



## Improving the Quality of Evaluation of Meat Products

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### ABSTRACT

The article has been devoted to the substantiation of approaches to improving the quality of evaluation of meat products. It has been established that the sanitary quality and safety of meat products depends on many factors, including the place of manufacture, the time of year, the capacity of the meat processing enterprise. It has been proved that high-quality meat products in sanitary terms are produced at large meat processing enterprises, less high-quality ones are produced by individual entrepreneurs and in most cases, low-quality ones are produced at low-tonnage meat processing enterprises. It has been revealed that not all meat products meet the sanitary requirements for the content of nitrites. A microbiological express method for determining the toxicity of meat products using *Colpoda steinii* infusoria has been proposed, which, according to the reliability of the results obtained, is identical to the classical method and corresponds to the production conditions of certified laboratories. To improve the quality and safety of meat products, it has been proposed to use a dye that is made from the blood of slaughtered animals by stabilizing it with table salt and treating it with an alcoholic solution of acetic acid, which gives the sausages a stable lasting color.

**Keywords:** Quality, Evaluation, Meat products, Enterprise, Safety, Nutrition.

**HOW TO CITE THIS ARTICLE:** Semak A E, Kazakova E V, Cherepanova N G, Prosekova E A, Altunina J O. Improving the Quality of Evaluation of Meat Products. Entomol. Appl. Sci. Lett. 2021;8(2):78-84. <https://doi.org/10.51847/CUMJASGUCH>

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**Received:** 19/03/2021

**Accepted:** 27/06/2021

### INTRODUCTION

One of the main tasks facing the economy in modern conditions is to increase food production and improve their quality and safety. Therewith, a significant weight among food products is occupied by meat products, for the production of which more than 50% of meat is used. In addition, meat products are a good environment for the development of microorganisms and can serve as a potential source of various pathogens that not only reduce the quality but cause a

danger to the health of the consumer under certain conditions [1, 2].

The issues of controlling the production of meat products are particularly relevant in modern conditions when the agricultural sector is being restructured to increase the production of meat products. As a rule, meat products are produced at a huge number of meat processing enterprises of various capacities and by individual entrepreneurs, which has led to a decrease in their sanitary quality and safety concerning the consumer.

This is especially true for meat products manufactured at low-tonnage meat processing enterprises and by individual entrepreneurs, where there is almost no state sanitary control. In addition, people who do not have professional training are often engaged in the production of meat products. Therefore, a lot of low-quality products are on sale, which can be a source of food poisoning and other diseases in people.

The study of issues related to the assessment of the quality of meat products found its reflection in the works of T. Bychkova [3], M. Zaslonskii [4], A. Isabaev [5], Y. Motorin [6], R. Mukhambetaliyev [7], S. Terebova [8] and others. Despite significant scientific research on this problem, an in-depth research is required on the production of high-quality and safe meat products for the consumer.

#### MATERIALS AND METHODS

The theoretical and methodological basis of the research was: abstract-logical method, methods of induction, deduction, analysis, synthesis, systematization – to substantiate approaches to assessing the quality of meat products. Meat, meat products, and sausages were used for the study, they were manufactured according to generally accepted and nitrite-free technologies [9-11].

Seven series of complex studies were also conducted: 614 samples of meat products (302 sausages and 312 smoked types of meat), 60 meat carcasses, 250 samples of auxiliary raw materials (table salt, starch, spices, intestinal shells), which are used in the production of meat products, were studied.

It is planned to systematize the features of assessing the quality of meat products in modern conditions, develop measures to coordinate activities between the main participants in this process, determine measures to improve the

quality of evaluating meat products in the course of the research.

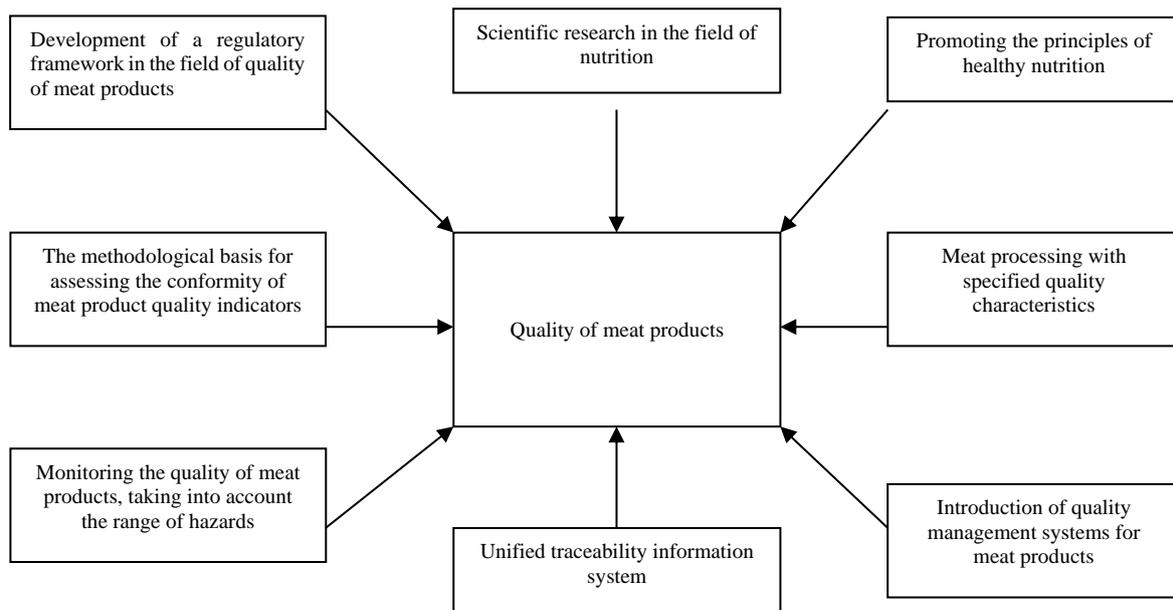
#### RESULTS AND DISCUSSION

The conducted studies of sausages, smoked meats, which are sold in Moscow and the Moscow region, found that a significant number of them do not meet sanitary requirements and there is a source of food infections, toxicosis, and other food diseases.

Studies on the general bacterial contamination found that 55% of meat products, including 81% of sausages and 31% of smoked meats do not meet sanitary requirements; 27% are contaminated with *Escherichia coli* bacteria, including 38% of sausages and 15% of smoked meats; salmonella – 12%, including 19% of sausages and 6% of smoked meats. The contamination of smoked meats with microflora is 2-3 times less compared to sausages.

At the same time, the quality of meat products depends on the development of a regulatory framework in the field of quality of meat products, scientific research in the field of nutrition, promotion of the principles of healthy nutrition, manufacture of meat products with specified quality characteristics, the introduction of quality management systems for meat products, a unified information system for traceability, monitoring the quality of meat products taking into account the spectrum of hazards (**Figure 1**).

We studied the possibility of bacterial contamination of meat products at all stages of their manufacture guided by the international requirements for the production of high-quality and safe meat products for the consumer, which would not have a degree of risk. Our studies established that the quality and safety of meat products mainly depend on the sanitary quality and safety of meat raw materials and auxiliary materials used in their manufacture.



**Figure 1.** Mechanisms for stimulating the manufacturer to produce high-quality meat products

The main source of meat contamination in modern conditions is the violation of technological and sanitary requirements for preparing animals for slaughter. Serovars of various bacteria of the *Escherichia coli* group were isolated from meat obtained from animals that were slaughtered with a violation of pre-slaughter preparation. At the same time, the total bacterial contamination of beef was 20-25% higher than that of pork.

A certain source of contamination of minced meat with microflora in the meat processing is auxiliary raw materials: table salt, spices, starch, and intestinal membranes. At the same time, bacterial contamination of table salt, starch, spices, and intestinal membranes does not significantly affect the bacterial contamination of meat products. The fact that they are significantly contaminated with spore-forming microflora, which is heat-resistant and does not die during the thermal processing of meat products is of concern. This can lead to spoilage of the finished product and even represent a source of food infections.

A significant source of bacterial contamination of meat products in the process of their manufacture is the low sanitary condition of premises, equipment, inventory, and overalls of workers, which can be significantly contaminated with microflora, especially spore-forming. When studying the bacterial contamination of meat and minced meat in the

meat processing, it was found that when they come into contact with contaminated surfaces of equipment, inventory, and workers' hands, the bacterial contamination of the finished product increases by 7.2 times compared to the initial one at low-tonnage meat processing enterprises, and by 6.4 times at large enterprises.

When studying the content of nitrites in meat products that were sold in Moscow and the Moscow region, it was found that not all of them meet sanitary requirements and can be a source of food diseases. According to the content of nitrites, 47% of meat products, including 45% of sausages and 49% of smoked meats do not meet sanitary requirements.

The content of nitrites in meat products is significantly influenced by the object of production: the most high-quality (in terms of nitrite content) meat products are manufactured at large meat processing enterprises, significantly less high-quality meat products – by individual entrepreneurs and at low-tonnage meat processing enterprises.

Our research established that one of the reasons for the sale of substandard meat products is the imperfection of sanitary quality control of products in state laboratories, which is due to the complexity and duration of laboratory tests. Therefore, in modern conditions, following the current rules of pre-slaughter inspection of animals, all finished meat products are subject to veterinary and sanitary control – inspection and organoleptic evaluation, and

if they are suspected of quality and safety – laboratory testing.

However, control laboratory tests of meat products do not guarantee the daily sanitary quality of meat products. Therefore, we propose a microbiological express method for determining the toxicity of meat products (sausage, smoked meat), which can be used even in the conditions of a state laboratory in the markets. The developed microbiological express method is based on the method of determining the toxicity of grain.

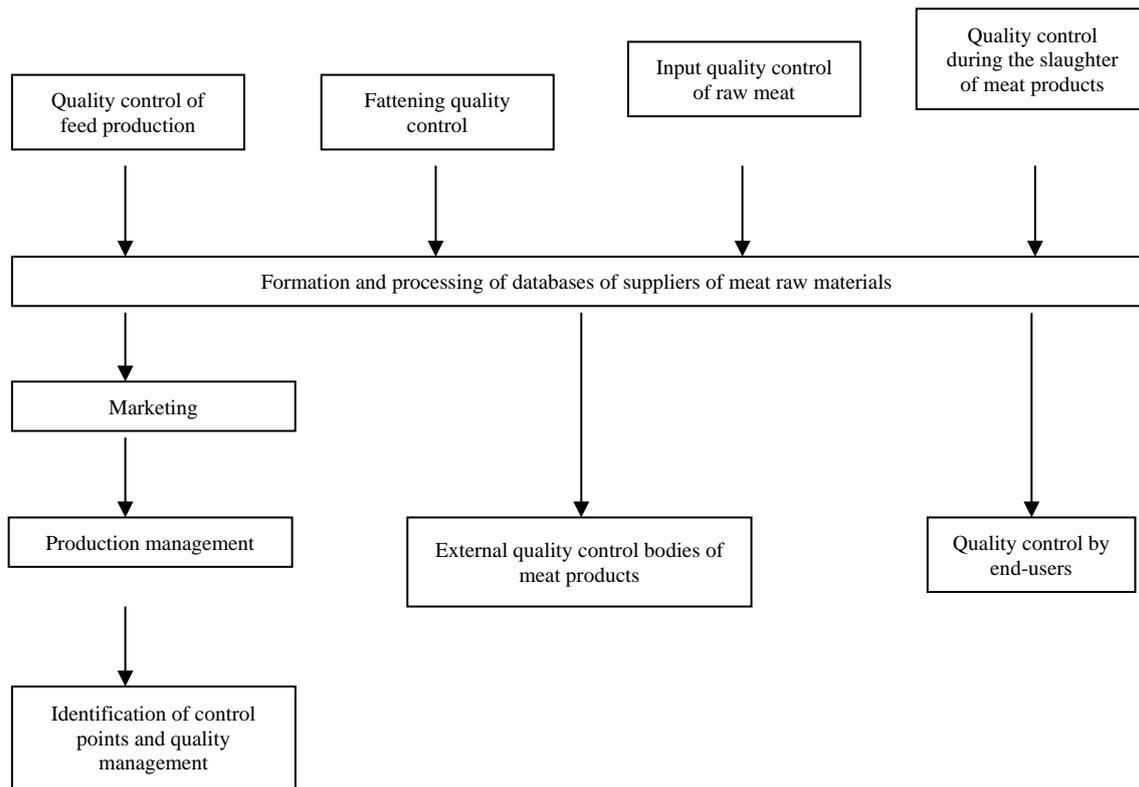
When developing a microbiological express method, it was found that the constituent ingredients of chemical origin (table salt, sodium nitrite), which are necessarily part of meat products, in technological concentrations and possibly their contamination with sanitary-indicative microflora do not cause the death of *Colpoda steinii* infusoria. The proposed microbiological express method for determining the toxicity of meat products (sausage, smoked meat) using *Colpoda steinii* infusoria is easily performed in a sanitary examination laboratory of various equipment and makes it possible to determine the degree of toxicity within 10 minutes to 3 hours, and the reliability of the research results is identical to the classical method.

One of the ways to reduce the content of nitrites in the diet of the consumer of meat products is the introduction of a nitrite-free technology for the production, replacement of nitrites with another safe dye. To solve this problem, we developed a nitrite-free technology for manufacturing a safe dye for sausage products, which can be produced not only at meat processing enterprises but also in private farms.

For the manufacture of dye, we suggest using blood that is obtained during the slaughter of farm animals. The blood is stabilized with table salt and treated with a 6% or 9% alcoholic solution of acetic acid (2.5% or 2% of its mass) following the method proposed by us. The proposed dye is a safe product that gives a stable color and allows abandoning the use of nitrites in sausage production. In this case, the introduction of nitrite-free technology into production will contribute to the production of sanitary-quality and safe sausage products.

Calculations also found that the economic effect of conducting one study to determine the toxicity of meat and meat products by the microbiological express method using *Colpoda steinii* infusoria as a test object compared to the classical method is 25.6 rubles. In addition to the economic effect, the introduction of the microbiological express method into the examination will improve the quality and safety of meat products (sausages, smoked meats) – a social effect.

In modern conditions, following the requirements of the international self-control system, approved by the new requirements of the European Food Regulation and the codes of international organizations, it is necessary to abandon the outdated system of control of the finished product for identifying deficiencies and switch to a preventive approach – eliminating potential sources of danger at all stages of production. However, the globalization of the meat products market requires the use of a quality management system that can provide an effective quality control assessment system (**Figure 2**).



**Figure 2.** Organizational scheme of quality control of meat products in modern conditions

Each meat processing enterprise shall adapt the technology of meat processing to international requirements. To do this, we propose to form critical points of sanitary control during the production of meat and meat products, where there is a high probability of contamination of products with microorganisms, chemical compositions, physical and mechanical factors. In this case, the quality and safety control of meat products shall begin from the farm when preparing animals for shipment to a meat processing enterprise – this is the first critical point of sanitary control at which control is carried out following the current sanitary rules. The second, third, and fourth critical points of sanitary control are carried out in the conditions of a meat processing enterprise following the requirements of the current rules. When conducting sanitary control according to a generally recognized method, we suggest that the admission of animals to a meat processing enterprise should be carried out according to the quantity and quality of meat, and it is mandatory to selectively examine meat and offal for toxicity using a biological express method with *Colpoda steinii* infusoria after conducting a post-slaughter sanitary examination of carcasses and organs.

When researching in a technological workshop, that is, finished products (meat products) – the fourth critical point of sanitary control, it is imperative to conduct toxicity studies using the biological express method according to generally accepted methods, following the requirements of the current rules and technological instructions. In the manufacture of sausages, it is also necessary to abandon the use of nitrites and use the ecologically safe dye we proposed.

The reliability of the presented approaches is confirmed by the fact that meat products (sausages and smoked meats) that are manufactured by meat processing enterprises and individual business entities and are sold do not always meet sanitary requirements and can be a source of food infections, toxicosis, and other food diseases [12-14].

Therewith, the proposed microbiological express method for determining the toxicity of meat products should be included in the methodology for the use of *Colpoda steinii* culture for toxicological studies of meat and meat products from animals and poultry, approved by state authorities. Also, the state bodies of the Russian Federation need to approve a nitrite-free

technology for making sausages using the dye developed by us.

The Veterinary Department of the Ministry of Agriculture of the Russian Federation is proposed to use the methodology developed by us for determining the quality and safety of meat products as a sample when developing sanitary rules within the framework of self-control of the quality and safety of meat products following the requirements of the current sanitary rules for meat processing enterprises.

If meat products are stored before sale, it is necessary to create appropriate conditions that would comply with the current rules of sanitary examination. Before shipping, stored meat products must be examined for toxicity – the fifth point of sanitary control. Meat products coming for sale must be examined in a certified laboratory following the requirements of the current regulations.

In doubtful cases, when conducting organoleptic studies of meat products, we suggest testing for toxicity using the biological express method. Carrying out quality and safety control of meat products according to the methodology developed by us will allow producing meat products that do not have risks regarding the health of the consumer and removing this type of product from the category of dangerous.

### CONCLUSION

Summing up, the sanitary quality and safety of meat products depend on many factors, including the place of manufacture, the time of year, the capacity of the meat processing enterprise. The main one is the sanitary condition of the equipment, inventory of the meat processing enterprise that manufactures products, as well as raw materials. It has been proved that high-quality meat products in sanitary terms are produced at large meat processing enterprises, less high-quality ones are produced by individual entrepreneurs and in most cases, low-quality ones are produced at low-tonnage meat processing enterprises.

Not all meat products meet the sanitary requirements for the content of nitrites. To a greater extent, the norms of nitrite content are observed at large meat processing enterprises, much less – at small enterprises and individual business entities. In addition, the microbiological express method for determining the toxicity of

meat products using *Colpoda steinii* infusoria is identical to the classical method in terms of the reliability of the results obtained, corresponds to the production conditions of certified laboratories, and makes it possible to quickly determine the degree of toxicity of the product under study.

To improve the quality and safety of meat products, it was proposed to use a dye that is made from the blood of slaughtered animals by stabilizing it with table salt and treating it with an alcoholic solution of acetic acid, which gives the sausages a stable lasting color. The introduction of a microbiological express method for determining the toxicity of meat products into the work of certified laboratories, in addition to the social effect, contributes to obtaining an economic effect, compared with the classical method.

In addition, the quality and safety control of meat products according to the proposed system using critical points of sanitary control from the procurement of raw materials, processing into meat products, storage, and sale will contribute to the production of high-quality meat products that do not have risks to the health of the consumer and remove this type of product from the category of dangerous.

**ACKNOWLEDGMENTS:** None

**CONFLICT OF INTEREST:** None

**FINANCIAL SUPPORT:** None

**ETHICS STATEMENT:** None

### REFERENCES

1. Hanawi SA, Saat NZ, Zulkafly M, Hazlenah H, Taibukahn NH, Yoganathan D, et al. Impact of a Healthy Lifestyle on the Psychological Well-being of University Students. *Int J Pharm Res Allied Sci.* 2020;9(2):1-7.
2. Ren-Zhang L, Chee-Lan L, Hui-Yin Y. The awareness and perception on Antimicrobial Stewardship among healthcare professionals in a tertiary teaching hospital Malaysia. *Arch Pharm Pract.* 2020;11(2):50-9.
3. Bychkova TK, Garganchuk AA. Digital technologies in veterinary and sanitary examination. Digital technologies are the

- basis of modern development of the agro. ind complex. 2020:195-8.
4. Zaslonskii MS, Madonova SV. Production technology and veterinary and sanitary examination of sausages. *Molodezh i Nauka.* 2019;10(11):18.
  5. Isabaev A. Veterinary and sanitary examination of meat under stress. *Vet selskokhoz zhivotn.* 2019;(10):12-6.
  6. Motorin Yu. Veterinary and sanitary examination as an object of automation. *Myasn Tekhnolog.* 2021;5(221):6-9.
  7. Mukhambetaliev RA, Kanieva NA, Stepanenko EA. Veterinary and sanitary examination of cattle meat in conditions of animal rearing in different regions of southern Russia. *Decision.* 2020;1:117-8.
  8. Terebova SV, Momot NV, Kolina YuA. Veterinary and sanitary examination of imported frozen pork. *Ippolog i Vet.* 2021;1(39):196-203.
  9. Agamirova EV, Agamirova EV, Lebedeva OY, Lebedev KA, Ilkevich SV. Methodology of estimation of quality of tourist product. *Calitatea.* 2017;18(157):82-4.
  10. Lukiyanchuk I, Panasenko S, Kazantseva S, Lebedev K, Lebedeva O. Development of online retailing logistics flows in a globalized digital economy. *Rev Inclus.* 2020;7(S2-1):407-16.
  11. Semak AE, Baranovich ES, Kazakova EV, Safonov AV, Biryukov VA. Organizational and economic aspects of aquaculture development under current conditions. *Rev Trism Estud Prat.* 2020;(4):51.
  12. Kuzmina EE, Sharonin PN, Tayupova OI, Shabanov OA, Titova AD. Formation of intercultural competency in personnel training for international tourism. *J Tour Stud Res.* 2021;1(1):1-8.
  13. Markova OV, Listopad EY, Shelygov AV, Fedorov AG, Kiselevich IV. Economic and legal aspects of the innovative activity of enterprises in the context of the digital economy. *Nexo Revista Cient.* 2021;34(02):964-72.
  14. Zavalko NA, Kozhina VO, Zhakevich AG, Matyunina OE, Lebedeva OY. Methodical approaches to rating the quality of financial control at the enterprise. *Calitatea.* 2017;18(161):69-72.