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Microbiological Contamination Level of Semi-finished Poultry Meat Pickled by Various Methods

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Abstract

This article presents the results of microbiological studies of chilled semi-finished poultry meat in a marinade. The recipe of the experimental sample used a complex food additive containing acetates and citrates. In the studied samples, sanitary indicative microorganisms (QMAFAnM, coliforms), opportunistic (Proteus), and pathogenic (Salmonella, Listeria monocytogenes) were determined. Based on the data obtained, proposals were developed to reduce the bacterial contamination of semi-finished poultry meat products.

Disciplinary: Food Science (Food Safety), Veterinary and Agriculture (Meat Products).

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1 Introduction

Meat is a perishable product. Special conditions needs for its long-term storage. If they are not observed in meat, under the influence of physicochemical factors and with the participation of its enzymes, undesirable changes may develop, including changes caused by microorganisms (Semenova et al., 2019). In this regard, during transportation, the best preservation method for

storing and selling the product is cooling and freezing. However, about the issue of preserving functional, taste, and quality characteristics, preference is still given to chilled products from poultry meat.

Currently, consumers pay great attention to poultry products, including semi-finished products. Pickled poultry meat occupies a special place among the wide variety of semi-finished products from poultry meat (Abdullaeva et al., 2017; Karre et al., 2013; Sholpan et al., 2019; Yousefi et al., 2018). Poultry meat is a dietary product, balanced in amino acid composition, easy to digest, and available to all population segments. Taste characteristics also affect the popularity of a given product (Yousefi et al., 2018; 2020). Therefore, in Russia, the share of poultry meat consumption is constantly increasing, and thus its production is also growing. At the moment, our country ranks fourth in the world in the production of poultry meat.

It is also essential to maintain the excellent quality characteristics of the product - the observance of sanitary and hygienic conditions at all areas of raw material processing, from the transportation of live poultry to the place of processing, slaughter, subsequent processing, and ending with the packaging of the finished product (Chernikova et al., 2020; Saravanan et al., 2015; Yousefi et al., 2020). Food products must meet the requirements of organoleptic, physical, and chemical indicators and meet the established hygienic conditions of the current regulatory documents. Products that do not meet the criteria in the field of quality and safety are not allowed for sale; without documents certifying quality and safety; expired; in the absence of proper storage and sale conditions.

Laboratory research is the basis for the prevention of food toxic infections at all stages of the food industry, which leads to the safety of the population and the spread of microbiological infections (MASEK et al., 1970). In this regard, the purpose of the research was to determine the microbial status of semi-finished products chilled in the marinade sold by retail trade enterprises and develop proposals for reducing their bacterial contamination at all stages of production.

2 Materials and Methods

The research involved semi-finished products chilled from poultry meat in a marinade. For the more obvious manifestation effect of adding acetates and citrates to the marinade, the conditions of violation of the temperature regime of storage of semi-finished products were simulated: the products were stored for 24 hours outside the refrigerator at a temperature of +28°C.

Two samples were used as the object of the study:

- **sample 1** (control sample) - semi-finished products from poultry meat, natural meat, and bone marinated "Chilled broiler chicken shashlik (drumstick)" (composition: broiler chicken drumstick, drinking water, dextrose, dry vegetables and herbs, salt, flavor enhancer, and aroma E621, antioxidants: E301, E316).

- **sample 2** (test sample) - semi-finished products from poultry meat, natural meat, and bone marinated "Chilled broiler chicken shashlik (drumstick)" (composition: broiler chicken drumstick, drinking water, dextrose, dry vegetables and herbs, salt, flavor enhancer, and aroma E621, antioxidants: E301, E316, stabilizers: sodium acetate E262, sodium citrate E331).

Semi-finished products were investigated by the method of washing off (rinsing) without burning the surface. All selected samples were weighed separately, placed in sterile test tubes, a physiological solution was added in an amount equal to the weight of the samples, and the mixture was shaken. The resulting suspension was used to conduct a series of dilutions of each sample and subsequent inoculations on conventional nutrient media.

To accelerate the detection and determination of QMAFAnM, we used a test with a substrate with a medium - MC-MediaPads (RAC). For this, the primary and several tenfold dilutions were prepared from the weighed portion of the product. The processing of the results was carried out by visually counting the red colonies. The results obtained were expressed by the number of colony-forming units (CFU) from 1.0 to 9.9 multiplied by 10n and recorded as "QMAFAnM N × 10^n CFU / g product".

Coliforms were determined by the classical method. When analyzing 1 cm3 of the primary dilution, each test sample was inoculated with Kessler's nutrient medium into test tubes. The injections were incubated at 37°C for 24 hours, after which the absence or presence of signs of the possible presence of E. coli bacteria was noted.

As an express determination of coliform in crops in parallel with inoculations in Petri dishes on agar nutrient media, we used susceptible test plates:

Petrifilm® (HSCC) for the decision of coliform bacteria for 24 h.

Test plates Petrifilm® (EC) to detect E. coli coliform bacteria within 24-48 hours.

Test plates Petrifilm® (EB) for enumeration of bacteria of the family Enterobacteriaceae after 24 hours.

To quickly detect bacteria of the genus Salmonella (within 20 minutes), the Singlepath-Salmonella rapid test manufactured by Merck was used. The determination of Salmonella using Singlepath tests is based on the method of visual immunochromatography (a type of immunoassay). The test is a diagnostic panel with a well for adding an enriched sample, a control (C), and a test (T) zone. The antigens of the determined bacteria present in the sample interact with the gold-labeled antibodies included in the test to form a colored antigen-antibody complex. The stained complex binds to the immobilized antibodies to create lines in the test and control windows. The test results are taken into account only if there is a red line in the control zone (C) after 20 minutes. A sample is considered positive if, after 20 minutes or earlier, red lines have formed in both the test (T) and control (C) zones. The sample is considered negative if the red line is absent in the test zone (T) but in the control zone (C).

3 Result and Discussion

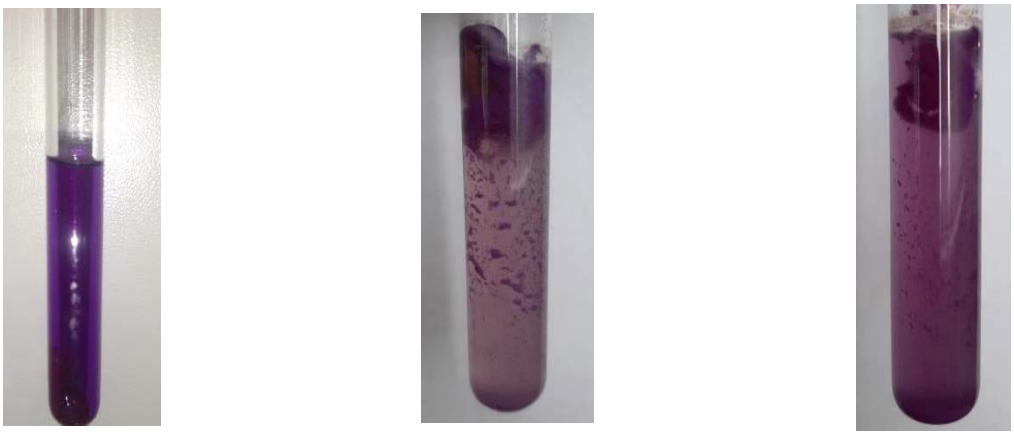
The results of the QMAFAnM research are in Figure 1.

Control sample Test sample

Figure 1: Results of rapid tests for the determination of QMAFAnM

The research results showed that the control sample had abundant contamination, and it was not possible to count bacterial colonies. However, in the prototype in the field of the environment, it was possible to detect single red dots randomly scattered over the entire surface.

For identifying the Escherichia coli (coliforms) bacteria, 1 ml of the corresponding dilutions were introduced into test tubes with Kessler's medium with a float, incubated at a temperature of 37°C for 24 hours. The results of sample studies are in Figure 2.



Original nutrient medium Kessler | Nutrient medium Kessler with control sample | Nutrient medium Kessler with test sample

Figure 2: Identification of coliform bacteria (coliforms) with Kessler's nutrient medium

The investigated microorganisms are widespread, live in the intestines of healthy animals and poultry. They are found in washes from equipment, tools, and workers' hands. In addition, they get into meat raw materials when production sanitary and hygienic regimes are violated. As a result

of this research, coliform was found in both samples, as evidenced by the "float" that emerged as a result of active gas formation due to lactose fermentation in both test tubes.

For detecting bacteria of the genus Proteus, tubes with freshly cut nutrient agar were inoculated into condensation water. The injections were incubated in an upright position at a temperature of 37°C for 48 hours. The results of the study of the samples are in Figure 3.

Original nutrient medium

Nutrient medium with control sample

Nutrient medium with test sample

Figure 3: Results of tests for the detection of bacteria of the genus Proteus

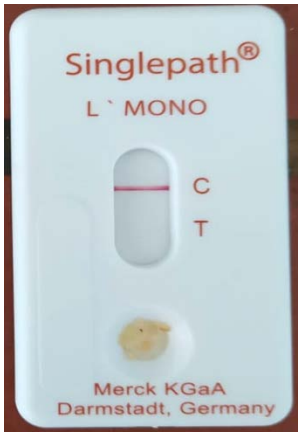
Bacteria of the genus Proteus were also found in both tubes. However, the most abundant growth of colonies took place on the medium with the control sample, indicating more substantial contamination of the sample with these microorganisms.

Pathogenic microorganisms were determined using express tests. The determination of Salmonella, Listeria monocytogenes is based on the method of visual immunochromatography (a type of enzyme-linked immunosorbent assay). The test is a diagnostic panel with a well for adding an enriched sample, a control (C), and a test (T) zone. The antigens of the determined bacteria present in the sample interact with the gold-labeled antibodies included in the test to form a colored antigen-antibody complex. The presence of bacteria of the genus Salmonella was not detected, which was confirmed by our research (Figures 4-5).

Control sample

Test sample

Figure 4: Results of Rapid Salmonella Tests



Control sample

Test sample

Figure 5: Rapid Test Results for Listeria monocytogenes

Listeria monocytogenes were also not detected in any sample of the studied semi-finished products, which indicates the well-being of listeriosis in the regions where the poultry was raised.

The generalized results of microbiological studies are in table 1.

Table 1: Microbiological indicators of pickled semi-finished products

Indicators	Norms for SanPiN 2.3.2.1078-01	Standards for TR CU 021	Samples	
			Control sample	Test sample
QMAFAnM, CFU / g	no more 1,0 ×106	no more 1,0 ×106	abundant growth	1,3 × 107
Coliforms	not allowed in product mass (g / cm3) 0.0001 g	not allowed in product mass (g / cm3) 0.0001 g	detected	detected
Proteus bacteria	not standardized	not standardized	detected	detected
Bacteria of the genus Salmonella	not allowed in 25 g	not allowed in 25 g	not detected	not detected
Listeriamonocytogenes	not allowed in 25 g	not allowed in 25 g	not detected	not detected

Thus, in the course of our study, it was found that semi-finished products chilled from poultry meat in a marinade had increased microbial contamination, coliforms and bacteria of the Proteus genus were detected in both samples, bacteria of the genus Salmonella and bacteria of the genus Listeria monocytogenes were not seen in the semi-finished products from poultry meat. The most intense contamination with microorganisms was noted in the control sample compared to the experimental one.

4 Conclusion

From this study, producers of meat and meat products need to monitor the sanitary and hygienic conditions in production strictly. It is necessary to ensure increased requirements for the

pure state of production, cutting, processing, and packaging of semi-finished products. Production facilities and equipment should be regularly cleaned and disinfected, and employees of the enterprise should ensure personal hygiene rules. Furthermore, it is necessary to maintain the temperature and humidity conditions of the premises at all stages of the processing of raw meat. Limiting the temperature from +3°C and below with a relative humidity of not more than 70% helps eliminate the risk of developing many pathogenic and opportunistic microorganisms, which will also guarantee the safety of the finished product.

In addition, for a prolonged shelf life of semi-finished products in the marinade, it is better to use complex mixtures that contain preservatives (salts of food acids, namely acetates and citrates) that can inhibit the growth and development of many microorganisms.

5 Availability of Data and Material

Data can be made available by contacting the corresponding author.

6 References

Abdullaeva, A. M., Seryogin, I. G., Nikitchenko, V. E. (2017). Microbiological monitoring of commercial poultry meat semi-finished products. *RUDN Journal of Agronomy and Animal Industries, 12*(4). DOI: 10.22363/2312-797x-2017-12-4-350-358

Chernikova, O., Pityurina, I., Terentyev, A., Rakhmaev, E. (2020). Analysis of safety indicators for poultry products produced in subsidiary farms in penitentiary facilities. *Agronomy Research, 18*(3). DOI: 10.15159/AR.20.126

Karre, L., Lopez, K., Getty, K. J. K. (2013). Natural antioxidants in meat and poultry products. *Meat Science*. DOI: 10.1016/j.meatsci.2013.01.007

Masek, J., Osancova, K., Cuthbertson, D. P. (1970). Nutrition. Proceedings of the Eighth International Congress, Prague, September 1969. *Nutrition. Proceedings of the Eighth International Congress*, Prague, September 1969.

Saravanan, S., Purushothaman, V., Murthy, T. R. G. K., Sukumar, K., Srinivasan, P., Gowthaman, V., … Kuchipudi, S. V. (2015). Molecular Epidemiology of Nontyphoidal Salmonella in Poultry and Poultry Products in India: Implications for Human Health. *Indian Journal of Microbiology, 55*(3). DOI: 10.1007/s12088-015-0530-z

Semenova, A. A., Derevitskaya, O. K., Dydykin, A. S., Aslanova, M. A., Vostrikova, N. L., Ivankin, A. N. (2019). The distinctive characteristics of the nutrient composition of reindeer meat from the Vorkuta district determined by the conditions of the region of origin. *Voprosy Pitaniia, 88*(5). DOI: 10.24411/0042-8833-2019-10056

Sholpan, A., Lamas, A., Cepeda, A., Franco, C. M. (2019). Raw poultry meatballs with soya flour: Shelf life and nutritional value. *Foods and Raw Materials, 7*(2). DOI: 10.21603/2308-4057-2019-2-396-402

Yousefi, M., Khorshidian, N., Hosseini, H. (2018). An overview of the functionality of inulin in meat and poultry products. *Nutrition and Food Science*. DOI: 10.1108/NFS-11-2017-0253

Yousefi, M., Khorshidian, N., Hosseini, H. (2020). Potential Application of Essential Oils for Mitigation of Listeria monocytogenes in Meat and Poultry Products. *Frontiers in Nutrition*. DOI: 10.3389/fnut.2020.577287

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