Use of Arfazetin infusion in production of functional meat products

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Abstract. The aim of the study was to develop a recipe and production technology for a functional meat product (cooked sausage) with the addition of an infusion of Arfazetin, which is a hypoglycemic agent, used in the treatment of type 2 diabetes of mild and moderate severity. Organoleptic evaluation of finished products with replacement of milk raw materials by 15% and 25% Arfazetin showed that juiciness decreases with an increase in the percentage of infusion from 7.82 in the control to 6.98 – 7.55 in the experimental samples. The study of hypoglycemic properties was performed on rats with three-day individual feeding using a glucose tolerance test. As the results of experiments showed, experimental rats were fed with boiled sausage containing 15% of Arfazetin. The blood glucose level gradually increased with a maximum value after 60 minutes to 7.8 mmol / l, which was 0.43 mmol / l lower than in the group of animals that were intragastrically injected with Arfazetin, and 0.53 mmol / l lower than in animals that were fed with cooked sausage containing 25% of replacement. The sample with 15% Arfazetin was the most effective, since it had more pronounced hypoglycemic properties with sufficient water retention capacity. It is established that this technology is quite promising in the field of production of functional meat products for use in medical nutrition in patients with type 2 diabetes.

1. Introduction

Production of products with added utility, being one of the most relevant areas of nutrition science, reflects the latest trends in the development of the food industry in general, and production processes in particular. In the Western countries and in the East, the attitude to functional products is very different. While in Japan functional products are considered as a separate class of products, the situation in the West is completely different. In the United States and Europe, emphasis is placed on the concept that a functional product is included in products used for daily consumption, without affecting the taste. In the West, functional products are usually an innovation. Meanwhile, in the East, functional products have been a part of people's lives for a long time. The market for functional food products is also rapidly developing in Russia. Production issues are the focus of attention of specialists.
engaged in the development of modern technologies and criteria for food quality [1]. In our country, the food market also receives a large number of functional food products, but among them, meat products account for only a small percentage. Currently, the level of development of the processing industry allows us to produce a diverse range of functional meat products. The ability to develop computer-generated recipes provides the right combination of ingredients and allows you to create products with the desired properties. One of the reasons limiting the possibility of increasing the range and improving the quality of meat products is the complexity of combining raw materials of animal and vegetable origin. Special attention should be paid to the issue of maximum use of plant raw materials that contain a large number of functional ingredients by nature. In this regard, much attention is paid to the use of functional additives of various directions based on plant components that enrich meat products with physiologically active components, allowing the prevention of various diseases. In today's world, people tend to optimize their health through food.

One of the most important medical and social problems associated with nutrition of the population is the significant prevalence and steady growth of the incidence of diabetes mellitus (DM) [2]. The rapid increase in the incidence of diabetes caused the adoption of UN resolution 61/225 of 20.12.2006 on diabetes with the recommendation that all states develop national strategies for the prevention and treatment of diabetes [3]. All this indicates the relevance of the problem under consideration and the need for preventive, complex and therapeutic measures, one of which is functional nutrition and diet therapy [4].

2. Statement of the problem

In this document, when justifying the introduction of Arfazetin into the meat product in the form of boiled sausage, we were guided by the provisions of the State Pharmacopoeia [5], the characteristics of the functional properties of the recipe components and their active principles. As an additive, Arfazetin was used, which was allowed to be used as a hypoglycemic agent (registration number 86/710/6, 92/221/9). Arfazetin collection contributes to reduction of glucose in blood, increases tolerance to carbohydrates, increases glycogen-forming function of liver. Collection is used as freshly prepared infusion for treatment of mild and moderate diabetes [6].

3. Materials and methods

The control sample of boiled sausage was obtained according to the production technology provided in the GOST-23670-79 "boiled sausage, sausage and sausage, meat bread. Specification [TS]. Sausage samples prepared in compositions with different amount of milk raw material substitute with Arfazetin are tested. In sample № 1 - 15%; and in ample № 2- 25% respectively. Organoleptic indices were evaluated on the basis of 68 tasting sheets on a 9-point scale. To evaluate the hypoglycemic activity of experimental Arfazetin samples a glucose tolerance test (GTT) was used, which is the most common study in endocrinology to diagnose carbohydrate metabolism disorders in diabetic patients. Experiments were carried out on 18 white nonlinear male rats weighing 250-320 g. The animal manufacturer is branch Andreevka GNU NBMT FMBA Rossini (Moscow region). Rats were kept in VILAR, the state veterinary laboratory, on a standard diet in standard plastic cages (6 rats per cell) with free access to water and food at a temperature of 20-25 °C and a relative humidity of no more than 75%. Rats were divided into 3 groups of 6 animals each. In the first group, Arfazetin of 2.5 ml/kg was administered to animals, and in the second and third groups, milled sausage was separately fed, replacing the raw milk by 15% and 25% by Arfazetin of 20 g/kg for 3 days. These doses correspond to the daily amount for the content of extractive substances.

Infusion was prepared according to the instructions: a filter bag (4.0 g) was placed in a beaker or enameled cup, 200 ml (1 beaker) of boiling water was poured, coated for 15 minutes by periodically pressing the bags with a spoon, then it was pressed. The volume was adjusted to 200 ml with boiled water.

On the 4 day of the experiment, a glucose tolerance test was performed after 12-14 hours of fasting (nighttime). Blood glucose levels of hind limb finger-derived rats were determined by a glucose
oxidase method using test strips and a "One Touch Verio Pro +" glucometer from Life Scan (USA), first starving and then, after administration of glucose at a dose of 2g/kg, after 30, 60 and 90 minutes. After 120 minutes, venous blood was collected from the tail vein into a clean plastic tube for 30-60 min, centrifuged for 15 min at 3000 rpm to obtain serum, which was then tested using DiaC glucose analysis kits on a Dirui CS mod, biochemical analyzer CS-T 240. All procedures in rats were carried out in accordance with the Helsinki Declaration on the Humane Treatment of Animals [7]. Statistical processing of the results was performed using the statistical analysis software package, and the validity of differences between groups was evaluated using the Mann-Whitney criterion.

4. Discussion of results

Organoleptic analysis of the functional meat products under study showed that these samples had an attractive appearance: the surface of the products was clean, dry, without streaks of fat. The consistency was characterized by the softness and juiciness of the product over the entire thickness. The samples had maximum taste and sensory characteristics.

| Table 1. Comparative assessment of organoleptic indicators of sausages (M±s) |
|-----------------------------------------------|
| Indicators          | Organoleptic estimation of samples (M±s) |
|                   | Control       | Sample 1       | Sample 2       |
| Appearance        | 8.54±0.25     | 8.67±0.63      | 8.44±0.90      |
| Color             | 8.72±0.52     | 8.58±0.58      | 8.64±0.36      |
| Smell             | 7.88±0.67     | 7.66±0.84      | 7.73±0.54      |
| Consistency       | 7.05±0.44     | 8.16±0.45      | 7.36±0.20      |
| Juiciness         | 7.82±0.55     | 7.55±0.63      | 6.98±0.36      |
| Taste             | 7.89±0.99     | 7.86±0.42      | 7.60±0.77      |

Based on the results of organoleptic evaluation, it is clear that the experimental samples had higher consistency indicators of 7.36 - 8.16 in comparison with the control sample. However, the juiciness of the prototypes decreased from 7.82 in the control to 6.98 – 7.55 in the test sample. Minor deviations were observed in the indicators of appearance, color, smell and taste.

The results of experiments based on the VILAR FGBNU showed that in control rats after the introduction of glucose, the character of the change in the glycemic curve occurred as follows: in animals of the first group, the blood glucose level increased 30 minutes after oral administration, then it gradually decreased. In the second group, the glucose level gradually increased by 60 minutes. In the third group, a fairly high glucose level was maintained from 30 to 90 minutes after administration. After 120 minutes, blood glucose levels returned to normal in all groups (Figure 1).

![Figure 1. A glycemic curve when carrying out GTT.](image-url)
Table 2. Glucose content in blood serum when performing the oral glucose tolerance test (M±s)

| Groups of animals | Blood glucose before introduction | Blood glucose in 30 minutes | Blood glucose in 60 minutes | Blood glucose in 90 minutes | Blood glucose in 120 minutes |
|-------------------|----------------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|
| group 1           | 5.98±0.6                         | 8.35±1.2                   | 8.23±1.1                   | 7.5±1.9                     | 5.66±0.8                    |
| group 2           | 5.4±0.8                          | 7.06±1.1                   | 7.8±0.8                    | 7.5±0.8                     | 5.53±0.55                   |
| group 3           | 5.88±0.4                         | 7.78±0.7                   | 8.33±1.4                   | 8.38±0.8                    | 5.87±0.9                    |

The results presented in table 2 showed that in the second group of rats, the blood glucose level rose gradually with a maximum value after 60 minutes to 7.8 mmol / l, which is 0.43– 0.47 mmol / l lower than in animals of the first and third groups, respectively. In the third experimental group, the level of glucose in the blood after exercise rose as much as possible after 60 minutes, maintaining high indicators by 90 minutes, which is 0.88 mmol / l higher than in the first and second group of animals.

Consequently, in the experiments conducted, it was found that the developed original sample of cooked sausage with 15% of Arfazetin on the background of carbohydrate load increases the tolerance to carbohydrates in rats. The sample with addition of 25% of Arfazetin inferior in these properties, which may be due to the transition of some Arfazetin in the broth when cooking, as water-holding ability of the product was lower. It should be noted that the moisture-retaining capacity of the product is one of the important quality indicators of meat products, as it contributes to the juiciness, tenderness of the product, weight loss during heat treatment, as well as appearance. The decrease in the number of functional groups is associated with the ability of water interaction and, as a result, a decrease in the hydrophilic properties of proteins [8].

5. Conclusion

The research, conducted in the field of development of the prescription and the production technology of boiled sausage with Arfazetin addition, allows us to assume that this technology is quite perspective in production of functional meat products for patients with diabetes of the 2nd types. It was experimentally revealed that reception of these products in the conditions of carbohydrate loading increases tolerance to carbohydrates in rats. The difference in glycemic properties of experimental samples of boiled sausage was caused by the different introduction of Arfazetin. Replacement of milk raw materials by 15% infusion was the most effective. The ability of meat holding water in this sample was sufficient for binding all quantity of Arfazetin. Addition of 25% of infusion has to be followed by addition in the compounding of the additional substances increasing the moisture-holding ability of forcemeat. However, use of excessive amounts of chemicals in such delicate product is undesirable.

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