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THE INFLUENCE OF THE TEMPERATURE ON THE CHEMICAL AND MICROBIOLOGICAL COMOSITION OF VACUUM PACKED VRSHNICHKI SAUSAGE

A. Kuzelov[1], D. Andronikov[1], N. Taskov[2], D. Saneva[2], D. Naseva[1]
[1]Faculty of Agriculture; [2]Faculty of Tourism and Business Logistics University Goce Delcev Stip, Krste Misirkov bb, Stip, R. Macedonia;
Corresponding autor: aco.kuzelov@ugd.edu.mk
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Abstract

This study reports the changes that occur at vacuum packed Vrshnichki sausage during the storage in cooling chambers at different temperature conditions of 4 ℃ and 8 ℃. Changes that occur during the storage were examined on 2-nd, 15-th, 25-th and 40-th day from production.

It was determined that during the storage time of the sausages substantial changes occur in the decreasing content of water and increasing content of proteins, fats and mineral materials. The total number of bacteria in the sausages increases during the storage mostly of those at 8 ℃.

Keywords: *Vrshnichki sausage, temperature, chemical and microbiological analysis*

Introduction

In the last two decades in R. Macedonia are produced different meat products, of which the largest group are sausages. According to Regulation of quality of meat and meat products of R. Macedonia (Official Journal No. 63/2013), semi dry sausages must not contain more than 55 % water and 30 % fat. Semi dry sausages are products from meat batter made by certain percentage of meat and bacon (ground of different sizes), additives and spices, stuffed into natural or artificial casing and heat-treated. The quality and durability of semi dry sausages are affected by many factors: composition, ground degree, thermal processing, vacuum packaging, temperature and relative humidity during the storage. A lot of authors performed microbiological and chemical examinations of semi dry sausages (Hughes et. al 2002; Chen et. al 2007; Pleadin et. al 2009).

The aim of this research is to determine the chemical and microbiological picture of semi dry Vrsnicki sausage, produced in industrial conditions and kept at different temperatures.

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Materials and Methods

As test material was taken Vrsnicki sausage produced from beef meat second category, pork meat third category, pork head meat, fat, skin emulsion, nitrite salt, polyphosphate, soy flour. Sausages are stuffed into pork intestines with diameter ⌀ 32 mm. After the filling, sausages are thermally treated. After the thermal processing, sausages are cooled with running cold water on 40° C and are taken in cooling chamber at 4 ° C. Sausages are vacuum packaged with vacuum machine Vebomatic. Total of 14 samples of sausages were divided into two groups, the first group was kept at 4 °C and the second at 8 °C.

Total nitrogen (TN) was determined according to the Kjeldahl method. Moisture content was determined by drying at (103 ± 2) °C to constant mass. The intramuscular fat content was determined according to AOAC International method, with petroleum ether as solvent. Minerals were determined by burning and combustion (4 – 5 h) at 525 – 550 °C. Total bacteria (Bacillus) number was analyzed by method - ISO 4833 / 2003.

Data were transformed into $\log_{10}$ CFU/g before comparison of means.

The results were statistically processed using mathematical program Microsoft EXEL ANOVA (single factor) 1997-2003.

Results, Discussion

The results of chemical analysis of the Vrshnichki sausage kept on T = 4 °C are shown in table 1.

Table 1. Dynamics of changes of chemical constitution of the Vrshnichki sausage during its storage on a temperature of 4 °C, $\acute{X}$ = mean, Sd = standard deviation

Figures 1. Caption

Number	Parameter	Chemical constitution			
		2-nd day	15-th day	25-th day	40-th day
		$\acute{X}$ Sd	$\acute{X}$ Sd	$\acute{X}$ Sd	$\acute{X}$ Sd
1.	Water ,%	68.48 +/- 2.5	64.22 +/- 2.28	58.45 +/- 1.90	53.80 +/- 1.38
2.	Fats %	12.28 +/- 0.30	14.42 +/- 0.35	17.12 +/- 0.95	18.52 +/- 0.92
3.	Proteins %	14.20 +/- 0.32	16.28 +/- 0.72	19.25 +/- 0.92	21.28 +/- 0.90
4.	Minerals %	3.40 +/- 0.20	3.85 +/- 0.22	5.25 +/- 0.120	5.58 +/- 0.58

As the data from table 1 show, on the 2-nd day the average content was 68.48 % of water, 14.20 % of proteins, 12.28 % of fats and 3.40 % of minerals . After 15 days of storage on a temperature of 4 °C and the water decreased to 64.22 %, the proteins increased 16.28 % the fats 14.42 and the minerals increased to 3.85 %. On the 25-th day production water content is reduced to 58.45 % as fat content 17.12 %, protein increased to 19.25 % and the mineral substances increased to 5.25 %. These changes are a result of the evaporation of the free water within the sausages. The last day of storage, i.e. on the 40-th day, the water decreased to 53.80 %, the fats increased to 18.52 %, the proteins increased to 21.28 % and the minerals increased to 5.58 %.

The results of chemical analysis of the Vrshnichki sausage kept on T = 8 °C are shown in table 2.

Table 2. Dynamics of changes of chemical constitution of the Vrshnichki sausage during its storage on a temperature of 8 °C, $\acute{X}$ = mean, Sd = standard deviation

Num.	Parameter	Chemical constitution			
		2-nd day	15-th day	25-th day	40-th day
		$\acute{X}$ Sd	$\acute{X}$ Sd	$\acute{X}$ Sd	$\acute{X}$ Sd
1.	Water ,%	68.48 +/- 2.5	64.52 +/- 2.28	60.20 +/- 1.92	55.18 +/- 1.40
2.	Fats %	12.28 +/- 0.30	15.43 +/- 1.35	17.82 +/- 1.35	18.82 +/- 1.48
3.	Proteins %	14.20 +/- 0.32	14.88 +/- 0.28	16.58 +/- 0.42	17.78 +/- 1.75
4.	Minerals %	3.40 +/- 0.20	4.52 +/- 0.58	5.18 +/- 0.28	5.52 +/- 0.45

As the data from table 2 show that after the 15 days of keeping the sausages on a temperature of 8 °C the water decreased to 64.52 %, while the fats increased to 15.40 %, the proteins increased to 14.88 % and the mineral materials increased to 4.52 %. On the 25-th day the mass decreased to 88 %, the water decreased to 60.20 %, while the fats increased to 17.82 %, the proteins increased to 16.58 % and the minerals increased to 5.18 %. On the last day of storage the water decreased to 55.18 %, while the fats increased to 18.82 %, the proteins increased to 17.78 % and the mineral materials increased to 5.52 %. The differences between the changes of the chemical constitution of the sausages kept on 4 °C and 8 °C are minor but still existent.

Since the content of water decreases during the storage of the sausages the content of dry mater (proteins, fats and mineral materials) adequately increases. The increase of the dry mater is not proportional for all three components, but it shows bigger or minor variability for some of them. The biggest increase on the 15-th, the 25-th and the 40-th day showed the fats of the sausages kept on 8 °C. On the other hand, the sausages kept on 4 °C show constant and standard increase of the content of fats and proteins. The differences between the changes of the fats and proteins in two samples are insignificant.

The quantity of minerals for both cases (sausages kept on 4 °C and 8 °C) is nearly identical for the examination intervals and there is no significant variation. During the storage period of the sausages the content of microorganisms also changes under the

influence of evaporation of the water thus increasing the content of dry mater especially the salt and the change of pH value.

As a result of the change of the chemical constitution of the sausages their microbiological picture also changes. The sausages kept on T = 8 ºC show significant increase of their overall number compared to the ones kept on 4 ºC. On the 15-th day of storage of the sausages on a temperature of 8 ºC the total number of bacteria was 8.0 log CFU/g, while on the 40-th day their number increased to 13.0 log CFU/g. The sausages kept on 4 ºC showed a total number of bacteria of 5.0 log CFU/g on the 15-th day and 8.0 log CFU/g on the 40-th day.
The increased number of bacteria is a result of the favorable conditions for their development (table 3).

Table 3. Microbiological picture of Vrsnichki sausage during its storage on a temperature of 4 ºC and 8 ºC.

Testing day	T = 4 ºC	T = 8 ºC
2-nd day	1.2 log CFU/g	1.7 log CFU/g
15-th day	5.0 log CFU/g	8.0 log CFU/g
25-th day	7.2 log CFU/g	8.5 log CFU/g
40-th day	8.0 log CFU/g	13.0 log CFU/g

Conclusion

Chemical analysis has shown that fat and water are within limits prescribed according to the rulebook for quality of meat and meat products of R. Macedonia. The content of protein in the finished product on average ranges from 17.78 % to 21.28 % in both groups tested products. The total number of bacteria is consistently higher in samples stored at a temperature of 8 º C, as we expected.

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