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EVALUATION OF THE EFFECT OF PLANT MATERIAL ON THE QUALITY OF COOKED SAUSAGES

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Various amounts of buckwheat hulls (1%, 1,5%, and 3%) were added to cooked turkey sausages. The effect of buckwheat hulls on the physicochemical characteristics of the cooked turkey sausages, including, pH, instrumental color, texture profile analysis (TPA), antioxidant content and sensory evaluation, were determined. Increased levels of added buckwheat hulls led to higher antioxidant activity. However, the protein and fat contents of the cooked turkey sausage samples were constant. The instrumental color in control sample were L*=65,1, a*=5,6, and b*=9,8. There were slight differences in the TPA among the treated samples. According to the results of the sensory and objective assessment of consumer properties, it can be argued that sample F1 with the introduction of buckwheat hulls 3,0% had a negative effect on sensory properties of cooked turkey sausages. The best marks were given to the sample F1 with the introduction of buckwheat hulls 1,0% on sensory evaluation.

Keywords: cooked turkey sausage, buckwheat hulls, physico-chemical, textural and sensory properties, antioxidant activity.

ӨСІМДІК ШИКІЗАТЫНЫҢ ПІСІРІЛГЕН ШҰЖЫҚҚА ӘСЕРІН ЗЕРТТЕУ

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Қарақұмық қауызының әр түрлі мөлшері (1%, 1,5% және 3%) пісірілген күркетауық шұжықтарына қосылды. Қарақұмық қауызының пісірілген күркетауық шұжықтарының физика-химиялық сипаттамаларына, оның ішінде pH, аспаптық түс, құрылымдық профильді

талдау (ТПА), антиоксидант құрамы және сенсорлық бағалау секілді әсері анықталд. Қарақұмық қауызының мөлшерін арттырған сайын дайын өнімде антиоксидант мқлшерінің жоғарылауына әкелді. Алайда күркетауық пісірілген шұжық үлгілеріндегі ақуыз бен май мөлшері тұрақты болды. Бақылау үлгісіндегі аспаптық түстер L * = 65.1, a * = 5.6 және b * = 9.8 болды. Өңделген үлгілер арасында ТРА-да аз айырмашылықтар байқалды. Тұтынушылық қасиеттерді сенсорлық және объективті бағалау нәтижелері бойынша қарақұмық қауызының 3,0% енгізілген F3 үлгісі пісірілген күркетауық шұжығының сенсорлық қасиеттеріне теріс әсер етті деп айтуға болады. Ең жақсы белгілерді органолептикалық бағалауға сәйкес қарақұмық қауызының 1,0% қосқанда F1 үлгісі алды.

Негізгі сөздер: пісірілген шұжық, қарақұмық қауызы, физико-химиялық, текстуралық және сенсорлық қасиеттері, антиоксидант мөлшері.

ИССЛЕДОВАНИЯ ВЛИЯНИЯ РАСТИТЕЛЬНОГО СЫРЬЯ НА КАЧЕСТВО ВАРЕНОЙ КОЛБАСЫ

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В вареные колбасы из индейки добавляли различное количество гречневой лузги (1%, 1,5% и 3%). Было определено влияние гречневой лузги на физико-химические характеристики вареных колбас из индейки, включая pH, инструментальную окраску, анализ профиля текстуры (ТРА), содержание антиоксидантов и органолептическую оценку. Повышенное количество добавленной гречневой лузги привело к более высокой антиоксидантной активности. Однако содержание белка и жира в образцах вареной колбасы из индейки с добавлением гречневой лузги не отличались от контрольного образца. Инструментальная окраска в контрольном образце была L * = 65,1, a * = 5,6 и b * = 9,8. Есть небольшие различия по анализу профиля текстуры (ТРА) вареных колбас из индейки. По результатам сенсорной и объективной оценки потребительских свойств можно утверждать, что образец F1 с введением гречневой лузги 3,0% отрицательно повлиял на сенсорные свойства вареных колбас из индейки. Наилучшие оценки получил образец F1 с внесением гречневой лузги 1,0% по органолептической оценке.

Ключевые слова: вареная колбаса из индейки, гречневая лузга, физико-химические, текстурные и органолептические показатели, содержание антиоксидантов.

Introduction

FAO predicts nearly 18% growth in global poultry production in 2027 compared to a base period of 2015-17 [1].

The chemical composition of turkey meat is superior to the meat of some other species of bird. Compared to all other bird species, turkey meat is richer in B vitamins group and has the lowest cholesterol content. Products from turkey meat have high nutritional value, characterizing the ability to meet the body's needs not only in proteins, lipids, also in minerals, vitamins [2].

Nowadays a promising trend in the production of meat products is the use of plant raw materials, which allows not only to enrich finished products with the necessary components to increase the biological value of products, but also to increase their digestibility [3]. Including, buckwheat, as a recognized medicine-food homologue, contains more bioactive substances than other crops with similar characteristics, including a variety of antioxidants, such as flavonoids, phenolic acid, quercetin, and melatonin. The antioxidative, anti-inflammatory, and antihypertensive activities of flavonoids have been confirmed [4]. Buckwheat hulls make up 16-22% of the grain mass, it is rich in various vitamins, including provitamins A, D, thiamine, riboflavin, nikitinic acid and others. Buckwheat hulls are characterized by a lower content of xylose, higher glucose and galactose [5].

According to analysis of Li Fu-hua, the hulls and brans of ten buckwheats, particularly, the hulls and brans of buckwheats showed higher

antioxidant capacity than relevant flours. Thus, hulls and brans of buckwheats, due to the low cost and easy availability, can serve as good substrates offering significantly lowcost, nutritional dietary supplements and bioactive compounds, and had a tremendous potential in food and pharmaceutical industry [6].

In connection with the above, the objective of this research was assessment the effect of buckwheat hulls on the quality of cooked turkey sausages.

Objects and Methods of Research

Cooked turkey sausage products were formulated using mechanically separated turkey (MST) meat obtained from Kraina Miesa (Poland). Ingredients used for cooked turkey sausage preparation were NaCl, milk, soy protein, ascorbic acid, and culinary tap iced water.

The turkey meat was separated from skin and was ground in a grinder (Poland) with 0.3 cm plate diameter and stored at -18°C until used for sausage preparation. Dry ingredients (salt, ascorbic acid, dried egg white, etc) were slowly added to the ground MST as powders. Afterwards, fatty skin was homogenized (9000 rpm) using Büchi Mixer B-400 (Germany) with iced water and soy protein was added by proportion 1:4:4 (soy protein:fat:iced water). Then, all materials together with all ingredients were homogenized and stuffing was packed in polypropylene tubes (approximately 60 g) with the capacity of 50 ml (2.5 cm diameter and 12 cm height), sealed and sausages were then heat-processed in a temperature-controlled water-bath (Germany) maintained at 90°C until a final internal temperature of 74°C was reached. Subsequently, meat products were cooled down on ice to 21°C. Final products were vacuum packed in polyethylene bags and stored at 4±1°C. The experiment was replicated in four independent production series.

To prepare the plant addition, buckwheat hulls were ground to a powdery state with the addition of a small amount of water in a ratio of 1:10 (one part of water to 10 parts of plant supplements). The use of such an amount of water improved the grinding process of buckwheat hulls prevented the loss of volatile components. The control sample was made without adding plant additives, and the experimental samples were made with the addition of buckwheat hulls in the amount of 1%, 1,5%, and 3% to the mass of minced meat.

All formulations were prepared with the same common ingredients: 60% turkey meat, 12-15% turkey fat, 15% water (ice- and cold-water), 3,8% soy protein, 2,3 % milk, 2% NaCl, 1,5% egg white, and 0.4 % ascorbic acid. The formulation of cooked sausages and composition of non-meat ingredients are presented in Tables 1 and 2. The process was replicated twice.

Table 1. The formulation of cooked sausage

Ingredients	Added buckwheat hulls content			
	Control	F1	F2	F3
Turkey meat,%	60,0	60,0	60,0	60,0
Turkey fat,%	15,0	14,0	13,5	12,0
Ice water,%	15,0	15,0	15,0	15,0
Buckwheat hulls,%	-	1	1,5	3
Non-meat ingredients,%	10,0	10,0	10,0	10,0

Table 2. The composition of non-meat ingredients

Ingredients	Amount (%)
Soy protein	3,8
Milk	2,3
Salt	2,0
White egg protein	1,5
Ascorbic acid	0,4
Total	10,0

The main physicochemical parameters of cooked turkey sausages were determined by standard methods generally accepted in research practice (Table 3).

The pH value of the homogenized sausages was measured by using a digital pH meter electrode (Thermo Fisher Scientific Inc.) [7].

Water activity (a_w) measurement was performed on Novasina IC-500 W-LAB equipment (Switzerland).

Texture profile analysis (TPA) of cooked turkey sausage samples was performed. A cylindrical samples, 2 cm in diameter and 2 cm long, were cut from the centre of the links and compressed twice to 75% of their original height between flat plates and a cylindrical probe (1 cm^2 in diameter) using Zwick/Roell Z010 testing machine (UK). In these experiments hardness, cohesiveness, springiness and chewiness were determined [8].

Color of the cooked turkey sausage slice was measured by using a reflectance colorimeter Minolta CR-400 and it was expressed by L* (lightness) a* (redness) and b* (yellowness) parameters in CIE Lab system. Samples of sausages were cut into slices (15-25 mm) before each measurement.

The total content of antioxidants was determined by the amperometric method on an antioxidant analyzer "Tsvet Yauza-01-AA" (Russia).

Sensory properties of cooked turkey sausages were evaluated by 8 trained panelists according to the Polish standard PN-ISO 4121:1998 [9]. Each member independently evaluated the cooked turkey sausage for taste, color, smell and consistency on a 5-point hedonic scale (1: extremely poor, 2: poor, 3: acceptable, 4: good and 5: excellent) [10]. 2 cm long pieces of sausages were distributed in white polystyrene plates and presented to the panelists with four-digit codes and in random order for evaluation. Experiments were conducted in an appropriately designed and lighted room and the mean score was estimated for each product.

Results and their discussion

The results presented in table 3 show a slight decrease in the mass fraction of fat. So, if the fat content in cooked turkey sausage without the addition of buckwheat hulls was 21.6%, then in sample F3 it was 21.57%, it is associated with a decrease in the addition of turkey fat. Generally, it is known that turkey meat contains a small amount of fat (12%), due to the fact that the main fat deposits are concentrated in the subcutaneous layer. And other physical-chemical parameters of the cooked turkey sausage samples were constant.

Table 3. Physical-chemical parameters of turkey sausages

Sample	pH	Moisture,%	Protein g/100g)	Fat (g/100g)	Water activity a_w
Control	6,0	67,8	19,3	21,6	0,98
F1	6,0	68	19,3	21,58	0,98
F2	6,0	68	19,3	21,57	0,98
F3	6,0	67,3	19,3	21,57	0,98

Texture profile analysis values of cooked turkey sausages as affected by various BH content is in Table 4. These figures show that increasing the number of added buckwheat hulls increased hardness and cohesiveness, which plays an important role in the storage of sausages. The research results show that the hardness in the control sample was 43%, while in cooked turkey sausages, developed according to the recipes, it was in the range of 41-45%.

Table 4. Instrumental indicators of cooked turkey sausages depending on the concentration of buckwheat hulls

Parameters	C	F1	F2	F3
Hardness [N]	43	43	44	45
Springiness [mm]	0,83	0,79	0,76	0,70
Cohesiveness [-]	0,25	0,29	0,30	0,30
Chewiness [N]	7,80	7,52	7,50	6,95
Lightness [L]	65,1	64,3	63,5	61,2
Redness [a]	5,6	5,5	5,5	4,9
Yellowness [b]	9,8	9,6	9,5	9,3
Antioxidant content, mg/100g	104,7	107,1	111,7	116,8

The color of cooked turkey sausages was analyzed using a colorimeter Minolta CR-400. The results are shown in Fig.1. Measurements of the color of cooked turkey sausages with buckwheat hulls in reflected light suggest its high quality [11]. This is indicated by the indicators of color intensity (lightness) of L=65,1%, which are combined with a value of the (redness) a=5,6% and (yellowness) b=9,8 % parameters in the resulting color. The large addition of buckwheat hulls slightly affected the color of the cooked turkey sausages. Thus, in sausages with buckwheat hulls 3%, the index of intense color was 1.06% less than in the control sample. This indicates an increase in "unclean" or dark tones, which are typical for buckwheat hulls.

The data presented in Table 4 showed that the test sample with the introduction of buckwheat hulls 3,0% had the higher antioxidant content. With an increase in the added buckwheat hulls, an increase in the content of antioxidants in cooked turkey sausages was observed, so if the content of antioxidants in the control was 104.7 mg, then in sample F3 it showed 116.8 mg. Based on the analysis of the results obtained, it was determined that buckwheat hulls can be used to increase antioxidant activity and requires further comprehensive study of antioxidant activity on food products [6].

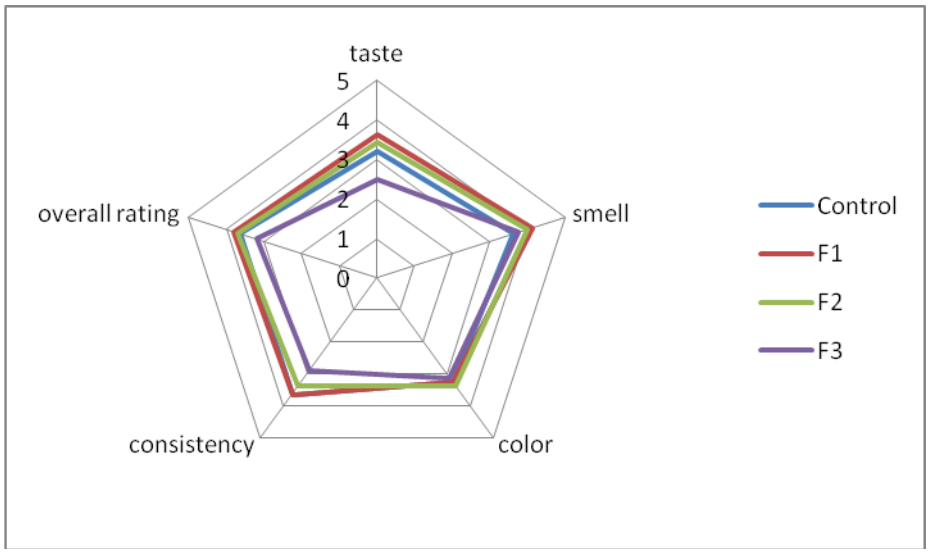

Figure 1. Sensory evaluation of sausage, C, 1, 1.5, 3%.

The data of sensory evaluation of sausages during storage showed that cooked turkey sausages with buckwheat hulls had significant differences in taste and smell from the control variant. The sample F3 had the lowest values for color, smell, consistency, since an increase in the added buckwheat hulls negatively affected all organoleptic characteristics (Fig. 1). The best marks were given to the sample F1 with the introduction of buckwheat hulls 1,0%.

Conclusion

This study was conducted to evaluate the effect of different buckwheat hulls in the initial mixture of cooked turkey sausages on the physicochemical, textural and sensory characteristics of the final product. There were slight differences in the among the cooked turkey sausages. According to the results of the sensory and objective assessment of consumer properties, it can be argued that the sample F1 with the introduction of buckwheat hulls 3,0% had a negative effect on sensory properties of cooked turkey sausages. The best marks were given to the sample F1 with the introduction of buckwheat hulls 1,0% on sensory evaluation. Thus, we can conclude that the resulting product with the additive1,0% is the optimal sample.

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