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Application of beekeeping products in the technology of raw smoked sausages

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Abstract. The safety of fermented sausage products is due to the elimination of a number of risks of biological origin, mainly of a microbiological nature. One of the most promising directions for the development of barrier technologies is the use of starter cultures and the biologically active substances produced by them in the production of fermented meat products. The research aims to study the influence of starter cultures and honey on a complex of physico-chemical, structural-mechanical, organoleptic indicators and nutritional value of raw smoked sausages. The article presents changes in the physical and chemical parameters of raw smoked sausages when using starter cultures in combination with different types of honey. When performing the work, 4 types of honey were used: from sunflower, phacelia, honeydew honey and from medicinal herbs. At the first stage of research, the proportion of honey application and the type of starter crops were selected. The

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next stage of the study was to determine the impact of the starter cultures included in the product BIOSTART PLUS 50 (lactic acid bacteria *Lactobacillus Sake* and yeasts *Debaryomyces Hansenii*) and honey on moisture loss during fermentation of raw smoked sausages, physicochemical parameters of finished products. Determination of moisture content in samples was carried out by drying in a drying cabinet at a temperature of $103\pm 2^{\circ}\text{C}$. Conducted studies prove that the use of the product BIOSTART PLUS 50 (lactic acid bacteria *Lactobacillus Sakei* and yeasts *Debaryomyces Hansenii*) and honey allows shortening the ripening and drying technological process. A comparative analysis of manufactured raw-smoked sausages in terms of nutritional value makes it possible to state that manufactured raw-smoked sausages with the addition of honey meet the requirements of the standard. The results of the set of studies carried out in this work showed that the use of a composition of lactic acid bacteria and yeast with the use of honey as a source of carbohydrates will allow intensifying the technological process and improve the quality of finished products

Keywords: starter cultures; honeydew honey; physical and chemical parameters; lactic acid bacteria; fermentation

Introduction

The increase in the standard of living led to a change in the consumer's attitude towards food products. The consumer is becoming increasingly demanding about food, he wants not only to eat well and avoid health risks, but also to receive products that suit his tastes. Quality becomes an important factor that determines the competitiveness of products. Dynamically developing biotechnology opens up new opportunities in food design. Using modern equipment and innovative technical methods, as well as appropriate food ingredients, we not only expand the range of food products useful and healthy for the human body, but also provide a preventive and necessary therapeutic effect.

The group of fermented meat products can be considered in the field of meat products as functional products that preserve the native properties of raw materials during the production process. Domestic fermented products include raw-smoked and raw-cured sausages and meat products. These products belong to the class of meat products that have a high biological value due to the absence of high-temperature heat treatment, which creates conditions for enriching them with various components, including those sensitive to high temperatures.

O.I. Petrova *et al.* (2020) claim in their work that the use of starter cultures in the technology of raw-smoked sausages ensured, under the condition of a gradual decrease in pH, stabilization of microbial activity, inhibition of the growth of unwanted microflora, and improvement of the organoleptic indicators of the product.

Scientists I. Vlasenko & T. Semko (2019) believe, that the presence of lactic acid bacteria and bifidobacteria (probiotics), including those introduced in the form of bacterial preparations (starters), and their metabolites, in the presence of a number of prebiotics, can further increase the biological value. The reduced moisture content makes them unique concentrates with a high level of complete protein and fat. The decrease in pH and water activity makes the product highly resistant to microbial spoilage and extends the shelf life even at normal temperature values. As carbohydrates, they chose honey, of particular interest is honeydew honey, which, due to its characteristics, as noted by the authors of I.K. Karabagias *et al.* (2020), namely the presence of a significant amount of different carbohydrates (more than 80%), has potential prebiotic capacity and is a source of nutrition for starter cultures.

I. Vlasenko & T. Semko (2019) claim that the use of starter cultures in the production of raw smoked and cured sausages and other meat products provides not only a probiotic effect, but also accelerates the process of ripening, structure formation, drying, changes the expressiveness of various sensory indicators (colour, taste, smell, consistency) to improve the level of biosafety and digestibility of the finished product. When using *Bifidobacterium* strains in practice, it is worth considering the optimal conditions for their development.

The use of starter cultures ensures a gradual decrease in pH, stable functioning of microorganisms, inhibition of the development of unwanted microflora and improvement of organoleptic properties. All over the world, the main criterion for choosing microorganisms as microbial inoculants is the degree of their influence on the smell and taste properties of the finished product. The purpose of this work is to intensify the technology of raw smoked sausages by using starter crops and beekeeping products – honey.

Literature Review

Researching the market of sausage products M. Yakymiv (2021), it was found that in recent years in Ukraine there has been a noticeable trend towards the growth of craft production, that is, small-scale production that uses selected raw materials and traditional methods of preparing meat products. Consumers distinguish such products because of their taste, naturalness and are ready to pay a high price.

Usually, such production is small and produces limited batches. Thanks to this, the manufacturer can control the quality of each product unit. Handmade products are prepared according to traditional recipes, which may include natural food additives, which improves the quality of products. In recent years, the volume and range of production of raw-smoked and raw-cured sausages has increased significantly, largely due to the emergence of numerous small craft-type productions.

M.V. Shynkaruk & O.O. Baluk (2021) claim that the most important technical characteristics of starters are: fermentation of carbohydrates with the formation of lactic acid, reduction of ripening time, improvement of the quality of the finished product and extension of the shelf life, denitrification, resistance to salts. Yeast fungi, which are often part of combinations of starter cultures, also use hydrocarbons as nutrients. Similarly to lactobacilli, yeast is used both to participate in the created taste-aromatic properties of the product and to perform protective and stimulating functions.

The life span of lactic acid bacteria in the presence of yeast increases many times. Together, they form a protected environment that prevents the invasion of foreign microorganisms. In this combination, lactic acid bacteria are more resistant to microbial antagonism than other bacteria. In the works of scientists (Hunko *et al.*, 2022) indicated that the main nutrients for starter cultures are carbohydrates contained in meat raw materials or are added additionally. Lactobacilli are very demanding on food sources. From carbohydrates, they mainly ferment hexoses (glucose, fructose, mannose, galactose) and disaccharides (lactose, maltose, sucrose), and only heterofermentative species, for example, some strains of *L. plantarum*, ferment pentoses (ribose, xylose, arabinose).

In the same meat, there are not enough hydrocarbons for complete fermentation of raw-smoked and cured sausages to obtain the desired result. Accordingly, there is a need for additional added sugars at the stage of making minced meat, to ensure an environment that is easily fermented by microorganisms. In modern production technology, along with traditional carbohydrates, lactose, and fructose are used as a component of taste-aromatic compositions and spice mixtures. Domestic and international researchers are working on improving the quality and safety of raw-smoked and raw-cured sausage products. A number of foreign and domestic researchers have paid attention to the

question of the use of sugars in the technology of raw smoked sausages.

A significant contribution to the study of honeydew honeys was made by the scientist L. Adamchuk *et al.* (2021). In her work, she notes that bees get honeydew from honeydew, the sap of plants that appears under the influence of temperature changes in the environment. It is a sugar substance of the vital activity of insects that parasitize plants. It has a dark colour with different shades. Yes, dark green from linden and spruce, brown from willow, brown-black from oak. From some plants, it is bright with a golden hue. In particular, it contains many potassium and iron salts useful for the body, especially in dark varieties. Compared to flower honey, honey contains more phosphorus, copper, manganese, molybdenum, sodium, and magnesium. Its total ash content is on average 0.569%, and the flower ash content is 0.123%. Compared to floral honey, the water content of honeydew honey is slightly lower, the amount of protein and dextrins is 2-3 times higher (Lesovoi *et al.*, 2020).

Previous studies have shown that the antibacterial and antioxidant activity of honeydew honey is higher than that of nectar. The mechanism of the high antibacterial activity of honeydew honey has not been fully elucidated (Ng *et al.*, 2020, Silva *et al.*, 2020). This situation is most likely due to the higher content of bioactive compounds, such as phenols, proteins and amino acids, in honeydew honey compared to flower honey (Seraglio *et al.*, 2019). In addition, the oligosaccharides of honeydew honey have a potential prebiotic capacity and contribute to the increase of bifidobacteria and lactobacilli populations in the human intestine (Karabagias *et al.*, 2020).

Carbohydrates in raw smoked sausages perform various functions, they not only serve as “food” for the fermentation process, but also directly affect the taste of the product, allowing the product to reach a certain degree of hardness. However, the use of sugar in large

quantities above 0.5-1.0% is advantageous as long as it does not lead to excessive oxidation and, accordingly, to significant weight loss. The use of biologically active ingredients, such as bee products, is one of the ways to improve the production of meat products, especially when creating new high-quality products, such as fermented and other sausage products.

The success of this approach depends mainly on the type of starter cultures capable of reducing product production time, improving quality indicators such as taste and aroma, and ensuring product safety for consumers. The number of various recipe additives introduced into the technology of raw-smoked sausages makes it necessary to carry out additional research on the dependence of the structural-mechanical, physico-chemical and sensory indicators of the finished product and to improve the production process.

Materials and Methods

The research was conducted in the laboratory of the Department of Meat, Fish, and Seafood Technology of the National University of Biore-sources and Nature Management of Ukraine in September-December 2022. For the production of trial samples of sausages, the recipe “Cheese-smoked savelat sausage of the highest grade” according to DSTU 4427:2005 (2006) was chosen.

At the first stage of the work, sausage products were made according to the technological scheme built on the basis of the technological scheme for the production of raw smoked sausages, given by V.H. Vynnykova (2006). For the production of fermented sausage products, meat raw materials were used: top grade boneless beef, boneless lean pork, boneless fatty pork in accordance with the requirements of regulatory documentation.

The procedure for preparing minced meat is as follows: first, frozen beef and lean pork were loaded into the cutter and chopped by cutting at low speeds, adding salt in the amount of 3.5% to the mass of raw materials

and a solution of sodium nitrite in the amount provided by the recipe. In the mixing process, pre-dissolved (1:4) starter cultures were introduced at the rate of 25 g per 100 kg of the main raw material mass, honey and spices, fatty pork were added, and cooking was carried out to the desired consistency of the meat system. Injecting the minced meat into the shell was carried out immediately after the minced meat preparation. Stuffing of minced meat was carried out using a manual sausage syringe. Aitzel casing was used as a sausage casing.

After carrying out a complex of technological operations according to the production scheme, the nutritional value of the developed raw-smoked sausages was determined. In order to ensure the fermentation process, starter cultures included in the BIOSTART PLUS 50 product manufactured by RAPS GmbH & Co. KG (Federal Republic of Germany) and med. were introduced into the minced sausage. According to the information provided by the representative of RAPS in Ukraine, BIOSTART PLUS 50 includes *Lactobacillus lactic acid bacteria Sakei*, and *Debaryomyces yeast mushrooms Hansenii*. As a control sample, the same raw-smoked sausage "High-quality raw-smoked servelat sausage" was taken, which included food glucose in the amount of 0.2% as a carbohydrate and BIOSTART PLUS 50 starter culture. The difference between the developed recipes and the control one is mainly the replacement of food glucose for honey of different types: sample No. 1 with sunflower honey; sample No. 2 with phacelia honey; sample No. 3 with honeydew honey; sample No. 4 with honey of medicinal herbs.

To obtain reliable experimental data, all studies were performed at least five times, two repetitions for each experiment. Sampling for sensory and physico-chemical studies and preparation for analysis were carried out in accordance with DSTU 4823.2:2007 (2007). Physicochemical indicators were determined by the following methods: protein content was determined by the Kjeldahl method according to ISO

1871:2009 (2009). The mass fraction of fat was measured by the Soxhlet method according to DSTU 8380:2015 (2015). The method is based on repeated extraction of fat with a solvent from a dried portion of the product, followed by removal of the solvent and drying of the sample to a constant weight. Extraction is carried out in the apparatus Soxhlet. Petroleum ether was used as a solvent. Determination of moisture content was carried out by drying in an oven at a temperature of $103\pm 2^{\circ}\text{C}$ (arbitration method) according to DSTU ISO 1442:2005 (2008). First, the weight of the product was determined, and then by drying the weight to a constant weight, the content of dry substances was determined; by the arithmetic difference of the mass of the raw and dry weight – the moisture content in the product. The content of table salt (sodium chloride) was determined by Mohr's method according to DSTU ISO 9297:2007 (2009). The organoleptic assessment and determination of the physicochemical parameters of honey were studied by standardized methods in accordance with DSTU 4497:2005 (2007).

Results and Discussion

One of the promising directions of intensification of the technological process of production of raw smoked sausages is the introduction of new biotechnological techniques based on the effective use of meat raw materials as their own enzyme systems, and on the purposeful introduction of starter cultures. A variety of technological techniques with the use of starter crops allows the production of finished products of high quality. When introducing starter cultures, it should be taken into account that the speed of their development directly depends on the amount of nutrient medium for them, at the same time, a significant introduction of sugars will speed up the technological process, but this may affect the organoleptic qualities of the finished product. The use of starter cultures and sugars in the production of raw-smoked sausages is due to the fact that lactic, pyruvic,

tartaric, acetic acids, ethanol, and other low-molecular compounds are formed as a result of the carbohydrate metabolism of microorganisms, which give the finished product a specific taste and aroma. Fat breakdown products: fatty acids and carbonyl compounds also play an important role in the formation of aroma.

The possibility of using honeydew honey in the production of fermented products has not been sufficiently studied. This direction requires the development of the technology of the mentioned ingredients, the study of their functional properties and mechanisms of interaction with the meat system, the preparation of recipes for fermented meat products, which include beekeeping products, and the development of technology.

According to numerous studies, it is known that the extract propolis, which was used to treat fermented sausages, shows an inhibitory effect against bacteria of the *Staphylococcus species aureus* and *Pseudomonas aeruginosa*, but more effective against gram-positive species (Safaei & Roosta Azad, 2020). Scientists Y. Sukhenko *et al.* (2021) during research, revealed inhibiting the growth of microbiota, which causes microbiological spoilage of semi-smoked sausages in a natural casing, 4-5 times more compared to control samples, without the formation of mould. Treatment of natural casings of semi-smoked sausage with aqueous extract of propolis in a dilution of 1:10 does not have a negative effect on the sensory and physico-chemical parameters of sausages.

Scientists J. Kocot *et al.* (2018) found that phenolic compounds, one of the main groups of beekeeping products, have an antioxidant effect. The Folin-Chocalto method is considered the main tool for measuring and estimating the amount of antioxidant compounds in extracts from various natural sources. The obtained results showed that propolis extract is an important source of phenolic components, such as phenolic acids and their esters and flavonoids. Hence, the propolis extract was analysed for

phenolic composition and the results showed that flavanones pinocembrin and naringenin, as well as flavonol galangin were the main (80.1%) compounds quantified. According to the work (Vargas-Sánchez *et al.*, 2019) it was reported that flavonoids pinocembrin and galangin are the main phenolic compounds in propolis extracts. The presence of phenolic compounds in natural extracts is highly correlated with antioxidant activity, so the inclusion of natural extracts in meat and meat products may be an important strategy to improve oxidative stability during storage. According to this study, dried pork sausages were treated with some antioxidants (propolis extracted with ethanol, 0.4% by weight; propolis extracted by water, 0.6% by weight; dried residue of propolis extracted by ethanol, 0.8% by weight./wt.) and stored for four weeks at 5, 10 and 20°C. At the end of storage, the results showed that lipid oxidation was reduced in the treated sausage products (50%, 59%, 35% and 91%, respectively) compared to the control. While in another product, ethanol-extracted propolis reduced lipid oxidation (78.5%) in beef patties during storage (8 days at 2°C), which was attributed to the presence of phenolic compounds such as quercetin, pinocembrin, kaempferol and luteolin.

O. Anjos *et al.* (2019) conducted a study on the use of bee pollen and bee pollen extract in the technology of blood sausages. Research data indicates a high antioxidant property of bee pollen and its extract. Which in turn affects the microbiological safety of the product. Another group of authors (Almeida *et al.*, 2017) investigated the effect of lyophilized bee pollen extract on the degree of lipid oxidation in pork sausage. The use of this extract showed a strong antioxidant effect in pork sausage, probably due to the high antioxidant activity and the presence of phenolic compounds in bee pollen, which has potential for use in sausage products.

The inclusion of flower pollen powder in the composition of sausages in the amount of 0.5 to 1.5 g/100 g (Novaković *et al.*, 2021),

resulted in a stable product during two months of refrigerated storage without negative impact on structural and mechanical characteristics. It can be concluded that pollen has excellent emulsifying properties, fat- and water-absorbing capacity, which qualify it for use in meat products, above all in heterogeneous colloidal products, such as sausages, where these properties are desired. Although excellent emulsifying properties in the pollen powder have been obtained, there is a certain limitation regarding sensory properties, especially due to obtaining a specific smell and taste, which can cause certain negative evaluations by consumers. In scientific research, propolis and bee pollen extracts are used instead of raw materials because they contain a greater number of bioactive components. However, the use of solvents of

different polarity affects the composition of the obtained extracts, since the components of beekeeping products have a diverse structure, and if hydrophilic ones dissolve better in polar solvents, such as alcohols, those with hydrophobic properties show a greater affinity for non-polar solvents, such as hydrocarbons. The properties of the extract strongly depend not only on the solvent used, but also on the extraction conditions. Also, readily available sugars are used for the production of raw smoked products, which contribute to the development and activity of microbiota, since glycogen (meat polysaccharide) cannot satisfy the needs of microorganisms. The authors investigated the characteristics of different types of honey, which were used in the composition of fermented products instead of glucose (Table 1).

Table 1. Physico-chemical indicators of honey

The name of the ingredient	Physico-chemical parameters		Organoleptic indicators		
	Mass fraction of moisture, %	Active acidity, units pH	Colour	Taste and aroma	Consistence
Honeydew honey	18.3	3.92	Dark brown	Pronounced fruity; weak honey	Viscous
Honey from medicinal herbs	18.1	3.84	Amber	Tender; saturated and pronounced	Liquid, viscous
Sunflower honey	17.2	3.75	Golden yellow	Astringent; weak honey	Thick, low tensile strength
Honey from phacelia	16.3	3.78	Light yellow	Saturated; tart-sweet	Thick, sticky

Source: author's development

The pH value of honey determines its antibacterial properties. Bioactive substances of natural components not only provide improved organoleptic properties, inhibit the growth of unwanted microorganisms, inhibit lipid oxidation, but also contribute to better functioning of the beneficial microflora of bacterial preparations.

Previous studies show that the antibacterial and antioxidant activity of honeydew honeys exceeds that of nectaries (Silva *et al.*, 2020). The next step was to examine the nutritional value

of the product. Since one of the important indicators of product quality is the value of its nutritional and biological value, and in most cases the change of these indicators depends primarily on the composition of the raw material, its changes in the course of internal biochemical processes, external influences, as well as due to the additives used.

The nutritional value of the product was investigated after the end of fermentation and drying of the product: cold smoking was carried out

at a temperature of 20°C for 48 hours in a smoking chamber, drying was carried out in two stages. The first stage – at a temperature of 11°C and a relative humidity of 85% for 7 days. The second stage at a temperature of 10°C and a relative humidity of 78% in a cabinet for ripening meat

for control samples, No. 1 and No. 2, the duration of drying was 7 days, for samples No. 3 and No. 4-9 days. The duration of drying for the samples was increased by two days in order to reach the moisture content in the products regulated by the DSTU for raw-smoked sausages (Fig. 1).

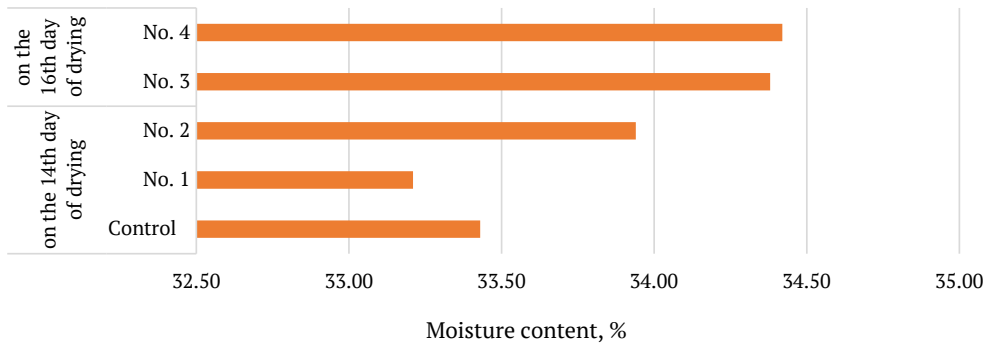


Figure 1. Changes in moisture content in raw smoked sausages during drying

Source: author's development

It was established that during the ripening-drying of loaves of raw-smoked sausages, the distribution of moisture by volume of the product is uneven, and it does not depend on the rate of diffusion of moisture inside the loaves. In general, it is also worth saying that in the samples that lost moisture the slowest (No. 3 and No. 4), lactic acid bacteria had more favourable conditions for increasing their population and producing lactic acid. From the presented data, it can be seen that the moisture content of experimental and control raw-smoked sausages

corresponds to the normative values (no more than 35%).

Probiotic lactobacilli are quite sensitive to salt, so it is necessary to add it to minced meat products according to the norm. For raw-smoked sausages, the mass fraction of kitchen salt is standardized at the level of 5-6%. According to the salt content, all samples at the exit met the requirements of DSTU 4427:2005 (2006), i.e., its fraction was less than 6%. The lowest percentage of salt, 4.12%, was found in the samples with honeydew honey (Fig. 2).

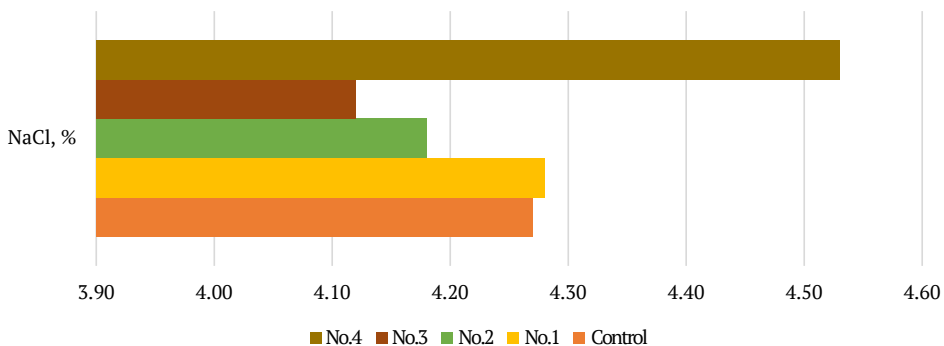


Figure 2. Mass fraction of salt in raw smoked sausages, %

Source: author's development

The main properties of bifidobacteria and lactobacilli are their high acid and aroma-forming properties able, expressed proteolytic activity, thanks to the developed complex of proteinases and peptidases, in relation not only to muscle, but also to connective tissue proteins.

With a decrease in the mass fraction of moisture, there was a redistribution of the mass

fractions of the main components of the product. In particular, in experimental variants, during ripening, the mass fraction of protein increased by 2.7-11.6% compared to the control sample (Table 2). In terms of protein content, sample No. 3 with honeydew honey and No. 4 with medicinal herb honey have the best results.

Table 2. Nutritional value of raw smoked sausages

Characteristic	Sample K with glucose	Sample No. 1 with sunflower honey	Sample No. 2 with phacelia honey	Sample No. 3 with honeydew honey	Sample No. 4 with honey from medicinal herbs
Protein content, g/100g	18.82	19.33	19.01	21.84	21.26
Fat content, g/100g	43.48	42.81	42.88	39.12	39.80
Energy value, kCal (kJ)	466.6 (1952)	462.61 (1935.5)	461.92 (1932.7)	439.44 (1838.6)	443.24 (1854.5)

Source: author's development

According to the results of the protein content study, it can be said that the use of honey in general does not cause a negative impact on the protein component of raw smoked sausage compared to the control sample, and ensures the nutritional value of the product is higher than the control when using its individual varieties. According to the fat content, the indicators of all samples were in the range from 39 to 43.5%, which corresponds to the normative indicator, no more than 65%.

The sample with honeydew honey had the lowest fat percentage of 39.12%, and 10% less than the control. The results of measuring the fat content indicate that the starter cultures most effectively caused the breakdown of fats in the medium with the addition of honeydew, which had a positive effect on the quality of the product. Fat breakdown products, namely free fatty acids and carbonyl compounds, play an important role in forming the aroma of the finished product, thereby influencing its consumer properties. Based on the results of measurements of protein and fat content, it is possible to calculate the energy value (calorie)

of products (Table 1). According to calculations, the samples of raw smoked sausages with phacelia honey and honeydew honey have the lowest caloric values, which is due to the lower fat content after the end of the fermentation period. The comparative analysis of the samples makes it possible to state that the manufactured raw-smoked sausage with the addition of honey generally meets the requirements of the standard in terms of physical and chemical parameters.

Conclusions

Microorganisms included in the composition of the starter cultures cause the breakdown of carbohydrates first, and then protein substances and fats (lipids), especially in the initial period of ripening, and thereby contribute to the formation of the desired aroma of the finished product. For this purpose, the recipes of raw smoked sausages include a significant amount of sucrose. However, based on the quantitative and qualitative composition of starter cultures, the most appropriate is the use of carbohydrates that can cause a synergistic effect in

the formation of functional and technological properties and organoleptic indicators of the product.

The results of the set of studies carried out in this work showed that the use of a composition of lactic acid bacteria and yeast with the use of honey as a source of carbohydrates will allow intensifying the technological process and improve the quality of finished products. This indicates the expediency of using the composition and honey in the technology of raw smoked sausages.

Based on the results of the work, new recipes and technology for raw smoked sausages were developed. The proposed technology makes it possible to reduce the period of production of products from 26 days to 16 days. It has been established that the use of bacterial cultures and honey contributes to the strengthening of the fermentation process, providing a pronounced taste-aromatic bouquet and the formation of a consistency, shortening the duration of the production of the product by 10 days compared to the product without the addition of starter cultures.

The sample with honeydew honey showed the most balanced parameters in the sausage maturation process. The average intensity of the decrease in pH and moisture loss, the lowest fat content, indicates that its composition is close to optimal for use as a carbohydrate for feeding starter cultures in the process of sausage ripening. It has been proven that the use of honey in the amount of 0.3% by weight of raw materials does not inhibit the development of technological microflora, but has a positive effect and stimulates the growth of desirable microorganisms.

In order to ensure high consumer properties of fermented sausages, it is necessary to additionally study the parameters of all technological operations and the mechanisms of influence of the applied additives on the safety of this group of sausages.

Acknowledgements

None.

Conflict of Interest

None.

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Анотація. Безпека ферментованих ковбасних виробів обумовлена усуненням низки ризиків біологічного походження, переважно мікробіологічної природи. Одним з найбільш перспективних напрямів розвитку бар'єрних технологій є використання стартових культур і вироблених ними біологічно активних речовин у виробництві ферментованих м'ясних продуктів. Дослідження має на меті вивчення впливу стартових культур та меду на комплекс фізико-хімічних, структурно-механічних, органолептичних показників та харчову цінність сирокочених ковбас. У статті представлено зміни фізико-хімічних показників сирокочених ковбас при використанні стартових культур в поєднанні з різними видами меду. При виконанні роботи використовували 4 види меду: з соняшника, фацелії, падевий мед та з лікарських трав. На першому етапі досліджень підбирали частку внесення меду та вид стартових культур. Подальшим етапом дослідження було визначення впливу стартових культур, що входять до складу продукту BIOSTART PLUS 50 (молочнокислі бактерії *Lactobacillus Sakei* та дріжджові гриби *Debaryomyces Hansenii*) та меду на втрати вологи під час ферментації сирокочених ковбас, фізико-хімічні показники готової продукції. Визначення вмісту вологи в зразках проводили методом висушуванням в сушильній шафі при температурі 103 ± 2 °C. Проведені дослідження

доводять, що застосування продукту BIOSTART PLUS 50 (молочнокислі бактерії *Lactobacillus Sakei* та дріжджові гриби *Debaryomyces Hansenii*) та меду дозволяє скоротити технологічний процес дозрівання і сушіння. Порівняльний аналіз виготовлених сиркопчених ковбас за харчовою цінністю дає змогу стверджувати, що виготовлені сиркопчені ковбаси з додаванням меду задовольняють вимоги стандарту. Результати комплексу досліджень, проведених у даній роботі, показали, що застосування композиції молочнокислих бактерій та дріжджів з використанням меду, як джерела вуглеводів, дозволить інтенсифікувати технологічний процес та підвищити якість готової продукції

Ключові слова: стартові культури; падевий мед; фізико-хімічні показники; молочно-кислі бактерії; ферментація