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INDICATORS OF THE SKIN MICROBIOTA AND THE PHAGOCYTIC ACTIVITY IN MEAT AND EGG PRODUCTION WORKERS

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Aim. The analysis of the indicators of skin microbiota and phagocytic activity of neutrophils and monocytes in employees of the "Peremoga Nova" poultry farm.

Methods. The presence of sanitary and epidemiologically important groups of bacteria and the number of mesophilic aerobic and facultative anaerobic microorganisms (MAFAnM) on the skin surface, leukogram parameters and phagocytic activity of professional phagocytes were determined. The indicators of students of the Bohdan Khmelnytsky National University of Cherkasy were used as a control.

Results. It was found that the MAFAnM index in the experimental group (3.2×10^3 CFU/cm^3) is significantly lower than in the control group (2.7×10^3 CFU/cm^3), however, the percentage of *Staphylococcus spp*. carriers is higher (67.5% versus 40.0%). In the experimental group, the relative and total number of monocytes is significantly higher compared to the control group. There is a positive correlation between the phagocytic number and the phagocytic index of monocytes and the value of MAFAnM.

Conclusions. There was an increase of the level of monocytes in meat and egg products workers against the background of the presence of bacteria of the *Staphylococcus spp*. group on the skin. It may indicate the activation of pro-inflammatory factors at the level of peripheral blood. An increased percentage of staphylococcal carriers is a sign of adaptation of *Staphylococcus spp*. bacteria to the antibiotics used in the manufacturing process.

Key words: skin microbiota, phagocytic activity, poultry farm, sanitary condition.

The modern industrial production of food products requires compliance with strict requirements for the sanitary condition of working areas and compliance with the hygiene standards by personnel. One of the important areas of control is microbiological monitoring. Microbial contamination can cause a deterioration of the employees' health and the development of occupational diseases in addition to affecting product quality [1]. An important biomarker of negative exogenous effects on the human body is the indicator of natural resistance [2]. A normal microbiota of the human body evolved in parallel with the formation of an immune system [3]. The question of the relationship between the microbiota of the body and factors of the human immune system in the conditions of specific production activities, in particular, remains largely open.

The analysis of the indicators of the skin microbiota and the phagocytic activity of neutrophils and monocytes in employees of the SOE "Peremoga Nova" poultry farm.

Materials and Methods

The microbiota biomaterial was obtained by rinsing from hands with a disposable applicator in a transport tube onto sterile nutrient media. The presence of bacteria of the *Escherichia coli* group

(ECG) was determined; *Staphylococcus spp.* (Staphylococcus); *Enterococcus spp*. (group D Streptococcus b-hemolytic); the total microbial count was assessed (an indicator of mesophilic aerobic and facultative anaerobic microorganisms, *MAFAnM*). Peripheral blood samples were obtained at the Municipal Non-Commercial Enterprise "Cherkasy Central District Hospital", where the examined people underwent a professional examination. The leukogram parameters were determined on the basis of a stained smear and the phagocytic activity of neutrophils and monocytes was determined by the ability to absorb latex particles. Control indicators were obtained from students of the Bohdan Khmelnytsky National University of Cherkasy. The number of examined people in both groups was 15 people. After testing for the normality of the distribution, the samples were compared using the Student's t-test. Relationships between indicators were analyzed by determining the Pearson correlation coefficient.

Results and Discussion

It was found that in the control group, bacteria of the *Escherichia coli* group were present in 22% of samples, in the experimental group in 20%; *Staphylococcus spp*. was present in 40% of the examined participants from the control group and 67.5% of the experimental one, *Enterococcus spp*. in 8% of the control and 5% of the experimental group, the average value of the MAFAnM index was 3.2×10^3 CFU/cm^3 in the control group and 2.7×10^3 CFU/cm^3 in the experimental group; the employees of the SOE "Peremoga Nova" had a significantly higher relative and total number of monocytes compared to the control (Table 1).

Within the groups, no significant difference was found between those examined with the presence of a sanitary-important microbiota and its absence. The employees of the SOE "Peremoga Nova" have a statistically significant positive correlation between the phagocytic number, phagocytic index of monocytes and the value of MAFAnM (Table 1).

Recent studies show an important role of the body's normal microbiota in immunological processes. There must be constant effective contact between the immune system and the microbiome. Sufficient exposure to a large number of microbes is critical for the development of a normal, functioning immune system. However, the resident microbiota can become pathogenic in case of injury, wound, or weakening of the host's immunity [3, 4].

Complex relationships with the immune system are observed not only in endosymbionts but also in bacterial groups on the body surface [5]. The mechanisms of interaction between the commensal skin microbiota and the immune system, in particular, during the development of inflammatory processes, are still not well understood [6]. An increased level of monocytes in workers of the SOE "Peremoga Nova" is an indirect sign of the activation of pro-inflammatory processes [7], which may be due to a constant contact with biological objects, antibiotics, premix feed, allergenic factors, etc. The maximum indicators of the phagocytic activity of monocytes were found in the carriers of *Staphylococcus spp*; apparently, they determined the statistically significant correlation between the phagocytic index of monocytes and the MAFAnM value. The highest percentage of *Staphylococcus spp.* in the experimental group may be a sign of adaptation of staphylococci to antibiotics. This is the only indicator of sanitary important forms that was higher than in the control. In general, the level of MAFAnM in the experimental group is lower than in the control, which indicates the proper sanitary condition of the working premises and the observance of hygiene standards by the personnel.

Conclusions

The indicators of MAFAnM among the workers of the meat and dairy products of the SOE "Peremoga Nova" are within the sanitary and hygienic norm, however, an increase of the monocytes' level against the background of the presence of *Staphylococcus spp*. group's bacteria on the skin may indicate the activation of pro-inflammatory factors at the level of peripheral blood. An increased percentage of carriers of staphylococci in the experimental group is a sign of adaptation of *Staphylococcus spp*. to antibiotics used in the production process.

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Table 1. **Indicators of professional phagocytes and MAFAnM in control and experimental groups**

Components	Control (n = 15) M ± SE	Experimental group (n = 15) M ± SE
Monocytes, %	6.21 ± 0.34	11.01 ± 0.67 ***
Monocytes, $\times 10^9$ /l	0.42 ± 0.06	0.65 ± 0.08 *
Neutrophils, %	59.11 ± 2.37	53.55 ± 1.72
Neutrophils, $\times 10^9$ /l	4.54 ± 0.74	3.01 ± 0,26
Phagocytic index of neutrophils	6.01 ± 0.57	6.75 ± 0.42
Phagocytic number of neutrophils	75.35 ± 0.95	75.22 ± 0.67
Phagocytic index of monocytes	5.44 ± 0.71	6.81 ± 0.51
Phagocytic number of monocytes	74.96 ± 0.82	76.12 ± 0.74
MAFAnM, $\times 10^3$ CFU/cm^3	3.20 ± 0,04	2.72 ± 0,08 ***
Correlation coefficients$_{MAFAnM/PhIN}$	0.35	0.46
Correlation coefficients$_{MAFAnM/PhNN}$	0.37	0.41
Correlation coefficients$_{MAFAnM/PhIM}$	0.44	0.86#
Correlation coefficients$_{MAFAnM/PhNM}$	0.42	0.65#

Note: * — $P < 0.05$; ** — $P < 0.01$; *** — $P < 0.001$: indicates significant differences in comparison with control; MAFAnM/PhIN — correlation between MAFAnM and the neutrophil phagocytic index; MAFAnM/PhNN — correlation between MAFAnM and the phagocytic number of neutrophils; MAFAnM/PhIM — correlation between MAFAnM and the phagocytic index of monocytes; MAFAnM/PhNM – correlation between MAFAnM and the phagocytic number of monocytes; # — significant correlation, $\boldsymbol{P} < 0.05$.

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