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Original research paper

SENSORY AND CHEMICAL CHARACTERISTICS OF SAUSAGES PRODUCED OF CYPRINID MEAT

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ABSTRACT: Fish meat and fish products are valuable source of nutrients of great importance for diverse and healthy nutrition. The optimal ratio of protein, fat, carbohydrates, minerals and vitamins contribute to high nutritive value of fish meat. Recommendations that fish should be regularly used in the diet are based on the fact that fish meat is the most important nutritional source of n–3 highly unsaturated fatty acids (n–3 HUFA).
The aim of this study was to investigate sensory and chemical properties of sausages produced from common carp, silver carp and grass carp obtained from the fish farm in Ečka.
The results of sensory analysis showed that odor and taste are typical for that kind of sausages, free of impurities. At sections, stuffing sausages consisted of fragmented mass, light brown-orange color, characteristic consistency for that type of sausage. Color stability at the interface was better for sausages that were cooked before the testing and the taste was the most acceptable for sausages that were fried.
Total protein content was 17.32%, fat 21.06%, water content was 48.06% and ash content was 0.94%. The amount of calcium was 25.0 mg/100 g and sodium chloride content was 0.95%.

Keywords: *cyprinid, sausages, sensory and chemistry characteristics*

INTRODUCTION

Fish meat and fish products are valuable source of nutrients that have great importance to diverse and healthy nutrition. The optimal ratio of proteins, fats, carbohydrates, vitamins and minerals contributes to the high nutrient value of fish meat (Ćirković et al., 2011). Since fish meat is the most important nutritional source of n–3 highly unsaturated fatty acids (n–3 HUFA) its regular use in human nutrition is recommended. Chemical composition of fish varies among species, and between individuals of the same species, depending on diet, age, sex, environment conditions and season (Guler et al., 2008; Ćirkovic et al., 2012a, Ljubojević et al., 2013). Proteins from fish meat have favorable amino acid composition with many free amino acids (Buchtová et al., 2010), and contain all essential amino acids necessary for human body and may be the only source of animal protein in the diet (Vladau et al., 2009). Characteristic of fish meat is very good protein digestibility (Untersmayr and Jensen-Jarolim, 2008).

Considering mineral composition, phosphorus is the most abundant (170 to 270 mg/100 g), followed by calcium (15 to 100

mg/100 g) and magnesium (20 to 35 mg/100 g) (Stamenković et al., 2006; Ikonić et al., 2011). The amount of fat is also very variable, so fish can be divided into lean (<5% fat), medium–fat (5–10% fat) and fat (> 10% fat) depending of their fat content.

Carp is the most dominant fish species in Serbia's fishponds (Ćirkovic et al., 2007), and the cyprinids are the most represented in the total world production of freshwater fishes (71.9%, 24.2 million tons in 2010) (FAO, 2012).

Consumption of fish meat is increasing, primarily due to the fact that fish is recommended as an important ingredient in healthy nutrition. Also, it should be noted that the manufacturing industry in this sector is still underdeveloped. Fish processing and new fish products development can provide better sale of fish, not only in traditional fish markets, but also in all other consumer goods stores.

Technological procedures of processing, keeping and storage are different for fish meat regarding to meat of mammalians. In order to apply the most appropriate technology and procedures for each fish species it is necessary to know composition and properties of raw fish meat during fish processing, (Konno, 2005; Čolović et al., 2013).

Chemical composition is an important indicator of food nutritional quality, as well as checking whether the product is in accordance to the Regulations (Regulations of quality and other requirements for fish, crayfish, shellfish, sea urchins, sea cucumbers, frogs, turtles, snails and their products, 2003). Okanovic et al (2013) showed the results of chemical analysis of sausages produced of carp meat and which were in accordance with the Regulations (2003). Because that sausage contains less fat than sausages produced from the meat of farm animals, is suitable for consumption of risk groups of population.

The aim of this paper is to show the process of carp meat sausages production and to determine the chemical characteristics of the final product.

MATERIALS AND METHODS

Common carp, grass carp and silver carp were delivered live from Ečka fish farm in a manufacturing plant where they were immediately slaughtered. Mean values of carp, grass carp and silver carp masses were approximately 2850 g, 6400 g and 5800 g, respectively. The fish heads and viscera were removed, washed with cold water and skin and bones were removed manually. Further processing was done in meat processing plant, "Djurdjevic" in Pecinci.

The pieces of fish meat were minced in a meat grinder using a grid with Ø 5 mm holes. Sausages were produced according to production procedures for boiled sausages, by the recipe: fish meat 50%, smoked fish meat 15%, hydrated soy flakes (1:2) 15%, vegetable fat 10%, and ice 5%. 1.5% of NaCl, 1.5% mixture of natural spices were added and as well 2% soy isolate as emulsifier. The raw material was filled into collagen casings Ø 32 mm and processed in the chamber for heat treatment: heated, dried, smoked at 55 °C, and roasted at 75 °C until achieving the temperature of 70 °C in the center of the product. The sausages were refrigerated, vacuum–packed, and the samples were stored at temperature of 4 °C until the end of the analysis.

Analyses of sausages were conducted at the Institute of Meat Hygiene and Technology in Belgrade.

Table 1.
Scale for sensory evaluation of sausage quality

Intensity	Levels of quality
5	highly acceptable
4	very acceptable
3	acceptable
2	low acceptable
1	non acceptable

Sensory characteristics of sausages were evaluated using quantitative–descriptive test *(SRPS ISO 6658)*, on a scale with intensity was from 1 to 5 (Table 1).The sensory properties of sausages were evaluated (appearance, cross–section look, color, texture, taste and flavor and overall acceptability) before and after heating (cooking and roasting). Sensory evaluation was performed by a sensory panel consisting of five persons. Panellists senses were previously tested by using the test for assessing the sense of taste *(SRPS ISO 5496)*, as well as a test for training of the assessors in the detection and recognition of odors *(SRPS ISO 3972).* The main chemical composition was evaluated by determining of the moisture content (SRP ISO 1442, 1997), total protein (SRP ISO 937, 1992), free fat (SRP ISO 1444, 1997), total ash (SRP ISO 936, 1998), and NaCl content (SRP ISO 1841-1, 1999). To determine calcium content, samples preparation was done by destroying of 1 g homogenized carp meat sausage sample by microwave's digestion in a mixture of concentrated nitric acid and hydrogen peroxide in a microwave oven START D (Milestone, Italy). Calcium from solution was determined by flame atomic absorption spectrometry at 422.7 nm on SPEKTRAA 220 (Varian, Australia).

RESULTS AND DISCUSSION

The paper of Ćirkovic et al. (2012b) shows the results of the chemical composition analysis of carp cultured in semi–intensive production system, with the addition of corn. The results of the carp meat analysis showed that the fat content of the sampled fish was 37.12. Such high percentage of fat was caused by low percentage of protein (11.37%), especially comparing obtainned values to the results of previous examination.

Meat with higher fat content required the addition of protein products (hydrated extruded soybean flakes). Addition of smoked carp meat, to which the fat and water content was reduced during the heat treatment, contributed to improvement of taste and the correction of the chemical composition of sausages.

The results of sensory evaluation of fish sausages are presented in the Tables 2, 3 and 4.

At the cross sections, sausage stuffing consists of light brown–orange fragmented mass and consistency characteristic to the type of sausage.

Sensory properties of manufactured sausage were specific to these types of product. There was no any deformation on the sausages surface, collagen casing was adhered to the stuffing, odor was without foreign impurities. The sausages intersection was balanced and cavity–free, sausage stuffing was consisted of minced mass and with light brownish color of chunks of smoked carp meat. Consistency was typical for that type of sausage. Odor of mild intensity and taste were characteristic for the carp meat sausage without impurities. Small bones occasionally could be felt (<3 mm), what was the result of manually deboning.

Small amount of salt (cca 1.5%) resulted in the impression of lack of salinity and contributed to the reduced score of sausages' flavor.

Table 2.
Results of sensory evaluation of sausages before heating

Sensory properties	$\overline{X}$	Sd	Se	Iv		Cv %
				X_{min}	X_{max}	
Appearance	4.66	0.40	0.16	4.00	5.00	8.58
Colour	4.58	0.58	0.23	3.50	5.00	12.66
Odor	4.83	0.40	0.16	4.00	5.00	8.58
Cross–section color	3.83	0.68	0.27	3.00	4.50	17.75
Texture	3.91	0.80	0.32	3.00	5.00	20.46
Taste	4.50	0.31	0.13	4.00	5.00	6.88

Table 3.
Results of sensory evaluation of sausages after cooking

Sensory properties	$\overline{X}$	Sd	Se	Iv		Cv %
				X_{min}	X_{max}	
Odor	4.83	0.40	0.16	4.00	5.00	8.28
Cross–section color	4.41	0.37	0.15	4.00	5.00	8.40
Texture	3.83	0.81	0.33	3.00	5.00	21.15
Taste	4.16	0.40	0.16	4.00	5.00	9.61

Table 4.
Results of sensory evaluation of sausages after roasting

Sensory properties	$\overline{X}$	Sd	Se	Iv		Cv %
				X_{min}	X_{max}	
Odor	4.91	0.20	0.08	4.50	5.00	4.07
Cross–section color	3.58	0.37	0.15	3.00	4.00	10.33
Texture	3.66	0.75	0.30	3.00	5.00	20.50
Taste	4.58	0.50	0.20	4.00	5.00	10.92

Table 5.
Results of chemical analysis of sausages produced from carp meat

Characteristic	According to Regulations*	Content	Sd	Cv %
Moisture content,		54.61	3.55	6.501
Total protein content, %	min 11% protein of meat	17.32	1.16	6.697
Fat content, %	max 25%	21.06	1.63	7.740
Ash content, %		2.07	0.18	8.696
Sodium chloride content, %		0.94	0.05	5.319
Calcium content, mg/100g		25.00	1.27	5.080

* Regulations of quality and other requirements for fish, crayfish, shellfish, sea urchins, sea cucumbers, frogs, turtles, snails and their products (2003)

Slightly leguminous flavor of added soy flakes was felt, as well as stronger taste of pepper. The texture was dry, grainy and mealy, and during cutting of thin sheets, stuffing was not compact. Added vegetable oil, which has a grain structure, was reason for that. Color stability at the cross-section was much higher after preparing sausages by cooking, than by roasting.

The most acceptable flavor of sausages was after roasting. After roasting the starchy flavor and grainy texture were pronounced.

The results of chemical analysis of carp meat sausages are shown in Table 5.

The results of chemical analysis showed that the composition of sausages were in accordance with regulations of quality and other requirements for fish, crayfish, shellfish, sea urchins, sea cucumbers, frogs, turtles, snails and their products (2003).

Lower moisture content is common for products stuffed into semipermeable collagen casings. Fat content (21.06%) is the result of the use of carps that were fed with a lot of corn. Sausage has higher protein content (17.32%) and less fat (21.06%) content than sausage produced from the farm animals' meat, and therefore represent nutritional valuable product

suitable for nutrition of different population groups.

Fish sausage produced by Al–Bulushi et al., (2011) contained 12.22% fat, while sausages from the market that were tested contained 5.5% of fat. Chuapoehuk et al. (2001) have published results of sausages made of catfish that contained 74.5% of water, 3.16% of fat and 13.73% of protein.

CONCLUSION

Based on presented examination of sausages made from carp, grass carp and silver carp meat, it can be concluded

Sensory properties of examined sausages were specific to the type of product.

Color stability at the intersection was more acceptable after cooking, than after roasting.

The most acceptable flavor of sausages was after roasting.

Quality final product was provided by appropriate technological process of production of cyprinid meat sausage.

Chemical analysis showed that the product corresponds to the Regulations.

Sausage has higher protein content (17.32%) and less fat (21.06%) content than sausages made from farm animals' meat, what represent nutritional valuable product suitable for nutrition of different population groups.

These results could help to develop similar products from different fish species, which would complete the current offer of fish and fish products in the market.

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СЕНЗОРНЕ И ХЕМИЈСКЕ КАРАКТЕРИСТИКЕ БАРЕНЕ КОБАСИЦЕ ПРОИЗВЕДЕНЕ ОД МЕСА ШАРАНСКЕ РИБЕ

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Сажетак: Месо рибе и рибљи производи су вредан извор хранљивих материја од великог значаја за разноврсну и здраву исхрану. Оптималан однос протеина, масти, угљених хидрата, минерала и витамина доприносе високој нутритивној вредности рибљег меса. Препоруке да се месо риба редовно користи у исхрани, заснива се на чињеници да је рибље месо је најважнији извор хранљивих н–3 високонезасићених масних киселина.

Циљ овог рада био је да се испитају сензорне и хемијске особине кобасица произведених од меса шарана, толстолобика и амура гајених у рибњаку Ечка.

Резултати сензорне анализе показали су да су мирис и укус типични за ту врсту кобасица, без страних примеса. На пресеку, надев кобасице састојао се од уситњене светле масе и комадића меса димљеног шарана браон–смеђе боје, конзистенције својствене за ту врсту кобасице. Стабилност боје на пресеку била је боља код кобасице које су куване пре тестирања, а укус је био најприхватљивији за кобасице које су пржене.

Укупан садржај протеина био је 17,32%, масти 21,06%, садржај воде био је 48,06%, а садржај пепела био је 0,94%. Количина калцијума била је 25,0 мг/100 г, а натријум хлорида 0,95%.

Кобасица има већи садржај протеина (17,32%) и мањи масти (21.06%) у односу на садржај кобасица произведених од меса животиња за клање, па самим тим представљају нутритивно вредан производ погодан за исхрану различитих група становништва.

Кључне речи: *циприниде, кобасице, сензорне и хемијске карактеристике*

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