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The Effect of Liquid Smoke on the Quality of Uncooked Smoked Sausages

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ABSTRACT

Meat products are highly nutritious, shelf stable and widely consumed food products. Today, a wide range of meat products is produced in the Republic of Armenia, which differ from each other in terms of quantity and variety of raw materials, additives, heat treatment, as well as in storage and packaging conditions.

The aim of the scientific work is to reveal the threats caused upon the use of different smoking methods in the production of uncooked smoked sausages in the meat industry and to study their quality indicators.

Introduction

As it has been mentioned above, a wide range of meat products is produced in the Republic of Armenia, which differ from each other in quantity and variety of the main raw materials, additives, heat treatment, as well as in storage and packaging conditions.

Increasing production capacity is a priority for food producers today, as natural resources are declining, but at the same time the demand for meat products is increasing.

It is noteworthy that the increase of production capacity in a natural way is almost impossible and the manufacturers turn to different methods to solve this problem. Some of these methods are: partial replacement of the main raw material with cheaper one, reduction in the duration of the technological phases in production, saving production areas and energy resources.

Of course, all these promote reduction in the cost price of final product and increase in the level of profitability, but the effect of the stated factors on the human organism is sometimes left behind the scope of researchers.

Materials and methods

Among the sausage products the uncooked smoked sausages which are produced from beef, pork, animal

fat and have a high nutritional value, long shelf life and improved organoleptic indices are of specific interest to the researchers.

Smoking is one of the most important phases in the production of uncooked smoked sausages, as a result of which the taste, smell, color and other qualitative properties of the finished product are formed (Kaim, 2006). However, it should be noted that smoking is a risk factor for quality, since during this process, substances appear on the product and its surface that can adversely affect the quality of the finished product (Feiner, 2010).

Therefore, in order to properly accomplish this process, comprehensive knowledge and skills are needed, that also require appropriate qualification of the employee. This is the main reason why the smoking process has appeared in the scope of our attention becoming a subject for scientific analysis that requires thorough investigation.

Currently, different smoking methods are used in the production of uncooked smoked sausages in Armenia, such as smoking, smoking with the use of liquid smoke, treatment with liquid smoke, etc. The latter's use significantly reduces production costs, the cost price of the finished product and enables to get finished product practically with the same organoleptic parameters in a shorter time (Fellows, 2009).

Nevertheless, the use of liquid smoke can contribute to the accumulation of such substances as benzopyrene and nitrosamines in the finished product, the content of which in finished products is regulated by Food Safety Technical Regulation 021, violation of which can even lead to criminal liability.

Nitrosamines are formed as a result of reaction between nitrates or nitrites with certain amines. Nitrosamines are found in consumer products such as processed meats, alcoholic beverages, cosmetics and tobacco smoke.

However, nitrosamines are considered to be strong carcinogenic compounds that cause cancer in various organs and tissues, such as the brain, lungs, liver, stomach, esophagus, kidneys, bladder and paranasal sinuses.

The formation of benzopyrene is due to smoking and often occurs in the animal's body via food intake due to soil contamination. Excess amount of benzopyrene contributes to the development of various types of cancer.

Results and discussions

We have developed and manufactured three samples of uncooked smoked sausages, which have been examined per organoleptic and physicochemical indicators, as well as per the content of benzopyrene and nitrosamines.

Table 1. Samples of uncooked sausages*

N	Sample name	Smoking method
1	Sample I	Only smoking
2	Sample II	Smoking and partial liquid smoke in the stuffing
3	Sample III	Only liquid smoke in the stuffing

*Composed by the authors.

First, recipes for three samples of uncooked smoked sausages to be produced were developed, which are presented in Table 2.

Table 2. Development of recipe for uncooked smoked sausage*

N	Indicator name	Quantity, kg		
		Sample I	Sample II	Sample III
1	Beef meat without sinew, h/q	45	45	45
2	Pork fat-free	25	25	25
3	Pork fat	30	30	30
4	Table salt	0.3	0.3	0.3
5	Sodium nitrite	0.01	0.01	0.01
6	Sugar	0.2	0.2	0.2
7	Nutmeg	0.03	0.03	0.03
8	Pepper	0.1	0.1	0.1
9	Garlic solution	0.05	0.05	0.05
10	Liquid smoke	-	0.5	1
11	Cognac	0.25	0.25	0.25

* Composed by the authors.

As shown in Table 2, sample I was prepared in accordance with the requirements of the normative document (GOST 16131-86), in the second sample 0.5 % liquid smoke was added, in the third sample it was added with the amount of 1 %, which assumes, that the third sample is not subjected to wood smoking, instead, the co-formation occurs on account of liquid smoke.

In the laboratory of the Chair of Animal-Based Food

Product Processing Technology, ANAU, the organoleptic and physicochemical parameters of the three samples were determined; a tasting assessment was carried out, the results of which are presented in Tables 3, 4, 5.

Table 3. Organoleptic indices of uncooked smoked sausage samples*

Indicator name	Sample I	Sample II	Sample III
Appearance	The surface is clean, dry, without damages, spots, without depositions from the filling and broth-fat on the membrane		
Consistency	solid		
Appearance and colour in the meat cut	Homogeneous, evenly mixed mince, dark red, without grey spots and empty spaces containing pieces of pork fat not more than 3 mm in size		
Taste and smell	salty, slightly spicy, with a pronounced spice and garlic aroma, with well expressed smoking flavour, without any off-taste and off-flavour		salty, slightly spicy, with a pronounced spice and garlic aroma, with well expressed smoking flavour and bitter taste

Table 4. Physicochemical parameters of uncooked smoked sausages*

Indicator name	Sample I	Sample II	Sample III
Mass fraction of moisture, %, not more than	27.5	28.6	30.8
Mass fraction of table salt %, not more than	5.4	4.9	3.8
Mass fraction of protein, %, not less than	18.0	18.0	18.0
Mass fraction of fat, %, not more than	58	58	58
Mass fraction of sodium nitrite, %, not more than	0.003	0.003	0.003

*Composed by the authors.

As it can be seen from Table 3, the organoleptic parameters of sample I and II are almost the same, while the addition of liquid smoke in sample III promotes the appearance of a sharp and bitter taste.

The analysis of Table 4 data suggests that the mass fraction of moisture increases in samples II and III due to the reduction of smoking process in the former case and the lack of heat treatment in the latter case, resulting in the decline of salt content in the finished product which leads to the high possibility of increasing the number of pathogenic bacteria in the uncooked smoked sausage, whereby reducing their shelf life.

The three experimental samples were tasted and assessed with a 30-point scale system, the results of which are introduced in Table 5.

Table 5. Tasting results of uncooked smoked sausages*

Indicator name	Sample I	Sample II	Sample III
Tasting result, points	27 /perfect/	21 /good/	18 /satisfactory/

*Composed by the authors.

Food safety is the most vital property for food product consumers and, hence, one of the prior goals of our study was to find out the effect of various smoking methods on the safety indices of the finished food product, in particular, on the amount of nitrosamines and benzopyrene. Per the stated regulations a sample mean was produced out of the three samples and submitted to the "National Institute of Health", CJSC, after S. Avdalbekyan under the Ministry of Health of the Republic of Armenia for the quantitative determination of nitrosamines and benzopyrene. The results are shown in Table 6.

The results of the research are normalized in line with the CU TR 021/2011 Technical Regulation on Food Safety.

Table 6. The amount of nitrosamines and benzopyrene in the samples tested*

Indicator name	Sample I		Sample II		Sample III	
	Norm, not more than	Test	Norm, not more than	Test	Norm, not more than	Test
Nitrosamine /the sum of NDMA and NDEA/, gr	0.004	0.0017	0.004	0.002	0.004	0.01
Benzapyrene, μg / kg	0.001	0.0007	0.001	0.0008	0.001	0.0009

*Composed by the sanitary-hygienic testing laboratory of "National Institute of Health", CJSC, after S. Avdalbekyan

As it can be seen from the results of Table 6, the amount of benzopyrene in the three samples fluctuates, but does not exceed the requirements of the CU TR 021/2011 Technical Regulation on Food Safety, in contrast to nitrosamines, the amount of which in the third sample exceeds the norm by 0.006 g. This difference is due to the fact that the third sample was manufactured only via liquid smoke and was not subjected to standard smoking, thus, accumulating carcinogenic substances in the finished product that can cause serious harm to the human body.

Conclusion

The aim of the scientific work was to identify the threats resulted from the use of various smoking methods in the production of uncooked smoked sausages in the meat industry and to study the quality indicators. At the end of the work we can conclude:

1. The recipes of three samples for the production of uncooked smoked sausages were developed and manufactured under production conditions through different smoking methods.

2. The finished product was examined per the organoleptic and physicochemical indicators, as a result of which the adverse effect of the liquid smoke increase was proved.

3. The three samples of uncooked smoked sausages were tested according to benzopyrene and nitrosamines amount, and it has been proved that uncooked smoked sausages produced only via liquid smoke contained excess amount of nitrosamines which exceeds the norm by 0.006 g.

4. The study findings were compared with the standards of CU TR 021/2011 (technical regulations on food safety) and CU TR 034/2013 (technical regulations on meat and meat product safety).

The aforestated conclusions give ground to note that when producing any type of food products and when implementing changes in the technological processes, it is necessary to analyze risk points, because sometimes, parallel to the reduction of production phases and primecost, the manufactured food products can cause serious harms to the human organism.

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