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Search for antibiotic-resistant strains of Gram-positive and Gram-negative microorganisms in poultry products

Research on the search for antibiotic-resistant strains of Gram-positive and Gram-negative microorganisms in poultry products is an urgent and important topic in modern medicine and the food industry. Antibiotics are widely used in poultry farming for the prevention and treatment of infections, but this also contributes to the development of antibiotic resistance in microorganisms. The purpose of this study is to identify and assess the level of antibiotic resistance of Gram-positive and Gram-negative bacteria present in meat and poultry-derived products. The methods include analyzing food samples, namely chicken fillets and chicken eggs, for the presence and identification of resistant strains, as well as testing their sensitivity to various antibiotics. During the study, it was found that 19.05 % of Gram-positive strains and 26.09 % of Gram-negative strains isolated from farm products exhibit resistance or multi-resistance properties. At the same time, 58.28 % of Gram-positive and 59.42 % of Gram-negative microorganisms also exhibit resistance or multi-resistance properties.

Keywords: antibiotic resistance, epidemiology, sanitary microbiology, poultry farming, food safety.

Introduction

The discovery of antibiotics is one of the most significant discoveries in the field of clinical and preventive medicine. The first antibacterial drug was discovered by the winner of the Nobel Prize in Physiology or Medicine (1945) by Alexander Fleming in 1929. Since then, antibiotics have become one of the most essential components of the treatment of infectious diseases [1]. Nevertheless, at the moment, the world community is facing a global challenge in the face of antibiotic resistance, a phenomenon that allows microbial agents to survive and multiply despite the use of antibacterial agents [2].

The study of the development and spread of resistant strains plays a key role in ensuring global biological safety and poses a serious threat to practical medicine. According to the World Health Organization (WHO), every year, the effectiveness of antibiotics decreases, which makes it impossible to use them further [3]. At the same time, according to experts, about 230,000 people die annually in the world from infectious diseases caused by multi-resistant bacteria [4]. At the same time, special attention is paid to the study of the sources of resistant strains, which are medical institutions, clinical and bacteriological laboratories, as well as agricultural entities [5].

At the same time, a separate role is assigned to the study of the role of agricultural facilities. The conditions of keeping livestock are one of the main reasons for the use of antibacterial drugs. The large crowding of animals in relatively small spaces creates a favorable environment for the spread of infectious diseases, which is a factor in the forced use of antibacterial drugs, both for therapeutic and preventive purposes [6]. The study by Van Boeckel and co-authors indicates that countries such as China, which could lead to China becoming a consumer of about 30 % of global antibiotic production by 2030. The other most “dangerous” country is India, according to researchers, 95 % of the population are carriers of microorganisms producing extended-spectrum beta-lactamases, which may be mediated by the uncontrolled use of antibiotics, both in medicine and in agriculture [7]. Poultry farming is also an integral part of agriculture. According to the Food and Agriculture Organization (FAO), global poultry consumption, including meat and eggs, continues to grow rapidly, and it is expected to increase by 20 % by 2030 [8]. At the same time, the subjects of poultry farming are also one of the main consumers of antibiotics. A review of scientific publications conducted by Ma and co-authors directly indicates the growing antibiotic resistance in poultry farming and the transfer of R-plasmids from animals to humans [9].

In an experiment conducted by Liu, Y. -Y. and co-authors, it is reported that a detailed genomic analysis of E.coli isolated from humans and birds revealed similarities in the structure of ColV/ColBM plasmids containing the mcr-1 gene (MCRPEC), which may indicate the spread of antibiotic resistance from birds to humans [10]. When comparing the genetic differences between E. coli strains in humans and poultry, it was found that ciprofloxacin-resistant *E. coli* strains in humans are associated with birds [11]. A study conducted by Dutil, L and co-authors showed that the temporary cessation of ceftiofur significantly reduces the resistance of Salmonella isolates in birds and humans, however, with the resumption of use, the trend has changed [12]. These studies have confirmed the transmission of antibiotic-resistant bacteria from animals to farm workers. The results revealed a high prevalence of resistance among farmers before and after the introduction of antibiotics in their workplaces. Despite the fact that this limited transmission does not seem to pose a threat to public health, the introduction of genes responsible for drug resistance into society and the hospital environment may pose a potential threat [13].

Kazakh scientific research in the field of antibiotic resistance in animal husbandry continues to develop. At the same time, there are already a number of studies that indicate the detection of resistant strains in farm animals. For example, the work of Madiev and Pimenov covers the study of antibiotic resistance of stains gathered from sows. The study indicates the sensitivity of the isolated strains to such groups of antibiotics as carbapenems, cephalosporins, polymyxins, tetracyclines, beta-lactams, penicillins, sulfonamides, aminoglycosides, tetracyclines [14]. Also, in Matchanova's work, it is indicated that the inappropriate use of antibacterial drugs in animal husbandry can lead to the rapid and sustainable development of antibiotic resistance, which will become a global challenge for Kazakhstan [15]. Thus, the search for antibiotic-resistant strains isolated from poultry products is an important step in ensuring biological safety, and the data obtained during the study can be used in making recommendations to counteract the development of global antibiotic resistance.

Materials and Methods

An exploratory, promising, experimental study was conducted. The object of the study is poultry products in the territory of the Karaganda region. 64 samples of products (n=64) were selected for the study, including 44 carcasses of broiler fillets and 20 chicken eggs purchased in supermarkets and farms of the Karaganda region. The exclusion criterion is: expired shelf life, violation of the integrity of the package, violation of the storage conditions of the product. The study was conducted according to the design shown in Figure 1.

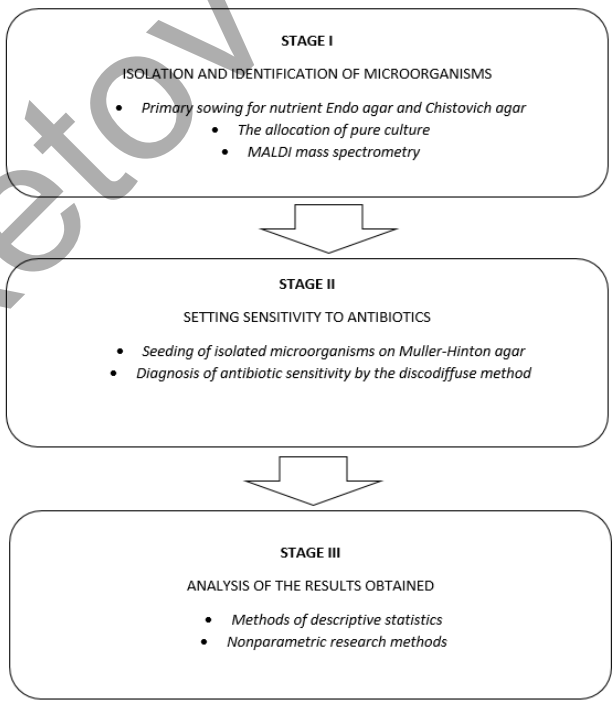

Figure 1. Design of the study "Search for antibiotic-resistant strains of Gram-positive and Gram-negative microorganisms in poultry products"

Primary sowing was carried out on pre-prepared, sterile nutrient media — yolk-salt agar (Sentral drug house) and endo medium (FBUN State Scientific Center for Applied Microbiology and Biotechnology). The cups with primary seeding were incubated in a microbiological thermostat for 24 hours. The isolation of pure culture was carried out by the depletion stroke method [16]. After obtaining pure crops, the isolates were divided into 2 groups: the first group includes isolates strains from farm products, the second group contains strains isolated from products of retail trade facilities. The identification of isolated microorganisms was carried out using a MALDI-TOF mass spectrometer located at the INOZH Research Institute of the Karaganda Medical University. To determine the sensitivity, Muller-Hinton agar (Condalab) was used, and a separate set of antibiotics for Gram-positive and Gram-negative microorganisms indicated in Table 1 and Table 2.

Table 1

A set of antibiotics used to determine sensitively Gram-positive isolates

Atibiotic group	The name of the antibiotic	Disc load, mcg/disk
Aminoglycosides	Tobramycin (TOB)	10
	Gentamicin (GEN)	10
Macrolides	Erythromycin (E)	15
Glycopeptides	Vancomycin (VA)	30
Penicillins	Oxacillin (OX)	1
Polyketides	Tetracycline (TE)	30

Table 2

A set of antibiotics used to determine sensitively Gram-negative isolates

Atibiotic group	The name of the antibiotic	Disc load, mcg/disk
Penicillins	Ampicillin/Sulbactam (AMP)	10
	Amoxicillin/Clavunate (AMC)	30
Cephalosporins	Cefotaxime (CTX)	5
	Cefepim (CPM)	30
	Cefuroxime (CXM)	30
	Ceftazidime (CZA)	30
	Cefoxitin (FOX)	30
Carbapenems	Meropenem (MEM)	10
	Imipenem (IMP)	10
Fluoroquinolones	Ciprofloxacin (CIP)	10
Aminoglycosides	Tobramycin (TOB)	10
	Gentamicin (GEN)	10
	Amikacin (AK)	10

At the same time, discs with CTX, AMC, and CXM were placed at a distance of no more than 1 cm from each other, to determine the production of extended-spectrum beta-lactamases, the selection of antibacterial drugs for research was carried out taking into account the popularity of use and species specificity. The cups with crops and antibiotics were incubated for 24 hours in a microbiological thermostat at a temperature of 37.0 C.

The growth delay values were taken from the manual of the European Committee on Antimicrobial Susceptibility Testing, Breakpoint tables for interpretation of MICs and zone diameters, Version 13.1, valid from 2023–06–29 [17]. Chi-square adjusted for continuity were chosen as statistical criteria to compare results that lack strains with questionable sensitivity [18]. Statistical data analysis was performed using the Microsoft Office professional software package: Exel2019, STATISTICA 12.5.192.7(trial version) and the matplotlib and pandas libraries for python 3.12.0.

Results and Discussion

As part of our study, we isolated and analyzed in detail 147 bacterial isolates (n=147). Of this total, 92 isolates (k1=92), which is 62.59 % (95 %CI:54.23 %-70.42 %), were classified as Gram-negative microorganisms. Gram-negative strains taken from poultry products account for 75.00 % (95 % CI:64.89 %-83.45 %), the remaining 25.00 % (95 % CI: 16.88 %- 34.66 %) are gathered from farm products. The remaining 55 isolates (k2=55), or 37.41 % (95 %CI:29.58 %-45.77 %), were identified as Gram-positive bacteria. At the same time, the share of isolates from products purchased at retail outlets accounts for 61.82 % (95 %CI:47.73 %-74.59 %), and the share of isolated strains from farm products is 38.18 % (95 % CI:25.41 %-52.27 %).

Table 3

Gram-positive strains of bacteria isolated from the studied products

The genus of isolates	The proportion in relation to the total number of strains extracted,%	Confidence intervals, %
Staphylococcus	81,82 %	59,04 % — 83,86
Streptococcus	18,18 %	9,08 % -30,90

Table 4

Gram-negative bacterial strains isolated from the studied products

The genus of isolates	The proportion in relation to the total number of strains extracted,%	Confidence intervals, %
Escherichia	50,00 %	39,39 %-60,61
Salmonella	10,87 %	5,34 %- 19,08
Citrobacter	7,61 %	3,57 %-15,76
Aeromonas	7,61 %	3,11 %-15,05
Serratia	4,35 %	1,20 %-10,76
Acinetobacter	3,26 %	0,68 %-9,23
Proteus	3,26 %	0,68 %-9,23
Moraxella	3,26 %	0,68 %-9,23
Enterobacter	3,26 %	0,68 %-9,23
Erwinia	2,17 %	0,26 %-7,63
Hafnia	2,17 %	0,26 %-7,63
Pantonea	2,17 %	0,26 %-7,63

As can be seen from the data in Table 3, the genus *Staphylococcus* prevails among the Gram-positive microflora, and less than 20 % of the isolates were assigned to the genus Streptococcus. Among Gram-negative isolates, the genus Escherichia prevails, which accounts for half of all isolated microorganisms, slightly more than 10 % of the isolates are represented by the genus Salmonella, isolates assigned to the genus *Citrobacter* and *Aeromonas* have the same amount, the proportions of the remaining isolates are shown in Table 4.

When analyzing Gram-positive microflora (Fig. 2) isolated from farm products, it became known that the isolates have absolute sensitivity to gentamicin, ciprofloxacin and vancomycin. At the same time, 4.76 % (95 %CI: 0.12 %-23.82 %) are sensitive to tobramycin, tetracycline, erythromycin and oxacillin. At the same time, it is important to note that these strains do not have multi-resistance, and are sensitive to other types of antibiotics. An interesting fact is that 75.00 % of resistant strains isolated from farm products belong to the genus *Staphylococcus*, and the remaining 25 % are representatives of the genus *Streptococcus*. Thus, it can be noted that the proportion of resistant strains among isolates from farm products is not large, and there are no multi-resistant strains at all. It should be noted that no pathogenic coagulase-negative microbiological agents have been identified, and accordingly, there is reason to believe that the extracted isolates belong to the normal microflora of broiler chicken fillets and chicken eggs.

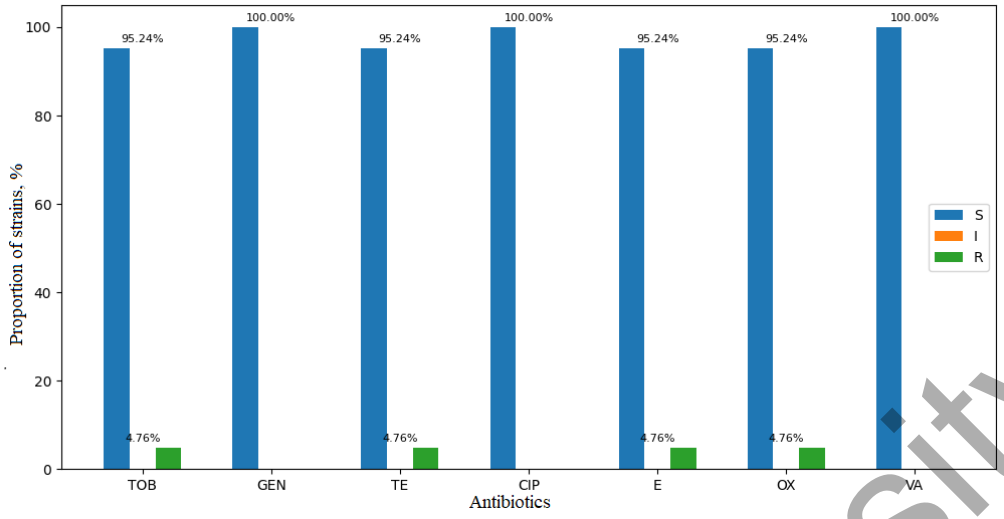

Figure 2. Sensitivity of Gram-positive strains isolated from farm products

At the same time, when studying the sensitivity of Gram-positive isolates from poultry products (Fig. 3), 32.35 % (95 %CI:17.39 %-50.53 %) show resistance to tobramycin, and 23.53 % (95 %CI:10.75 %-41.17 %) to gentamicin. At the same time, 45.45 % are resistant to both tobramycin and gentamicin, and all of them belong to the genus *Staphylococcus*. An interesting fact is that among the strains showing resistance to all studied aminoglycosides, 60.00 % of the strains are multi-resistant, and show resistance to other antibacterial drugs.

When examining the sensitivity of the isolated strains to tetracycline, it was found that 20.59 % (95 %CI:8.70 %-37.90 %) are not sensitive to this antibacterial drug. At the same time, all of them belong to the genus Staphylococcus, and in 50.00 % of cases they are multi-resistant, and in 14.29 % they are absolutely resistant to aminoglycosides.

At the same time, it was found that the isolated Gram-positive strains do not show resistance to ciprofloxacin, but at the same time 8.82 % (95 %CI:1.86 %-23.68 %) are questionably sensitive, although there is no reason to believe that these strains will not soon become sensitive to this drug.

In the case of erythromycin, it was found that 23.35 % (95 %CI:10.75 %-41.17 %) are resistant to this drug. At the same time, half of them are multi-resistant, and show resistance to both aminoglycosides and penicillins.

Upon detailed analysis of the sensitivity of the isolates to oxacillin, it became known that 17.65 % (95 %CI:6.76 %-34.53 %) exhibit resistance properties, while 66.67 % are classified as multi-resistant. It should be noted that all these isolates are assigned to the genus *Staphylococcus.*

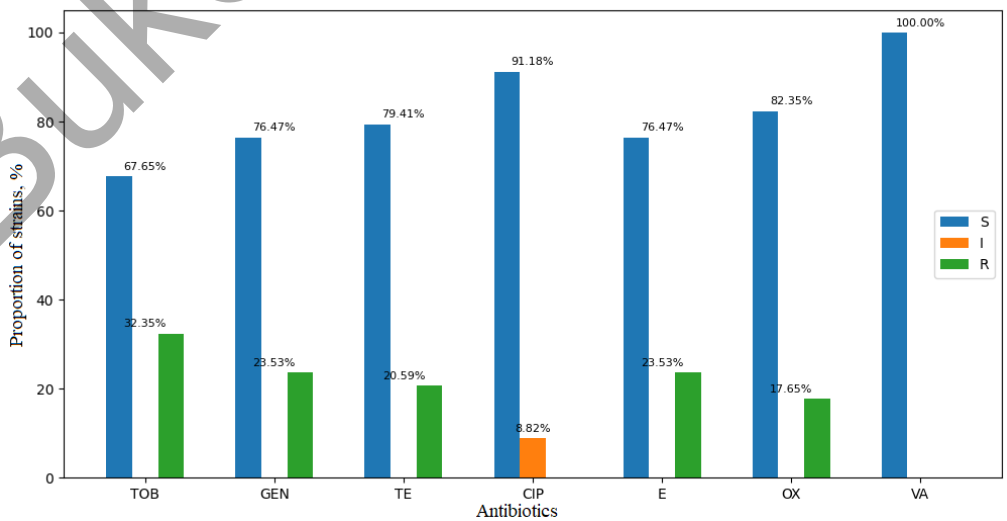

Figure 3. Sensitivity of Gram-positive strains isolated from poultry farm products.

When analyzing the sensitivity of Gram-negative strains isolated from farm products (Fig. 4), 91.30 % (95 % CI:89.42 %-98.80 %) were sensitive to ampicillin/sulbactam and amoxicillin/clavunate. It is worth noting that 8.70 % (95 %CI:1.07 %-28.04 %) are classified as resistant, while it is noted that these strains belong to the genus *Escherichia* and *Serratia*, and show resistance to two antibacterial drugs simultaneously. At the same time, the Serratia strain is multi-resistant, and does not show sensitivity to ceftazidime and amoxicillin/clavunate. At the same time, when studying the resistance of strains isolated from poultry products (Fig. 5), the sensitivity of the obtained isolates to ampicillin/sulbactam is only 79.71 % (95 % CI:70.45 %-87.14 %), and to amoxicillin/clavunate 94.20 % (95 % CI:87.53 %-97.96 %), the rest are classified as stable, however, in this case, only 50 % (95 %CI:6.76 %- 93.24 %) are absolutely resistant to the group of penicillins studied, these strains belong to the family *Escherichia* and *Aeromonadaceae*, at the same time, these strains show resistance to other types of antibacterial drugs, and the *Aeromonadaceae* strain is pan-resistant, and shows resistance to all groups of antibacterial drugs.

During the test to assess sensitivity to cephalosporins, it was found that strains isolated from farm products are absolutely sensitive to cefotaxime and cefepime and cefoxitin, but at the same time, the proportion of sensitive strains to cefuroxime is 96.65 % (95 %CI:78.05 %-99.89 %), and the proportion of resistant strains is 4.35 % (95 %CI:0.11 %-21.95 %). This strain is a representative of the genus *Escherichia*, and is resistant only to this antibacterial drug, at the same time, the proportion of strains sensitive to ceftazidime is 82.61 % (95 % CI:61.22 %-95.05 %), doubtfully resistant is 4.35 % (95 % CI: 0.11 %-21.95 %), and The proportion of resistant strains was 13.04 % (95 % CI:2.78 %-33.59 %). The strain showing questionable sensitivity belongs to the genus Escherichia, and does not show resistance to the rest of the studied antibiotics. In the case of resistant strains, 66.67 % of them also belong to the genus *Escherichia*, and do not show resistance to other antibacterial drugs, while the remaining 33.33 % are the aforementioned *Serratia* strain. At the same time, the proportion of strains isolated from poultry farm products is 94.20 % (95 % CI: 85.82 %-98.40 %), and the proportion of resistant strains is 5.80 %(95 % CI:1.60 %- 14.18 %), it should be noted that sensitive strains belong to the genus *Proteus* and *Citrobacter*, and also show resistance, or questionable sensitivity to cefotaxime, and are also multi-resistant to penicillins and aminoglycosides. At the same time, the proportion of strains sensitive to cefipime is only 86.76 % (95 %CI: 76.68 %- 93.86 %), and the proportion of resistant strains is 4.41 % (95 %CI:0.91 %-12.18 %) — the remaining strains are classified as doubtfully sensitive.

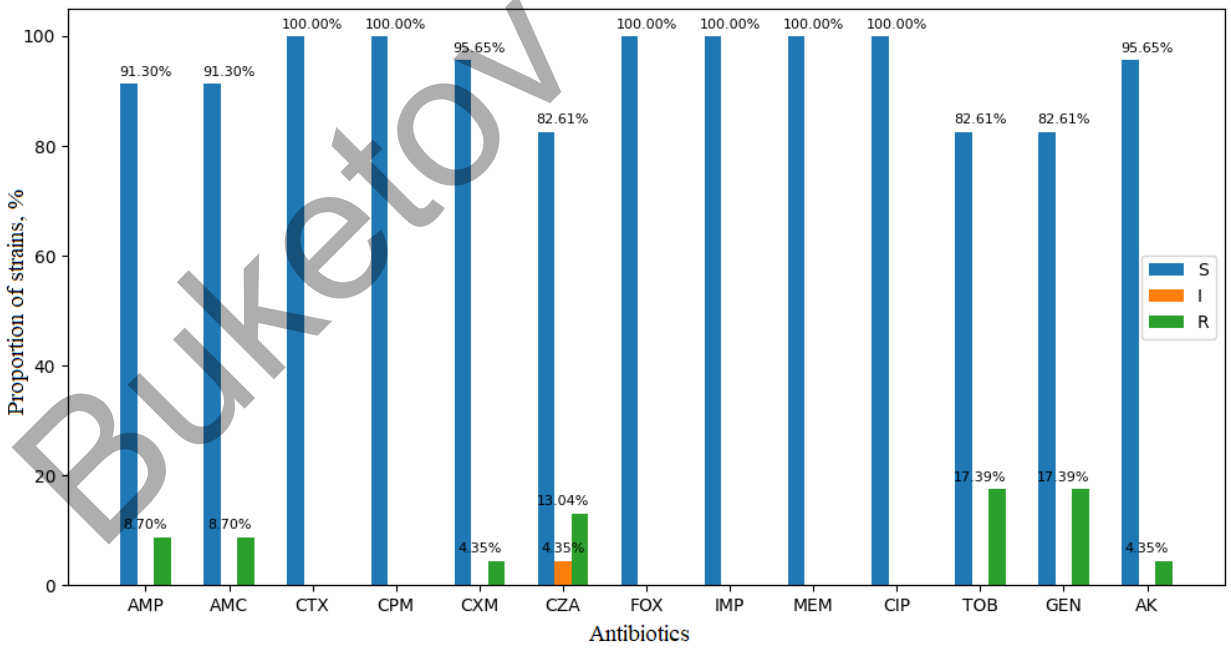

Figure 4. Sensitivity of Gram-negative strains isolated from farm products

Upon detailed study, it became known that most of the isolated strains, namely 66 % of *Escherichia*, are multi-resistant. These strains exhibit resistance to aminoglycosides, the remaining 33 % are the aforementioned pan-resistant strain of *Aeromonadaceae*. It is worth noting that the strains isolated from poultry products exhibit the least resistance to cefuroxime, namely 73.91 % (95 %CI:61.94 %-83.75 %), while the pro-

portion of strains exhibiting resistance is 18.84 %(95 %CI:10.43 %-30.06 %). During a detailed analysis, it became known that, in addition to the pan-resistant strain, from the genus *Aeromonas*, resistance to cefuroxime is manifested by isolated multi-resistant strains of *Proteus*, *Citrobacter*, and *Aeromonas*, and an interesting fact is that in 100 % of cases, these strains are also resistant to aminoglycosides and penicillins. The proportion of strains showing sensitivity to ceftazidime is 88.41 % (95 %CI:78.43 %-94.86 %), resistant — 8.70 % (95 % CI:3.26 %-17.97 %), the rest are classified as strains showing questionable resistance. Of the resistant strains, 60 % belong to the *Enterobacteriaceae* family, the rest are classified as *Aeromonas*. An interesting fact was that 50.00 % of strains resistant to this antibiotic were isolated from poultry products and 66.67 % show resistance to both penicillins and aminoglycosides, in the remaining 33.33 % of observations, the strains do not show multi-resistance properties. At the same time, 100 % of the isolated *Aeromonas* strains are multi-resistant, and in addition to the pan-resistant strain, they also exhibit 100 % resistance to aminoglycosides and penicillins. At the same time, 1 strain of *Aeromonas* was noted, which shows resistance to ciprofloxacin. The last studied antibacterial drug from the group of cephalosporins was cefoxitin, 79.71 % (95 % CI:68.31 %-88.44 %) of the isolated strains are sensitive to it, while 20.29 % (95 %CI:11.56 %-31.69 %) are resistant. Among the resistant strains, 1 *Citrobacte*r strain and 1 *Salmonella* strain have been isolated, which show resistance only to this antibiotic, the remaining strains belong to the *Enterobacteriaceae* and *Aeromonas* family, and are multi-resistant, but at the same time, in addition to the pan-resistant *Aeromonas* strain, all the above-mentioned strains show sensitivity to ciprofloxacin.

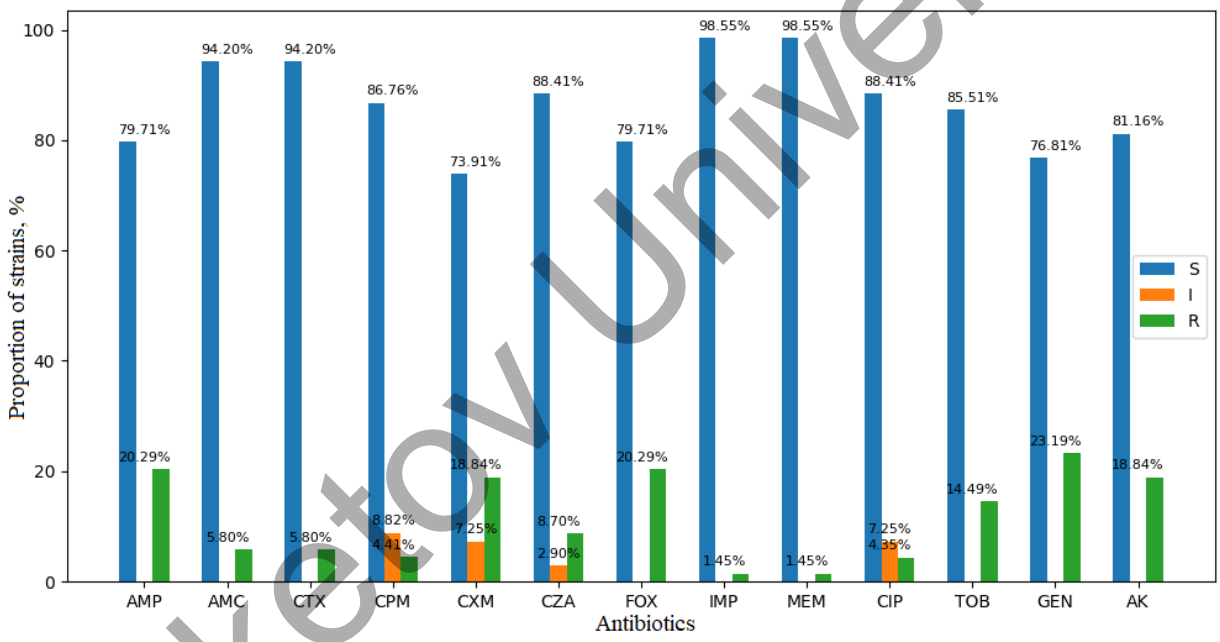

Figure 5. Sensitivity of Gram-negative strains isolated from poultry farm products.

In the study of sensitivity to carbapenems, it became known that strains isolated from farm products are absolutely sensitive to meropenem and imipenem. At the same time, strains isolated from poultry farm products are only 98.55 % (95 %CI:92.19 %-99.96 %) sensitive to meropenem and imipenem. At the same time, only the pan-resistant *Aeromonas* strain shows resistance.

Analyzing resistance to ciprofloxacin, it became known that strains isolated from farm products are also absolutely sensitive. At the same time, the proportion of sensitive strains isolated from poultry farm products is only 88.41 % (95 % CI: 78.43 %- 94.86 %), resistant — 7.25 % (95 % CI: 2.39 %-16.11 %), the rest are classified as strains showing questionable sensitivity. With the exception of the pan-resistant *Aeromonas* strain, the remaining *Enterobacter*and *Acinetobacter*, at the same time, exhibit multi-resistance properties only in half of the cases, and are multi-resistant to all groups of antibiotics, except carbapenems.

In the study of resistance to aminoglycosides, it was found that most of the strains isolated from poultry products exhibit resistance to gentamicin, namely -23.19 % (95-CI: 13.87 %- 34.91 %), the remaining 76.81 % (95 %-CI: 65.09 %-86.13 %) strains are classified as sensitive. At the same time, the strains show the greatest sensitivity to tobramycin, namely 85.51 % (95 %CI: 74.96 %-92.83 %), the rest are resistant. The proportion of strains sensitive to amikacin in this group of isolates is 81.16 % (95 % CI: 69.94 %-

89.57 %), the remaining 18.84 %(95 % CI: 10.43 %-30.06 %) are classified as resistant. It is noteworthy to note that sensitivity to gentamicin is only 25.00 % accompanied by concomitant sensitivity to amikacin, and the proportion of strains absolutely resistant to aminoglycosides is 18.75 %. It is worth noting that the proportion of strains that are absolutely sensitive to aminoglycosides is 75.00 % resistant to cephalosporins, and in 25.00 % of cases it is absolutely sensitive to penicillins.

At the same time, it was found that the proportion of sensitive strains to tobramycin and gentamicin in the group of isolates gathered from farm products is the same, and amounts to 82.61 % (95 %CI: 61.22 %-95.05 %), and resistant — 17.39 % (95 %CI: 4.95 %-38.78 %). It should be noted that the same strains belonging to the *Enterobacteriaceae* family exhibit paired sensitivity. At the same time, 95.65 % (95 % CI: 78.05 %-99.89 %) of the isolated strains are classified as sensitive, and only 4.35 % (95 % CI: 0.11 %-21.95 %) are resistant. This strain belongs to the genus *Serattia*, is multi-resistant, and exhibits resistance properties to ampicillin/sulbactam and ceftazidime.

When analyzing the production of extended-spectrum beta-lactamases, in addition to the aforementioned pan-resistant strain *Aeromonas*, a strain belonging to the genus Proteus was identified that exhibits resistance to ampicillin/sulbactam, cefotaxime and cefuroxime. An important fact is that the genus Proteus is not a representative of the normal microflora of the chicken body, and was presumably introduced from outside. At the same time, it should be noted that bacteria of this genus are identified in food mainly in violation of storage or production conditions. At the same time, this isolate also shows resistance to all aminoglycazides, which can serve as confirmation that this strain was introduced during transportation or production of the product. Another isolate that causes alertness is the *Citrobacter* strain. This isolate exhibits resistance to ampicillin/sulbactam and cefuroxime, as well as tobramycin and gentamicin, but is sensitive to cefotaxime. An important fact is that all the above-mentioned microorganisms were isolated from poultry products. During statistical processing, using the Chi-square statistical criterion adjusted for continuity, it was found that there is no statistical difference between isolates from poultry farm products and isolates from farm products producing broad-spectrum beta-lactamases ($p=0.747$ at $\alpha=0.05$). Accordingly, it can be assumed that the isolated, that the fact of the detection of these strains in poultry products is rather a special case.

Examining the resistance of gram-positive strains of bacteria isolated from farm products, it was found that only 19.05 % (95 %CI:5.45 %- 41.91 %) exhibit resistance properties to certain types of antibacterial drugs, while the number of resistant and multi-resistant strains isolated from poultry products is the same, and it is 29.41 % (95 %CI: 14.64 %- 46.30 %) for each of the groups. When analyzing the stability of Gram-negative microorganisms and farm products, it was found that only 21.74 % (95 %CI:7.46 %- 43.70 %) are stable, and only 4.35 % (95 %CI: 0.11 %- 21.95 %) exhibit multi-resistance properties. When considering Gram-negative isolated strains and poultry farm products, it became known that 31.88 %(95 %CI:21.17 %-44.21 %) exhibit resistance properties, while 27.54 %(95 %CI: 17.46 %- 39.62 %) are multi-resistant, with the vast majority belonging to the family *Enterobactereace*.

In the study of statistical differences between Gram-positive strains isolated from farm products and isolates from poultry products, significant differences were found (Chi-squared $p=0.005$, at $\alpha=0.05$). Accordingly, it can be assumed that resistant and multi-resistant strains in products produced in poultry farms will occur more often than in farm products. At the same time, significant differences between Gram-positive strains isolated from poultry and farm products are also present (Chi-squared $p=0.04$, at $\alpha=0.05$). Thus, it can be assumed that non-compliance with the rules for the use of antibacterial drugs in poultry farms may contribute to the spread of antibiotic resistance among both animals and humans.

Conclusion

The data of the conducted study indicate a high prevalence of resistant and multi-resistant strains of Gram-positive and Gram-negative microorganisms in poultry products produced in the Karaganda region. Among resistant and multi-resistant strains, bacteria of the *Enterobacteriaceae* and *Staphylococcaceae* families predominate. However, despite this fact, a pan-resistant strain of a bacterium belonging to the genus *Aeromonas* was isolated from poultry farm products. When comparing strains isolated from farm products and poultry products, a statistical difference was established, due to this, it can be assumed that the excessive use of antibacterial drugs in industrial poultry farming can serve as a precedent for the spread of antibiotic-resistant strains, both among animals and among end users.

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Құс өнімдерінде грамоң және грамтеріс микроорганизмдердің антибиотикке төзімді штамдарын іздеу

Құс өнімдеріндегі грамоң және грамтеріс микроорганизмдердің антибиотикке төзімді штамдарын іздеу бойынша зерттеу қазіргі заманғы медицина мен тамақ өнеркәсібіндегі өзекті және маңызды тақырып. Антибиотиктер құсшаруашылығында инфекциялардың алдын алу және емдеу үшін кеңінен қолданылады, бірақ бұл микроорганизмдерде антибиотикке төзімділіктің дамуына ықпал етеді. Зерттеудің мақсаты құсшаруашылығынан алынған ет пен өнімдерде болатын грамоң және грамтеріс бактериялардың антибиотикке төзімділік деңгейін анықтау және бағалау. Әдістерге төзімді штамдардың бар-жоғын анықтау және анықтау үшін тағам үлгілерін, атап айтқанда тауық еті мен тауық жұмыртқасын талдау және олардың әртүрлі антибиотиктерге сезімталдығын тексеру кіреді. Зерттеу нәтижесінде ауылшаруашылық өнімдерінен бөлінген грамоң штамдардың 19,05 %-ы және

грамтеріс штамдардың 26,09 %-ы төзімділік немесе көп төзімділік қасиеттерін көрсететіні анықталды. Сонымен қатар грамоң микроорганизмдердің 58,28%-ы және грамтеріс микроорганизмдердің 59,42 %-ы да төзімділік немесе көп төзімділік қасиеттерін көрсетеді.

Кілт сөздер: антибиотикке төзімділік, эпидемиология, санитарлық микробиология, құсшаруашылығы, тамақ қауіпсіздігі.

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Поиск антибиотико-резистентных штаммов грамположительных и грамотрицательных микроорганизмов в продуктах птицеводства

Исследование по поиску антибиотико-резистентных штаммов грамположительных и грамотрицательных микроорганизмов в продуктах птицеводства представляет собой актуальную и важную тему в современной медицине и пищевой промышленности. Антибиотики широко используются в птицеводстве для профилактики и лечения инфекций, однако это также способствует развитию антибиотикорезистентности у микроорганизмов. Целью данного исследования является выявление и оценка уровня антибиотикорезистентности грамположительных и грамотрицательных бактерий, присутствующих в мясе и продуктах, производных от птицеводства. Методы включают в себя анализ образцов продуктов, а именно куриных филе и куриных яиц, на предмет наличия и идентификации резистентных штаммов, а также тестирование их чувствительности к различным антибиотикам. В ходе исследования было выяснено, что 19,05 % грамположительных штаммов и 26,09 % грамотрицательных штаммов, выделенных из продуктов фермерских хозяйств, проявляют свойства резистентности или мультирезистентности. В то же время 58,28 % грамположительных и 59,42 % грамотрицательных микроорганизмов также проявляют свойства резистентности или мультирезистентности.

Ключевые слова: антибиотикорезистентность, эпидемиология, санитарная микробиология, птицеводство, пищевая безопасность.

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