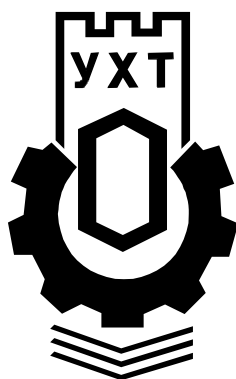


**УНИВЕРСИТЕТ ПО ХРАНИТЕЛНИ ТЕХНОЛОГИИ -
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part I**

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INFLUENCE OF THE EXTRACT OF BASIL ON THE OXIDATIVE CHANGES, MICROBIOLOGICAL IMAGE AND SENSORY PROPERTIES IN SEMI-DURABLE SAUSAGES

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Abstract

This paper presents the influence of the basil extract (*Ocimum Basilicum*) on the oxidative changes and durability of semi-durable sausage during the storage of sausage at a temperature of +4 °C. Control sample (sample 1) and sample with supplement 0,2 g/kg extract basil (sample 2) were examined. Changes were monitored in the content of acid degree, peroxide number, free fatty acids, microbiological image and sensory analysis image. Peroxide number, acid degree, free fatty acids and microbiological condition were checked on the 1st, 7th, 16th, 34th, 45th and 60th day of production, and sensory analysis was done on the first day and the 60th day of production. Sausages produced with the addition of 0,2 g/kg extract of basil had smaller oxidative changes, better microbiological image and the better sensory properties.

Key words: basil, basil extract, oxidative changes, microbiological image, sensory properties, semi-durable sausage

Introduction

Basil is a plant - spice which is widespread in the Mediterranean, as well as in India or in general in moderate climate regions. Because of its good sensory properties and remedial action it is widely used in the household. In India this plant is used in traditional and official medicine. In Ayurveda and Sidha medicine, it is used for the treatment of various infections, skin diseases, liver disorders, colds, against intestinal

parasites etc. Essential oils of basil have anti-inflammatory, antioxidant, immune-modulatory and anti-stress activity (Danon 1985; Picuric et al., 2000; Popovic et al., 2007;). Some authors also say that basil has antibacterial activity. (Nebedum et al., 2009, Nguefack et al., 2004, Sanchez et al., 2010.). Basil extract (extracted with organic solvents and carbon dioxide in the supercritical state) show strong antioxidant effect. (Kelmet.al., 2000, Leal et al., 2008, Yun et al., 2003).



Plant family Lamiaceae, and plants like rosemary, sage, oregano, thyme and basil and their extracts are known for their antioxidant properties. These plants and their extracts have equivalent or higher antioxidant activity than synthetic antioxidants (Đarmati et al.,1991). In the basil and his extract the cardinal ingredients are kavikol, linalool and eugenol (Oscar Danon1985). It is confirmed that some ingredients of basil extract possess stronger antioxidant effect than vitamin E.

In gastronomy - cooking, basil is used in most countries in the Mediterranean when spicing mutton and pork, sauces, soups, fish, basil extract is used in spice mixtures for meat products such as pates, sausages.

Based on literature data and practical knowledge, basil extract is underrepresented in the meat industry. Because in the literature there is very little information on the impact of basil extract on the quality and durability of semi durable sausages, our research is to examine how the basil extract acts on oxidative changes, microbiological image and sensory qualities of semi-durable sausage.

Material and method

As material for examination we have used the semi-durable sausage of the type produced home. Sausage was produced in compliance with all veterinary sanitary regulations which apply in the Republic of Macedonia. For the production of the sausage the following raw material was used: beef second category (25%), pork second category (20%), claim adipose tissue (30%), meat steak (10%) and hard water - ice (15%): per 1 kg is added 18 grams of nitrite curing salt and 3 grams phosphate product.

As regards spices, mild ground red pepper and ground black pepper are added. The mixture is stuffed into small pork's intestine. For the experiment were prepared one control sample (sample 1) without adding a extract and other sample by adding 0,2g / kg extract basil (sample2). The extract was applied to the production - grinding the mixture. After filling and leaving the water to come out of the sausage, it was thermically prepared Thermal processing is implemented by the following formula: 35 minutes drying, 20

minutes smoked at 62°C, 35 minutes of boiling at 78°C or until the center of the product does not reach a temperature of 69-72 ° C.

The extract which was applied in the sausage is made in the USA company. After thermal processing, it was vacuumed with vacuum machine Vebomak. After vacuum packeging, sausage was stored in a chamber at a temperature of +4 °C. During storage on the 1st, 10th, 20th, 30th, 40th and 50th day of production, sausages were examined in view of acid level, peroxide number , microbiological image. Sensory analysis of the sausages were conducted of the first day and 60th day of production. Acid level was examined by the method of ISO 660 (2000), and peroxide number by the method ISO- 3960 (2001).

Microbiological image

Microbiological tests were performed as examining the presence of clostridium, streptococcus, staphilococcus, escerihia and total number of bacteria.

For bacteriological examination, material was taken from each sample - 20 g of material, which before planting is homogenized with 180 ml sterile distilled water from which is made other dilutions. The number of bacteria is in log / CFU / g.

Sensory examination

The evaluation was performed by a 5 experienced specialists following sensory attributes: external appearance, appearance of cut, color section, smell, taste, consistency, appearance of meat drain. Evaluators were served bread and water for rinsing - cleaning the mouth after every test samples.

Statistical processing

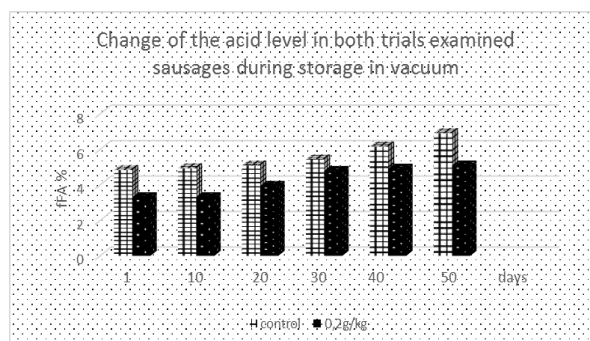
The obtained results have been processed mathematically statistically by determining the medium value, measures of variation, statistical significance (EXCEL MS Office 2000).

Results and discussion

Indicators from hydrolytic and oxidative changes in both groups of examined sausages are shown in Figure 1 and Figure 2. The quantity of free fatty acids expressed as acid number for temporary storage of sausages increased in both groups of examined sausages.

Bigger is the increase in the control sausages. But oxidative changes don't follow the trend of the hydrolysis of fats. Peroxide number that expresses the amount of oxidation products of fatty acids in both groups examined was at the beginning from 0.70 to 0.93 mmol / kg. During storage of sausages on the temperature of +4 ° C in both groups examined sausages increases especially in sample 1 and is 1.50 mmol / kg, and in sample 2 is 0.72 mmol / kg.

In the Rulebook for the quality of minced meat, meat preparations and meat products (Official Gazette of the Republic of Macedonia No. 63 as of 29.04.2013) there are no prescribed allowed values for peroxide number and acid degree in meat products. Thus, it is not possible to interpret the obtained results in accordance with the Rulebook. According to Oshtrich Matijashevich Biserka (1963) and Raseta (1985) sensory changes of sausages are visible only when the value of peroxide number is greater than 5 mmol/kg, and can be concluded that the oxidation process in the tested samples is not expressed. Pichurich et al., (2000) examined the antioxidative activity of basil and basil extract and found that extracts of basil showed relatively antioxidative activity. The results we obtained are probably as a result of antioxidative activity from extract of basil or any of his ingredients and vacuum packaging of sausages.



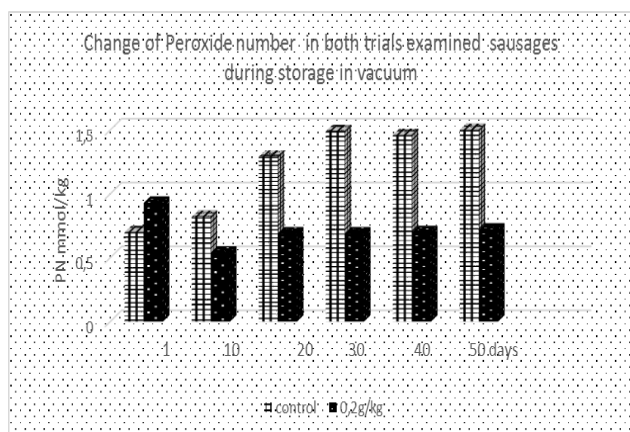
Microbiological examination

Table 1. The results of microbiological tests (TNB)

Days	Sample 1	Sample 2
1	1.69 Log /CFU g.	1.66 Log /CFU g.
10	1.77 Log /CFU g.	1.73 Log /CFU g.
20	1.84 Log /CFU g.	1.75 Log /CFU g.
30	1.88 Log /CFU g.	1.77 Log /CFU g.
40	1.92 Log /CFU g.	1.80 Log /CFU g.
50	1.95 Log /CFU g.	1.89 Log /CFU g.

In both groups of tested sausages from the beginning to the end of the test, Proteus, Esherichia, Clostridii and Salmonela were not determined. Determined is the total number of bacteria which are mostly bacillus. Total number of bacteria is greater during storage of sausages in the control group compared with sausages sample where 0,2g / kg extract of basil was added. There are no statistically significant differences between the samples examined in terms of microbiological image of the tested sausages.

Few authors have studied the effect of anti bacterial extract of basil (Popovichet al., (2007), Nebedumet al., (2009)) say that basil extract leads to a reduction of the initial number of bacteria especially with Listeria monocytogenes. This effect can be explained by the action of essential oils and aromatic compounds that are found in the extract. Nguefack et al., (2004) investigated the antibacterial activity of extracts obtained from various plants (Cymbopogon citratus, Ocimum basilicum, Ocimum gratissimum, Thymus vulgaris and Zingiber officinale) i.e. their antibacterial activity against Staphylococcus aureus, Listeria monocytogenes,





L. Innocua and found that all tested extracts showed antibacterial activity in different degree. Strongest antibacterial activity showed extracts of *O. Gratissimum* C. *Citratus* and weakest of *Zingiber officinale* and *Ocimum Basilicum*). Sanchez, et al (2010) investigated the anti microbial activity of extracts of basil (*Ocimum basilicum*), cactus (*Opuntia Ficus*) and sweet acacia (*Farnesiana L.*) and found these extracts are most active against *V. Cholera*. The extracts of these plants disrupt the cell membrane of *V. cholerae*, causing increased thinness of the membrane, reduction of cytoplasmic pH value and hyperpolarization of the cell membrane, these four plant extracts can be studied as future alternatives to control *V. Cholerae* in the food and diseases associated with this organism. Based on the above said, the results we obtained in terms of microbiological condition are probably due to the relatively small antibacterial effect of basil extract and the effects of high temperature during thermal processing of sausages.

Sensory examination

Based on the presented results in table 2, it can be seen that immediately after the end of production and storage, both groups tested sausages had acceptable sensory properties. In terms of the parameter occurrence of liquid, immediately after manufacture, both groups tested sausages did not have an appearance of meat drain.

At end of the production in sample 1, there was a small amount of liquid in three samples and with the second sample, in two samples. This is probably a result of the beginning putrescence of these tested sausages (appearance of slicing).

In all sensory properties there is no statistically significant differences between tests examined except in sensory attributes - taste and smell in sample 2 immediately after production and eventually got by keeping high grades (8.2 ± 0.25 and $8.5, \pm 0, 22$) from the sample 1 ($6, 4 \pm 0,28$ and $6,6 \pm 0,28$) and the difference is statistically significant ($p < 0,001$). Sensory characteristic - taste in sample 2 immediately after production and eventually won by keeping

the major grades (8.8 ± 0.28 and $8,5, \pm 0,22$) in terms of sample 1 ($6,6 \pm 0,22$ and $6,4 \pm 0.50$) and the difference is statistically significant ($p < 0,001$). These higher grades in sensory properties like taste and smell in sample 2 are as a result of the contribution of basil extract.

Table 2. Results of sensory evaluation immediately after the end of production and the end of storing sausages

Sensory properties	After the end of production		At the end of storing sausages	
	Sample 1 – X±Sd	Sample 2 – X±Sd	Sample 1 – X±Sd	Sample 2 – X±Sd
External appearance	7,4±0,25	7,7±0,22	6,6±0,28	7,4±0,42
Appearance of crosssection	7.4±0,40	7,6±0.45	5,8±0,25	6,6±0,18
Color of crosssection	6,6±0,40	6,2±0.20	6,8±0,45	7.0±0,20
Smell	6,,4±0,28	8..2±0.25	6,6±0,28	8,5,±0,22
Taste	6,6±0,22	8.8±0.28	6,4±0,50	8,5,±0,22
Consistency	7,2±0,28	7,2±0.42	6,6±0,25	7,6±0,42
Appearance of meat drain	no	no	In 3 samples	In 2 samples

Conclusions

According to the results of our tests we can conclude the following:

- While storing the sausage, there was a small increase in the peroxide number and at the end of the storage acid level was increased.
- Sausages produced with the addition of 0,2g / kg basil extract (sample 2), there were smaller oxidative changes, better microbiological image and better sensory properties when compared with the control sample (sample 1).
- The extract of basil in the amount of 0,2g / kg has little antioxidant and antibacterial effect, and contributes to the formation of better flavor and smell of the finished product.



Basil extract can be used in the production of semi-durable sausage of the examined home type and other semi-durable sausage.

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