Study of changes in active acidity (ph) in sausages

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Abstract. Uncooked smoked sausages stand out among sausages due to sophisticated production technology. The main production processes are salting, fermentation and drying. The drying process is accompanied by the most complex processes: biochemical, physicochemical, changes in microflora, as a result of which the consistency, taste, color and aroma are formed, characteristic of raw smoked sausages. The article presents the results of studies of the influence of starter cultures on the quality indicators of raw smoked sausages. Two formulations of raw smoked sausages are proposed, in the production of which starter cultures are used, a study of changes in such indicators as water activity, active acidity, organoleptic indicators of the finished product were carried out.

1. Introduction

At the present stage of the food industry development, the meat industry occupies one of the leading places in the food industry and is constantly introducing new types of meat products [1-9]. Meat industry enterprises are engaged in the production of a wide range of products, introducing scientific research [10-15]. The main categories of products are meat and offal, semi-finished products, sausages, canned meat. The assortment of meat products is constantly expanding and basically corresponds to the basic principles of food combinatorics [16-23]. The enterprises of the industry are introducing new approaches to ensuring the quality and safety of products [24-29]. Sausages are of particular interest.

This group of meat products is distinguished by a variety of assortments and constant improvement of production technologies. Raw smoked sausages are one of the most consumed food products among sausages. They are canned products made from minced meat with the addition of salt and spices and smoked and dried. This type of sausages is distinguished by a noble taste and aroma, and also has a long shelf life, which has earned it popularity among consumers.

Currently, a huge variety of uncooked smoked sausages is produced, which have features in production technology and are distinguished by a large selection of taste. However, the production technology of this type of meat product is one of the most complex and is due to the long drying process, during which many reactions take place in the sausage loaf, which ultimately form the color, taste and aroma of raw smoked sausages.

In order to shorten the production time and at the same time maintain the quality of the product, the technologists have developed an accelerated technology for the production of raw smoked sausages.
In contrast to the classical technology, the accelerated technology does not include the process of salting raw meat in pieces with further aging in technological containers, which reduces the time and resources for the production of sausages.

The aim of the study is to study the influence of starter cultures on the quality indicators of raw smoked sausages.

2. Materials and methods
BioSTART Plus 50 and Biostart Express were rinsed as starter cultures, the characteristics are shown in table 1.

| BioSTART Plus 50 | baterium of fermented milk group Lactobacillus |
| Biostart Express | Lactobacillus sakei, Staphylococcus carnosus, Staphylococcus xylosus, Pediococcus pentosaceus and Candida famata |

For a comparative analysis of starter cultures, 4 sausage samples were developed:

- Spicy Biostart Express
- Spicy BioSTART Plus 50
- Gourmet Biostart Express
- Gourmet BioSTART Plus 50

The recipes for raw smoked sausages are presented in tables 2 and 3.

| Name of raw materials | Quantity, kg |
|-----------------------|-------------|
| Ham                   | 36          |
| Pork frozen           | 74          |
| Spig backbone         | 70          |
| Soy protein           | 20          |
| NaCl                  | 3.4         |
| NaNO₂                 | 2.4         |
| Dextrose              | 0.5         |
| Spice                 | 1.5         |
| Starting culture: (Biostart Express, BioSTART Plus 50) | 0.4 |

| Name of raw materials | Quantity, kg |
|-----------------------|-------------|
| Spig backbone         | 60          |
| Frozen chicken fillet | 60          |
| Chicken fillet        | 80          |
| NaCl                  | 3.4         |
| NaNO₂                 | 2.4         |
| Dextrose              | 0.4         |
| Spice                 | 2           |
| Starting culture: (Biostart Express, BioSTART Plus 50) | 0.4 |

The development of the samples under study was carried out using the following technology:
• Preparation of raw meat. Pork carcasses are deboned and trimmed. Frozen meat blocks are crushed using a crusher.
• Preparation of auxiliary raw materials. Spices, food additives and starter cultures are prepared in accordance with the recipe.
• Cooking minced sausage. Lean raw meat, spices and starter cultures are loaded into the cutter, then mixed for 5-7 minutes. Further, fatty meat raw materials, bacon are added to the cutter and mixed for another 2-3 minutes. The temperature of the medium should be 10-120 °C. After the completion of the process, the sausage meat is transferred to technological containers.
• Syringe. The filling of the casings is carried out using a vacuum syringe and a clipper to secure the ends of the casing. At this stage, the weight and appearance of the sausage loaves are controlled.
• Hanging on frames. The formed sausage loaves are hung on the frames, keeping the distance between the sausages. After filling, the frames are moved for ripening.
• Maturation and fermentation. The frames with sausages are moved to climatic chambers. The temperature in the chamber should be 2-40C, humidity 84-90%. The process lasts 48 hours.
• Smoking. In smoking chambers, certain modes are set: temperature 20-220C, humidity 74-80%. The duration of the process is 2-3 days.
• Drying. This process is carried out in drying chambers at a temperature of 11-150 °C with a humidity of 79-85%. Drying time 24-35 days.
• Packaging. The finished sausages are vacuum packed, labeled and stored prior to transportation.

3. Results and discussions
When monitoring the safety indicators of raw smoked sausages, the indicator of water activity is of great importance. This indicator characterizes the binding energy of moisture for microorganisms, and also affects the biochemical and physicochemical processes that occur in the finished product. For raw smoked sausages, indicators have been determined that guarantee the microbiological safety of the product.

Figure 1 shows the values of water activity in the studied samples of raw smoked sausages.

![Figure 1](image_url)

Figure 1. The results of measuring the water activity in raw smoked sausages.

Based on the data obtained, it was found that the water activity indicators of all the studied samples of raw smoked sausages did not exceed the permissible value equal to 0.88. A sample of uncooked smoked sausage "Delicacy" BioSTART Plus 50 has the best readings of water activity.

Further studies were conducted on the change in the ph index during the drying process. The results of measuring the dynamics of changes in the ph index during the drying process are presented in figures 2 and 3.
The pH index has a strong influence on the formation of the texture of raw smoked sausages. Consistency formation occurs during the drying process, this is characterized by a sharp decrease in pH and a degree of moisture loss. Texture hardness appears when the pH value is increased to 5.3. The end of the drying process also determines the pH value, its value should reach 5.4 and will not change.

Graphs 3 and 4 show that the pH values for all samples of raw smoked sausages reached the required value of 5.4. The drying process was faster for the uncooked smoked sausages "Delikatesnaya" and was 24 days.

At the next stage, the organoleptic indicators of the samples were studied; in the study, the quality indicators of uncooked sausages from GOST R 55456 Uncooked sausages were taken as regulatory requirements. Technical conditions.

Table 4 shows the results of the study of organoleptic characteristics of the studied samples of raw smoked sausages.
Table 4. Results of compliance with organoleptic indicators.

| index   | Appearance                                                                 | Consistency                  | Sectional view                                                                 | Smell and taste                                                                 | Shape and size                                                                 |
|---------|-----------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| standard | The surface is clean, dry, without damages to the casing, slips, minced meat | Tight or elastic             | The minced meat is evenly mixed, without gray spots and voids, its color and pattern are regulated by the document according to which the product is developed | Pleasant, characteristic of this type of product; with a smoking aroma, no foreign smell; taste is regulated by the document according to which the product is developed | Round, oval, rectangular or other shape with a maximum normal section size of 20-90 mm |

Sample name                  | Evaluation of organoleptic quality indicators on a 9-point scale | Total score | Arithmetic mean |
|-----------------------------|-----------------------------------------------------------------|-------------|----------------|
| Spicy Biostart Express      | 9                                                               | 42          | 8.4            |
| Spicy BioSTART Plus 50      | 9                                                               | 45          | 9              |
| Delicacy Biostart Express   | 9                                                               | 43          | 8.6            |
| Delicacy BioSTART Plus 50   | 9                                                               | 44          | 8.8            |

Based on the assessment of organoleptic indicators, it can be concluded that the organoleptic indicators of the prototypes meet the requirements of GOST R 55456 Raw smoked sausages. Technical conditions.

In addition to determining compliance, the organoleptic indicators were assessed on a 9-point scale in accordance with GOST 9959 Meat and meat products. General conditions for carrying out sensory evaluation. The results are shown in table 5.

Table 5. Results of evaluating organoleptic indicators on a 9-point scale.

| Sample name                  | Evaluation of organoleptic quality indicators on a 9-point scale | Total score | Arithmetic mean |
|-----------------------------|-----------------------------------------------------------------|-------------|----------------|
| Spicy Biostart Express      | 9                                                               | 42          | 8.4            |
| Spicy BioSTART Plus 50      | 9                                                               | 45          | 9              |
| Delicacy Biostart Express   | 9                                                               | 43          | 8.6            |
| Delicacy BioSTART Plus 50   | 9                                                               | 44          | 8.8            |

After analyzing the data in Table 5, we can conclude that the sample of uncooked smoked sausage "Piquant" BioSTART Plus 50 has the best organoleptic characteristics.
4. Conclusion
In the course of the research, it was found that all 4 prototypes have stable quality indicators, the water activity of the samples does not exceed the regulated indicator 0.88, the best result is observed in the sample "Delicatessen" BioSTART Plus 50. Studies of active acidity suggest that starter cultures allow achieve the required pH values, within the specified production time. A significant difference in the maturation time of the samples is characterized by a significant difference in the raw materials used.

The organoleptic evaluation of the samples indicates a steadily formed organoleptic profile of raw smoked sausages, and the appearance meets the requirements for raw smoked sausages.

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