INFLUENCE OF FEEDING OF RATS WITH COOKED SAUSAGE CONTAINING LACTULOSE AND FOOD FIBERS ON THE MORPHOLOGY OF THEIR INTERNAL ORGANS

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Background

Numerous investigations of the last decades have clearly shown that food products are a source of natural components of foods being not only nutritionally valuable for the organism, but also regulating its numerous functions and reactions.

Wide use of refining of many foods necessary for the organism has gradually led to deficiency of rough fiber ballast substances in human diets, the basis of which are food fibers. The observations of researches during many years have confirmed the need for the presence of ballast substances in foods which have a favorable effect on carbohydrates metabolism in gastrointestinal tract, prevention of development of oncological diseases as well as cardiovascular and digestive systems of a human [1].

At the same time recent publications pay much attention to so called optimum (healthy) nutrition, involving individual selection of food substances in maximum degree meeting the requirements of a human in energy, plastic and regulatory compounds.

Under the present conditions a spectrum of diseases, in the pathogenesis of which can be actively involved microorganisms, permanently inhabiting the organism of a human becomes broader. To maintain normal microflora of the intestines the substances are necessary which have bifidogenic effect, providing microflora with the source of carbon and energy [2]. Among all the bifidogenic food materials it is the lactulose that has been largely studied and spread, and this has been the basis for its inclusion into the recipe of sausage products during creating of new foods of curative and curative and preventive nutrition, restoring useful microflora of large intestines [3].

Analysis of publications suggests that lactulose has already found application in the manufacture of canned meats for child nutrition as a bifidogenic factor [4]. However, there are no data about its use in mass produced meat products.

Objectives

Taking this into account we have conducted investigations on combined use of the beet food fibers and lactulose in cooked sausage products.

Methods of investigations

The investigations were carried out using the domestic concentrate of clarified food beet fibers [5] based on sugar beet, obtained in the North-Caucasus Sugar and Sugar Beet Research Institute (Specifications 9112-003-05122481-99), and the lactulose syrup "Lactusun", (Specifications 9223-003-43576397-98) as synthesized from milk sugar specially for food industry by "Felicita Ltd." (Moscow). The mass fraction of lactulose in the preparation corresponds to 65%.

For the experiments a recipe of cooked sausage "Diabetic", (high grade, according to GOST), was selected, into the experimental samples of which the hydrated 1:5 clarified food beet fibers were added during cutting.

Results and discussion

The amount of hydrated beet fibers to be incorporated that wouldn't lead to changes of physico-chemical, structural-mechanical and sensory indices of sausage items [4] was determined in the previous investigations. When lactulose was introduced into sausage items instead of sugar, sweetness of lactulose was taken into account to preserve traditional taste of the product, and the recommendation on its dosage for preventive-curative foods.

Analysis of chemical indices of sausage items (Table) manufactured according to the existing formulation (control) and those with the incorporation into the ground meat of 10% hydrated beet fibers and 500 g of lactulose per 100 kg of unsalted raw materials (experiment 3) has shown that the test samples of the products contain by 3.9% more moisture, 0.9 less protein and 2.3% less fat.

Table. Chemical composition of sausage products

Samples	Indices, %					
	Moisture	Fat	Ash	Protein	Salt	Nitrite
Control	68.0 ±0.1	14.6±0.1	3.1± 0.1	12.7± 0.1	1.98± 0.1	0.0027± 0.0020
Experiment	71.9 ±0.2	12.3±0.1	2.9±0.1	11.8±0.1	2.00 ±0.1	0.0032± 0.0010

In accordance with the accepted regulations, prior to recommending a new product into commercial production and wide use in trade it is necessary to carry out long-term test of its safety under conditions of biological experiment on laboratory animals. Our task was to conduct a test on the influence of long-term feeding experimental laboratory animals – rats – with cooked sausage added with lactulose.

Then the morphological investigations of white not thoroughbred rats with the initial weight 100 g were conducted. All the animals were divided into 3 groups: 1) control – the animals got 20 g of sausage "Diabetic", manufactured according to GOST, 2) 20 g of sausage "Diabetic" with lactulose to each animal 3) animals were maintained on common diets of vivarium. Feeding of all groups of animals with experimental and control diets was conducted during 3 weeks.

In the investigations of chronic toxicity all the feed mixtures were prepared "ex tempore" by simple mixing of the components in design proportions. 50 g of feeds and water without restriction were given to each animal. In the course of the experiments behavioral reactions of rats, their appearance, as well as the weight of the body and their daily gain were analyzed. The killing of rats for blood intake, weighing of internal organs, analysis of microflora of different parts of the gastrointestinal tract and histological investigation of parenchymatous organs (heart, kidneys, liver, spleen, intestines) was carried out by decapitation under the conditions of ether Raush anesthesia. After killing of the animals their pathologic-anatomical examination was carried out.

The material for histological examination was fixed in 10% neutral aqueous solution of formalin during 48 hours at room temperature. After termination of fixation and washing of the organs in cold running water the pieces of the organs under investigation were dehydrated in alcohols of increasing strength (from 70^0 to 100^0), and then the samples were enclosed into paraffin according to common procedure. Then the sections of organs with the thickness 7-10 mcm were made on the rotor microtome.

During the whole experiment the animals of the control (the common vivarium and feeding with the sausage manufactured according to State standard without additives) and experimental series (similar sausage but with the addition of lactulose) did not show any differences in behavior reactions. The external examination of rats has shown general good state of the animals, normal state of the scalp and absence of the signs of inflammation reactions in mucosa. The preservation of all the test animals in experimental and control groups was full (100%) in the course of the experiment.

Dynamics of live weight gain of laboratory animals of the control and experimental group during chronic biological experiment was studied, which proved similar.

Pathologo-anatomical investigations of the animals after killing did not reveal external signs of inflammation processes in internal organs – digestion canal, pancreas and liver, respiratory system, organs of circulation and formation of the blood, urinary excretion systems.

Histological investigations of liver, cardiac muscle, kidneys and spleen of the experimental animals in all the series of experiments and at all times did not reveal any pathological changes and differences from the structure of the same organs of the control group of rats.

To determine possible negative effect of the studied amounts of the added lactulose to feeds of laboratory animals the body weight and the weight of some internal organs (liver, spleen, kidney and heart) of the animals were measured. Based on these data an integral index of chronic intoxication (IPKhI) being a relative mass of the organ in % to the whole weight of the body was calculated. According to the obtained data, IPKhI for all the animals was within norm.

As a result of pathologo-anatomic and histological study of anatomical and microstructure peculiarities of internal organs of rats, having during three weeks usual diets of the vivarium, diets added with the "Diabetic" sausage (GOST) and sausage "Diabetic" with the additives the following was determined.

Thus, study of physiological characteristics and of the microstructure of laboratory rats in the chronic experiment shows the possibility of use of the tested food additives in sausage items in the animals' diets. The data obtained show the absence of cumulative toxic effect in the tested diets, and accordingly, in the food additives used in the sausage items, which allows to recommend them for use in meat production technology.

Taking into account curative and preventive properties of food fibers, capable to improve peristalsis of intestines and remove toxic substances from the organism, and the possibility of lactulose to restore normal microflora in the intestines, they can be used for development of functional meat products.

References

1. Ugolev A.M. Natural technologies of biological systems // L.: "Nauka" Publishing House, Leningrad department 1987, 317 pp.

2. Shenderov B.A., Manvelova M.A. Functional nutrition and probiotics: microecological aspects // M.: Agar Publishing house, 1997, 24 pp.

3. Russian lactulose – XX century // edited by A.G.Khramtsov. M.: 2000, 119 pages

4. Patent Russia N° 2126638. Composition for production of canned meat for children.

Authors: Lisitsyn A.B. ,Ustinova A.V., Belyakina N.E., Timoshenko N.V.,Ladodo K.S., Borovik T.E. Published 27.02.99

5. Kolesnikov V.A., Molotilin Yu.I., Artemyev A.I., Lisitsyn A.B., Kudryashov L.S., Malikova V.I. Food beet fibers and possibility of their use in meat industry // Vse o myase (Russian magazine), 2001, N°3, pp.6-8

Fig. 1 Microstructure of raw-fermented sausage from white meat. Twenty days of holding

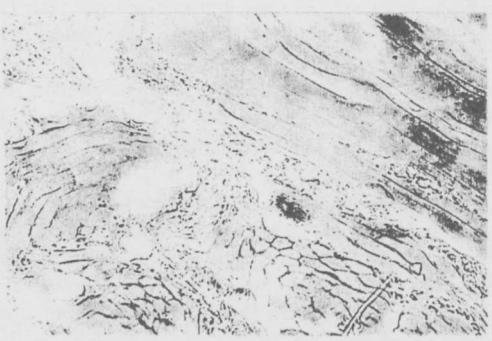

Fig.2. Microstructure of raw-fermented sausage from red meat. Twenty days of holding