UDC 637.4/.5'652.055:579:608.3:619(477.63) **DOI 10.36016/JVMBBS-2020-6-4-6**

MICROBIOLOGICAL MONITORING OF POULTRY PRODUCTS IN DNIPROPETROVSK REGION (UKRAINE)

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Summary. The aim of the work was to analyze the microbial status of poultry products in Dnipropetrovsk Region in 2019. The author summarizes the results of studies of three groups of potentially dangerous microbiological factors. It was found that 0.9–2.9% of the studied samples had higher quantity of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM), while in 0.5–2.9% of cases coliform bacteria were isolated, in 13.23% of samples — *Salmonella* spp., in 0.37–0.70% — cocci, in 0.18–0.28% — *Proteus* spp., in 0.18–0.55% — *Listeria monocytogenes*. During the work, violations of the safety criteria for raw materials and poultry products were found, as evidenced by the isolation of pathogens *Salmonella* spp. and *L. monocytogenes*. Geographical serotype predisposition is shown in the occurrence and development of salmonellosis infection in the region, which is caused by the dominance of *Salmonella* group D among poultry in Dnipropetrovsk Region. The most intensive contamination with microorganisms (in 2.9% of samples) was observed in minced meat and meat of mechanical deboning from poultry

Keywords: MAFAnM, coliform bacteria, *Salmonella*, *Proteus*, *Staphylococcus aureus*, *Listeria monocytogenes*

Introduction. For industrial enterprises in many branches, microbiological parameters are the important quality indicators of the products. Their control allows the manufacturer to avoid economic (unusable products, penalties), image losses, and, ultimately, the loss of the market. First of all, they control the microbiological parameters that are standardized. Thus, products that contain a lot of moisture — food products, are affected by microorganisms especially quickly and severely (Kachan, 2020).

According to Regulation No 178/2002 of the European Parliament and the EU Council (EP and CEU, 2002), ensuring a high level of protection of human life and health is one of the main objectives of EU food law. Poultry production is of particular note, due to the volume of its production and widespread use due to the relatively low cost, as compared with the products of other livestock industries. To date, more than 100 infectious diseases are known to be transmitted to humans through products of animal origin (Seryogin, Nikitchenko and Abdullaeva, 2015). Thus, only in Dnipropetrovsk Region in 2019, 20 nosological forms of infectious diseases were registered, the sources of which were animals. Analysis of the epidemic situation in the region during this period, according to the State Service of Ukraine on Food Safety and Consumer Protection, shows that the etiological structure of acute intestinal infections was represented by norovirus (30% outbreaks), bacterial pathogens (30%), hepatitis A virus (10%) or had an unknown etiology (30 %). Violations of the requirements of the legislation on food safety and quality, prove their social significance and the need for careful study.

The aim of the work was to analyze the microbial status of poultry products in Dnipropetrovsk Region in 2019.

Materials and methods. The compliance of microbiological indicators with the requirements of normative documents in seven types of poultry products was determined. We analyzed the results of veterinary statistical reporting of Dnipropetrovsk Region for 2019.

A total of 2,076 samples were examined in real time, of which 94.0% were products of domestic Ukrainian production, 3.2% — imports, 2.1% — exports, 0.6% — state control (Table 1).

Table 1 — List of researched poultry products in Dnipropetrovsk Region during 2019

Type of poultry products	Number of samples
Semi-finished and culinary products from meat, in particular poultry	715
Sausages, in particular poultry	543
Poultry meat	362
Eggs	302
Minced meat and mechanically deboned poultry meat	68
Egg products	55
Poultry co-products	31
Total	2,076

Preparation of the tested samples was performed in accordance with DSTU ISO 6887-2:2005 (ISO 6887-2:2003, IDT) (DSSU, 2005a).

The methods provided by DSTU ISO 4833:2006 (ISO 4833:2003, IDT) (DSSU, 2008), DSTU ISO 4832:2015 (ISO 4832:2006, IDT) (SE 'UkrNDNC', 2018), DSTU EN 12824:2004 (EN 12824:1997, IDT) (DSSU, 2005d), DSTU ISO 11290-1:2003 (ISO 11290-1:1996, IDT) (DSSU, 2005c), DSTU 7444:2013 (MEDTU, 2014), and DSTU ISO

6888-2:2003 (ISO 6888-2:1999, IDT) (DSSU, 2005b) were used for microbiological control of poultry production (Table 2).

Results and discussion. Non-compliance of microbiological indicators with the requirements of regulatory documents were found in four types of poultry products (Table 3). It is found that the number of high-risk products includes poultry meat; semi-finished products and culinary products from it; minced meat and mechanically deboned poultry, as well as ready-to-eat meat products (those that have undergone heat treatment) — sausages, in particular from poultry.

The results of sowing samples showed that QMAFAnM exceeded the permissible norms in 2.8% of samples from semi-finished and culinary products from poultry meat, in 0.92% — in sausages, in 2.94% — in minced meat and mechanically deboned poultry, in 1.38% — in poultry meat.

Coliform bacteria were detected in 0.50–2.94% of samples, including in samples of semi-finished products — 2.94%, in sausages — 2.39%, in minced meat and mechanically deboned poultry meat — 2.94%, in poultry meat — 0.55%.

Salmonella group D bacteria were isolated in 13.23% of samples of minced meat from poultry and mechanically deboned poultry meat (Table 4).

The presence of staphylococci in semi-finished products is not standardized, but studies have shown that they are present in 0.70% of samples and in 0.37% of sausages.

Proteus bacteria were found in 0.28% of semi-finished products and in 0.18% of sausages.

Table 2 — List of investigated potentially dangerous microbiological factors in poultry products

Groups (names) of dangerous factors	Range	Control method
Sanitary-indicative:		
Mesophilic-aerobic and facultative-anaerobic microorganisms (MAFAnM)	Not more than 5.0×10^5 CFU/g	DSTU ISO 4833:2006 (ISO 4833:2003, IDT) (DSSU, 2008)
Coliform bacteria	Not allowed in 0.0001 g	DSTU ISO 4832:2015 (ISO 4832:2006, IDT) (SE 'UkrNDNC', 2018)
Pathogenic microorganisms:		
Salmonella spp.	Not allowed in 25 g	DSTU EN 12824:2004 (EN 12824:1997, IDT) (DSSU, 2005d)
Listeria monocytogenes	Not allowed in 25 g	DSTU ISO 11290-1:2003 (ISO 11290-1:1996, IDT) (DSSU, 2005c)
Conditionally pathogenic microorganisms:		
Proteus spp.	Not allowed in 0.1 g	DSTU 7444:2013 (MEDTU, 2014)
Staphylococcus aureus	Not standardized	DSTU ISO 6888-2:2003 (ISO 6888-2:1999, IDT) (DSSU, 2005b)

Table 3 — Non-compliance of microbiological indicators in poultry products in Dnipropetrovsk Region

Type of poultry products	Groups of dangerous factors, samples/%					
	MAFAnM	Coliform bacteria	*Salmonella* spp.	*S. aureus*	*Proteus* spp.	*L. monocytogenes*
Semi-finished and culinary products from meat, in particular from poultry	20/2.80	21/2.94	—	5/0.70	2/0.28	—
Sausages, in particular from poultry	5/0.92	13/2.39	—	2/0.37	1/0.18	1/0.18
Minced meat and mechanically deboned poultry meat	2/2.94	2/2.94	9/13.23	—	—	—
Poultry meat	5/1.38	2/0.55	—	—	—	2/0.55

Note. '—' — not found.

Table 4 — The results of serological identification of *Salmonella* (n = 9)

Serological group	Serological variant	Poultry products and their origin	
		Frozen mechanically deboned poultry meat (domestic), %	Chicken meat — backs (import),%
D	0:9, Vi	44.4	55.6

L. monocytogenes bacteria were isolated from 0.18% of sausage samples and 0.55% of poultry meat, indicating a presence of listeriosis in poultry farming areas.

Research data show that raw materials and poultry food products in 0.9–2.9% of cases had increased microbial contamination. The most intense contamination by microorganisms (2.9%) was observed in minced meat and mechanically deboned poultry, compared with other types of samples, as evidenced by reports of other researchers (Abdullaeva, Seryogin and Nikitchenko, 2017). The increase in the contact surface of the structural particles of minced meat and mechanically deboned poultry meat with air and the surface of the equipment, as well as the high degree of grinding of various tissues and bone marrow, the presence of excess meat juice and high pH make this raw material a good breeding ground for microorganisms. In this regard, minced meat and mechanically deboned meat belong to the category of high-risk, perishable raw materials. EU Commission Regulation No 2073/2005 (CEC, 2005) also states that minced meat and semi-finished meat products belong to high-risk products.

Detection of *Salmonella* spp. and *L. monocytogenes* in poultry meat and mechanically deboned meat proves that the specified pathogenic microflora can penetrate into finished products and semi-finished products.

Thus, salmonella can be stored for a long time in the environment: in water for up to 5 months, in meat and sausages — 2–4 months, in frozen meat — about 6 months (in poultry carcasses — more than a year). In some meat products, salmonella can not only be stored but also reproduced without changing the appearance and taste of the products. Salting and smoking have a very weak effect on them, and freezing even increases the survival time of microorganisms in food. Today, according to the results of epidemiological investigations, it is established that sick poultry is one of the leading factors in the transmission of this disease (FBHI 'CHERSY', 2020). Detection of *Salmonella* group D in mechanically deboned meat samples indicates a geographical serotype predisposition, which is due to the dominance of *Salmonella* group D among poultry in Dnipropetrovsk Region (Martynenko, 2019). The prevalence of *Salmonella* group D pathogens in the etiological structure of human salmonellosis (more than 80%) is reported by Pimenov, Laishevtcev and Pimenova (2017). Current trends in the development of poultry farming in Ukraine draw attention to the products of this industry, which are imported into the country, as indicated by the identified inconsistencies DSTU EN 12824:2004 (EN 12824:1997, IDT) (DSSU, 2005d). The analysis of outbreaks of *Salmonella* infections caused by poultry products shows that they are quite common in importing countries (*The Guardian*, 2019; Whitworth, 2019; Kalisz, 2019). Thus, today five countries (Great Britain, Denmark, Poland, Hungary, and the Czech Republic) have international veterinary certificates for the import of minced meat and/or mechanically deboned meat into the customs territory of Ukraine.

Detection of *L. monocytogenes* and its increased ability to grow or survive in a refrigerated environment compared to most other microorganisms confirms that this pathogen is a significant risk factor in food production. This is especially true for ready-to-eat foods that do not undergo heat treatment during production, as well as foods that may be contaminated during production.

Detection *Proteus* bacteria in semi-finished products and sausages allowed to establish that the degree of contamination of the tested samples with organic residues did not exceed 0.28%. Therefore, the source of pathogenic bacteria are infected poultry products. The obtained results confirm that meat products are at risk, as reported in other sources (FSBI 'ORCFSVPS', 2016).

Conclusions. Violations of food safety criteria in poultry products and raw materials have been established, as evidenced by the isolation of S*almonella* spp. and *L. monocytogenes*. The geographical serotype predisposition in the occurrence and development of *Salmonella* infection in the region is shown. Violation of hygiene criteria of technological processes is proved, as evidenced by exceeding the permissible limits of QMAFAnM in 0.9–2.9% of the studied samples.

Acknowledgement. The author is grateful to Director of the Dnipropetrovsk Regional State Laboratory of Veterinary Medicine Mr. Oleksandr G. Malimon for providing data on the results of bacteriological tests for 2019.

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