

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Biological Assessment of Summer Sausage with Preprocessing for Starter Cultures and Meat Raw by Electromagnetic Field of Low Frequencies.

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### ABSTRACT

The paper presents the research results of the biological safety of summer sausage with the use of electromagnetic processing of raw meat and starting cultures. Biological assessment of summer sausage carried out by conventional experimental methods on laboratory growing male rats for 28 days. Biochemical studies consisted of determining the total serum protein (colorimetric) protein fractions (nephelometric), calcium, phosphorus, iron, cholesterol, triglycerides, transaminase activity, and alkaline phosphatase kit produced by «Elitech Clinical Sestem». Results of the study of the morphological and biochemical indices of the blood of rats showed no load on the body of the test animals.

**Keywords:** electromagnetic effects, starter cultures, minced model, summer sausage

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## INTRODUCTION

With the development of market relations, more and more attention is paying to increased production of high-quality delicatessen meat products. Thus, production of summer sausages increased from 2.8% (2005) to 5% (2010) and is projecting to achieved in 2016 of 7.5% (about 225 thousand. Tons) of the total production of sausages [1, 11, 12].

Traditionally, summer sausage technology included the use for the manufacture of chilled raw meat of high quality. Due to the reduction of livestock and deficit, mainly chilled beef, many meat processing plants producing summer sausage, we switched to using thawed raw meat, including those with significant variations in quality. In turn, this has led to instability in the quality of products and production losses associated with the advent of technological marriage [1, 2, 17].

One solution to the problem of reducing the marriage, the stabilization of the quality of summer sausages and increasing production is the use of advanced technologies. One such technology is the introduction of electromagnetic treatment of low frequency (LF EMF) of raw meat and starter cultures [1, 2, 15].

## MATERIALS AND METHODS

As a prototype, studied summer sausage with prescription formulations in accordance with TU 9213-006-00422020-2002 using electromagnetic treatment of raw meat and starter cultures. As a control, salami had been selecting in accordance with the specifications 9213-006-00422020-2002 without LF EMF.

Biological evaluation of summer sausage carried out by conventional experimental methods on laboratory growing male rats for 28 days. [9, 14]

Studied weight gain - individual animal weighing 2 times per week on laboratory electronic balance.

Integral indicator of chronic intoxication (IPHI) was calculating by dividing the body weight of the animal on the weight of his body. [9]

The killing of laboratory rats produced dekapitirovaniya simultaneous manner.

The blood of rats was determined the number of red blood cells under a microscope by counting chamber Goryaeva. The amount of hemoglobin - with hemoglobin meter Sali, erythrocyte sedimentation rate (ESR) - Panchenkova in the capillaries, the number of white blood cells - the method of calculation in the chamber Goryaeva [1, 7, 13].

Biochemical studies of the blood of experimental rats were carried out in the laboratory of Krasnodar Scientific Research Veterinary Institute of the Russian Academy of Agricultural Sciences on the biochemical analyzer Vitalab Flexor Junior (Country of the Netherlands) using the reference normative documents. Biochemical studies consisted of determining the total serum protein (colorimetric) protein fractions (nephelometric), calcium, phosphorus, iron, cholesterol, triglycerides, transaminase activity, and alkaline phosphatase kit produced by «Elitech Clinical Sestem».

Rations for growing rats were prepared in accordance with the needs of laboratory rats in nutrients [10].

For histological studies meat fixed in 10% neutral formalin aqueous solution for 24 hours. Washed in cold running will of 12 hours and was encasing in gelatin according to the conventional technique. Material cut into microtome-cryostat «MIKROM - HM 525» (Germany) at 20 °C, yielding 10-15 micron thick sections. Sections were prepared sausage at a temperature in the cryostat chamber -28 °C [1]. Sections were staining with hematoxylin and Ehrlich questioned a 1% freshly prepared aqueous-alcoholic eosin; concluded under the cover slips in glycerol gelatin, after melting it in the water bath [1, 9].

Study of the microstructure of samples for histological preparations and photographed on digital photographic light microscope was carried out on «AXIOIMIGER.A1» (Carl Zeiss, Germany) with an image

analysis system connected «AXIOVISION» using an appropriate computer program morphological lenses at magnifications of  $\times$  to  $2 \times 63$  [1].

**MAIN PART**

In addition to such qualitative indicators as chemical composition, microbiological, physical-chemical, biochemical and organoleptic characteristics, is crucial biological evaluation of protein [3, 4, 16].

Determination of digestibility of proteins with proteolytic enzymes allows greater utilization degree predicted proteins by the human body [5, 6]. The findings of in vitro digestibility of samples of summer sausages, produced in three recipes: with the addition of GDL and starter cultures (control) and starter cultures and raw meat, processed EMF LF shown in table 1.

**Table 1: Assessment of the digestibility of summer sausages**

Pattern of sausages	Digestibility in vitro tyrosine mg / g protein		
	Pepsin	Trypsin	Sum
Verifying	10,02±0,49	10,95±0,50	20,97±0,85
Test	13,08±0,60	11,84±0,55	24,92±0,76

The rate and extent of digestibility of protein hydrolysis experienced sausages control samples exceeds 18.8%, indicating a more efficient protein hydrolysis enzymes starter cultures. In turn, this will enhance the lability protein summer sausages to proteases of the digestive tract.

In the study of indicators of the biological assessment of food, the most objective results will be obtain by using higher animals, such as rats.

For this reason, we decided to conduct studies to assess the biological value of summer sausage on white laboratory rats' inbred counterparts. This experiment was conducting in a vivarium GNU North Caucasus Research Institute of livestock within 28 days. For the experiment were dividing into two groups of five rats each head at the age of 1 month.

The first group of animals served as a control, while the second was a pilot. Rations for growing rats were prepared in accordance with the needs of laboratory rats in nutrients. The diet presented in table 2.

**Table 2: The diets for growing rats**

The name	Verifying	Test
Durum wheat	23,4	33,4
Corn yellow	35	1,5
Sausage	-	50
Oilcake of soybeans	8	-
Fishmeal	12	-
Dry milk	6	-
Vegetable oil	12	-
Tricalcium phosphate	2	2
Lizinmonohlogidrat	0,5	0,5
Methionine	0,1	0,1
Premix	1,0	1
TOTAL	100	100
At 1 kg of food contains:		
Metabolizable energy, MJ	13,0	13,0
Crude protein,%	19,6	19,5
Crude fat,%	15,8	15,9
Crude fiber,%	1,9	1,8
Ca, %	1,1	1,0
P, %	0,77	0,7
Lysine, %	1,5	1,44
Methionine + cystine	0,7	0,7

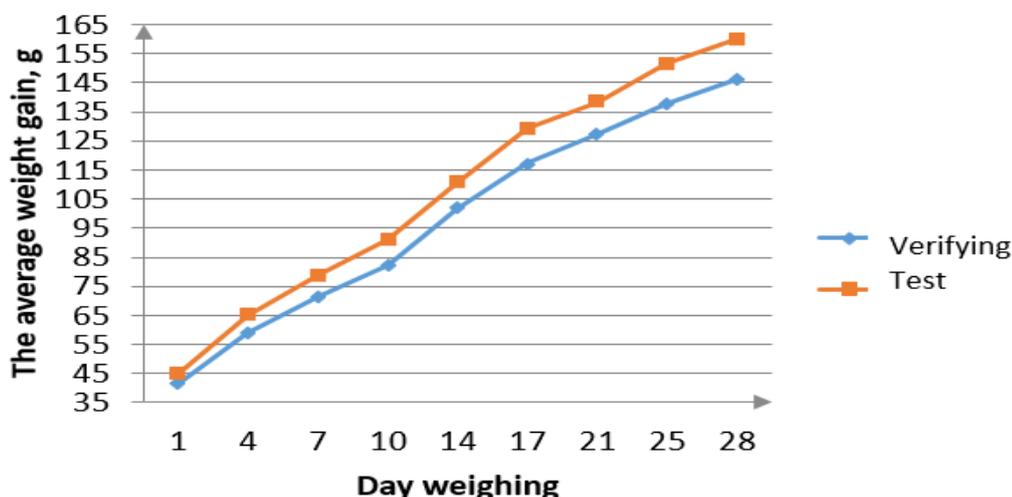
Growth performance in rats were determined twice a week. The results of the rat growth indicators are present in table 3.

**Table 3: Growth performance rats**

Groups	Live weight in the formulation, g	Live weight at the end of experience, g	The increase in body weight in 28 days, g	The average increase for the 28 days	
				g	%
Verifying	47,5 ± 2,4	146,2 ± 7,46	103,7 ± 5,09	3,63 ± 0,18	100
Test	48,4 ± 2,42	159,5 ± 8,0	111,1 ± 5,60	3,97 ± 0,20	107,5

Our data indicate that the addition to the diet of rats'summer sausage had a positive impact on the growth and development of animals. The average weight gain for 28 days in the test group was 3.97 g and 107.5% compared to control.

Growth dynamics of body weight in rats during the experiment is show in fig. 1.



**Figure 1: The growth of body weight of rats in the experiment**

The rectilinear nature of the schedule weight gain of the experimental group of rats treated with the lure in summer sausage, points to an even weight gain in the animals during the entire period of experience.

On the first day of the experiment, the average weight of experimental group exceeded the control by 3.7 After 28 days, the average weight of feeding the experimental group exceeded the control 13.6 In keeping with the original difference, and the average weight gain of an experimental batch was 9.9 g.

Blood chemistry laboratory rats was performed on biochemical analyzer Vita lab Flexor Junior (Country of the Netherlands).

Integral indicator of chronic intoxication (IPHI) was calculating by dividing the body weight of the animal on the weight of his body. IPHI data presented in table 4.

**Table 4: Integrated indicator of chronic intoxication IICI rats**

Indicators	Verifying	Test
IICI liver	5,46±0,05	5,28±0,3
IICI heart	0,36±0,03	0,36±0,01
IICI kidneys	0,91±0,14	0,94±0,03
IICI spleen	0,55±0,4	0,49±0,1

## SPECULATION

Replacing part of the diet to summer sausage did not have a significant effect on the white blood cell count, which indicates the absence of inflammatory processes in the body of the animal. These figures are within the same size and do not deviate from the standard data types.

The increased rate of eosinophils may indicate an allergic reaction to food components. In the control group, average of eosinophils has gone beyond the norm. The decline of this indicator in the test group indicates a decrease in allergic load in animals [8].

Lowering indicator of segmented neutrophils in the experimental group may be indicative of the inflammatory process in the body of the animal. Because the number of leukocytes is normally produce and feeding sausage containing a large amount of salt and sodium nitrite, which could affect the result.

The average value of the color index of rat blood, which characterizes the relative content of hemoglobin in a red blood cell, the two groups are in the same limit and without abnormalities.

Increasing the total protein content in the blood of rats of the experimental group shows a good protein digestibility of the diet [7]. We assume that the reduction in enzyme activity is not due to possible diseases and disorders in the body. This can be explain by the fact that under the influence of starter cultures a partial hydrolysis of proteins, which contributes to more rapid and effective learning in rats.

Elevated triglyceride in the test group indicates a high content of fat in the diet of animals [7]. The level of cholesterol in experimental rats is not increased, and the corresponding control counterparts, from which one can draw a conclusion about the absence of a functional load on the liver of experimental animals and metabolic shift toward pathology.

Underreporting Fe by 17.6 mmol / l in the experimental group shows a more complete assimilation of Fe rat organism. The indicator in the experimental group is within the normal range without deviation.

Indicators of alanine aminotransferase and aspartate aminotransferase activity in the experimental and control groups decreased by 74 U and 10.4 U with respect to the control group. Decreased activity of these enzymes can indicate a lack of toxic load on the liver hepatocytes.

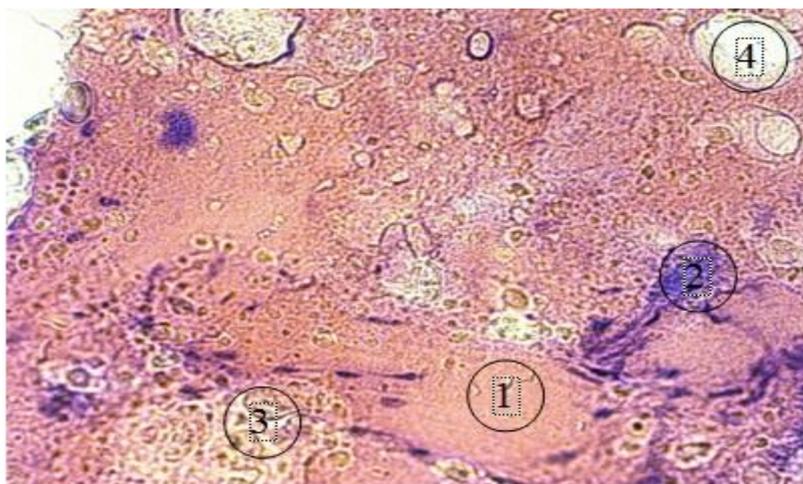
We noted a high activity of enzyme in both groups, but the most significant improvement manifested in rats of the experimental group. Thus, the activity of alkaline phosphatase in the group, which was feedingsummer sausage, was 1352.6 Unit and the control-1290.4 Unit.

Introduction to the diet of experimental rats'summer sausage positive impact on the animal, which is confirm by the overall results of the biochemical analysis of blood.

### **The histological structure of summer sausages**

The minced meat after holding summer sausage developed all the morphological characteristics typical of the development process of maturation of the product. In many places in the muscle fibers, there is a significant degradation, exciting as the fibrillary protein complex and sarcolemma. A significant part of the muscle fibers is fragmented. Due to the partial loss of moisture, transverse sections form muscle fibers as well as in the original raw meat acquires a more pronounced polygonal character.

From cellular material (mainly the sarcoplasmic material) is formed by a fine-grained protein mass, located between muscle fibers and connective tissue elements, occupying a significant portion of sausage material. Number grained protein mass corresponds to that type of meat product (Fig. 2). Between the muscle fibers found a large number of microspores.



**Figure 2: Fragments of muscle fibers in raw sausages. Ochre. hematoxylin-eosin. SW. × 200.**  
**1 - Fragments of muscle fibers; 2 - Microorganisms; 3 - microspores; 4 - fat inclusion.**

The fibrous connective elements of the skeleton muscles swollen. The cell nuclei of connective tissue layers was not detecting. Membrane and cytoplasmic element fat cells was not found.

Individual colonies bacterial starter, located between the particles like meat, and cover the inner surface of the minced far detected in greater numbers. The maximum number of colonies of bacterial flora are located in close proximity to the surface of the sausage stick, and in places of formation fines protein mass.

We assume that the emergence of a large number of microspores occurs as a result of low-frequency EMF, which destroys the cell structure of the muscle fiber. Microspores contribute to the diffusion of water from the center to the periphery of the stick that can condition the drying rate sausages.

### CONCLUSION

It found that the rate and extent of digestibility of protein hydrolysis experienced sausages exceeds the control samples, indicating a more efficient protein hydrolysis enzymes starter cultures. In turn, this contributes to the labile protein summer sausages to proteases of the digestive tract.

Results of the study of the morphological and biochemical indices of the blood of rats showed no load on the body of the test animals.

Microstructural studies of finished products show the emergence of a large number of microspores in the resulting electromagnetic treatment of raw meat, which in turn will accelerate the drying of summer sausages.

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