Puolanne E. (2005). *Reducing the sodium content in meat products: The effect of the formulation in low-sodium ground meat patties*. Meat Science, 69, pp. 53-60.

[15] CTAC. (2009). *Salt Reduction guide for the Food Industry: Reformulation of products to reduce sodium*. Edikom, Saint-Lambert, Canada.
URL: http://www.foodtechcanada.ca/siteimages/Salt%20reduction%20guide%20for%20the%20food%20industry.pdf. Accessed 18 March 2018.

[16] Fouladkhah A., Berlin D., Bruntz D. (2015). *High-Sodium Processed Foods: Public Health Burden and Sodium Reduction Strategies for Industry Practitioners*. Food Reviews International, 31, 4, pp. 341-354.

[17] Višnjevec I. (2006). *The influence of various methods of salting and desalination on the quality of Karst* (in Slovenian). Diploma work, Biotechnology faculty, Ljubljana University, Ljubljana, Slovenia.

[18] da Silva F. C. V., Martins D. D. T., de Souza B. E., dos Santos P. E., da Silva P. A. F., da Silva B., A., do Nascimento O. C. M. (2013). *Physicochemical and microbiological parameters of dried salted pork meat with different sodium chloride levels*. Food Sci. Technol., (Campinas), 33, (2), pp. 382-386.

[19] Desmond E. (2006). *Reducing salt: A challenge for the meat industry*. Meat Science, 74, (1), pp. 188-196.

[20] Beganović A. (1975). *Microbiology of meat and meat products* (in Croatian). Sarajevo University, Sarajevo, Bosnia and Herzegovina.

[21] Džinleski B. (1969). *Sheep pastrma in the diet of the population* (in Serbian). Tehnologija mesa, 10, (6), pp. 175-179.

[22] Joksimović J., Radovanović R., Šutić M., Obradović D., Striber M., Čarapić G., Đurić N. (1984). *Contribution to the knowledge of the prosciutto production and the quality factors* (in Serbian). Tehnologija mesa, 25, 2, pp. 34-46.

[23] Hamm R. (1974). *Effect of kitchen salt and polyphosphate on muscle protein and on the ability to attach water to meat* (in Serbian). In: Rahelić S. (Ed.), Meat brining - NODA '73, Koprodukt, Novi Sad, Serbia, pp. 51-62.

[24] Stamenković T., Šušnjarac N., Jovanović V., Jovanović S. (2003). *Loss of mass, sensory properties and chemical indicators of beef ham obtained by traditional and modified smoke* (in Serbian). Tehnologija mesa, 44, (1-2), pp. 79-84.

[25] Radovanović R., Stamenković T., Saičić S. (2003). *Sensory properties and chemical indicators of bovine smoked ham* (in Serbian). Tehnologija mesa, 44, (5-6), pp. 212-219.

[26] Čaušević Z., Milanović A., Glogovac Ž., Velagić-Habul E., Smajić A., Lelek M. (1986).*Contribution to knowing the beef prosciutto production* (in Croatian). Sarajevo Agricultural faculty Yearbook, XXXIV, 38, pp. 153-161.

[27] Sinanović N., Smajić A., Ganić A. (2005). *Sensory assessment of quality of dried meat products on the market of Sarajevo Canton* (in Bosnian). Sarajevo Agricultural faculty Yearbook, L, (55/2), pp. 177-187.

[28] Kurćubić V., Vesković-Moračanin S. (2017). *Comparative tests of beef ham produced in a traditional and industrial way* (in Serbian). XXII Biotechnology counselling proceedings, 2, pp. 585-590.