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Prevalence of Causative Agents of Emergent Food Zoonotic Diseases in Animals, Animal Origin Products and Environmental Objects

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Abstract

Data on a degree of the prevalence of the causative agents of the emergent food zoonotic diseases in animals, animal origin products, and environmental objects are given in this article. The results of the research have shown that the largest prevalence of the causative agents of emergent infections is in the poultry (38%), in the meat and meat products (36%), and in the milk products (31%). The emergent pathogens have been found in the washings from equipment, workers' hands, and feeds.

Keywords

Emergent infections; Animal origin products; Food poisoning in environment

Introduction

Manufacture of food products within the modern-day hygienic requirements of quality and safety undermines the comprehensive complex estimation of factors that influence human health. The most significant factor at the initial stage is the microbial contamination of food products with pathogens of so-called emergent infections through the alimentary transmission route [1,2].

According to the literature data, it is known that about 200 diseases are transmitted through food products. At present, there are 18 types of bacteria; 26 types of parasites, including protozoa; 9 groups of viruses, 4 groups of biotoxins, 9 groups of chemical compounds, 3 groups of biologically active substances, different toxic herbs, mushrooms, food additives, etc., which can cause food poisoning in humans [3,4].

The main factors in the transmission of causative agents of emergent infections are products of animal origin (meat and milk), which often are seeded with the microorganisms, which cause food zoonotic diseases. Zoonotic diseases cause a huge economic loss due to animals' failure/inefficiency to provide milk, eggs, and meat; deaths; and expenses involved in veterinary examination, microbiological studies, quarantine, organization of transport and slaughter of sick animals, meat disposal, disinfection, and personnel and environment protection [5].

The specific danger is represented by the food products made from the meat of animals forcibly killed because they were infected with an unrecognized disease. The modern technologies in processing: gentle thermal treatment, heating in microwave ovens, pasteurization in the flow, chemical preservation, and the use of filling-agent-type additives, thickeners, and emulsifiers, without additional thermal processing, facilitate the occurrence of the emergent food zoonotic disease pathogens in products [6,7].

Recently, the situation has been complicated by the fact that many cases of food poisoning of bacterial origin are linked with raw material and products received from clinically healthy animals—but, as bacteria carriers, they are dangerous to humans. Such microorganisms are referred to as facultative parasites, i.e., they can not only live in a warm-blooded organism, but can also be natural inhabitants of the environment. The life cycle of such parasites includes their continuous transfer from the environment into the animal organism where they

function as parasites and their return to the environment where they live as saprophytes [8].

Bacterial contamination with the food zoonosis pathogen occurs across the whole food chain (from the food that was eaten by the killed animals to product consumers).

Several researchers have found that the isolation rate of food zoonosis pathogens from corresponds to the finding rate of these serovars in humans. This fact proves that the epidemiological situation often reflects the epizootic situation and vice versa [9].

All these facts provide new challenges, in particular, for veterinary science and practice, directed to increase the veterinary-sanitary efficiency expertise. In current practice, veterinary specialists pay attention mainly to the sanitary estimation of slaughter products to identify different animal diseases and take measures to ration the use of meat and meat products obtained by slaughtering sick animals [10].

Methods

This work has been done by applying methods used in international scientific practice and has been constantly upgraded based on patent information elaborations.

With an aim to study emergent infection pathogens and food poisoning etiology, the different organs (the liver, spleen, lungs, and lymphoid nodes) taken from healthy and forcibly killed animals were served as the materials for the bacterial study.

The primary selection of cultures has been conducted on the basis of growth characteristics and microscopy of microslides made from separate colonies.

The morphological, cultural, and biochemical characteristics of the cultures have been studied according to common schemes. Identification of the isolated emergent pathogens was done according to the Bergey's Manual [7].

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#	Animal species	Heads examined	Species in isolated culture						Total isolated	
			Salmonella	Escherichia	Listeria	Yersinia	Campylobacter	Staphylococcus		Clostridia
1	Beef cattle	545	72	38	16	1	1	26	4	158
2	Small cattle	460	33	12	18	1	–	15	7	86
3	Pigs	220	36	14	12	4	11	15	4	96
4	Horses	150	6	4	–	–	–	–	–	10
5	Poultry	260	38	17	12	–	17	19	3	106
Total animals examined		1,635	185	85	58	6	29	75	18	456

Table 1: Variants of cultures isolated from agricultural animals and birds

#	Type of object	Samples examined	Species in isolated culture						Total isolated
			Salmonella	Escherichia	Listeria	Yersinia	Campylobacter	Staphylococcus	
1	Meat and meat products	250	91 (36%)	35 (14%)	12 (5%)	1 (3%)	7 (3%)	21 (8.4%)	167
2	Milk products	250	77 (31%)	40 (16%)	12 (5%)	1 (2%)	5 (2%)	74 (29.6%)	209
3	Poultry's meat	250	95 (38%)	60 (24%)	20 (8%)	–	–	17 (7%)	192
4	Egg (content and washings)	100	30 (30%)	15 (15%)	3 (3%)	1 (1%)	–	12 (12%)	61
5	Fish meat	100	6 (6%)	–	–	1 (1%)	–	1 (1%)	8
6	Feed and fodder	50	7 (14%)	4 (8%)	1 (2%)	1 (2%)	–	–	13
7	Washings of milking machines	20	4 (20%)	3 (15%)	–	–	–	6 (30%)	13
8	Washings of workers' hands	20	5 (25%)	2 (10%)	–	–	–	7 (35%)	14
Total samples examined		790	315	159	48	5	12	138	677

Table 2: Variants of cultures isolated from food products and environmental objects

The standard methods of calculation of average numbers and average errors will be used for processing the math results.

The scientific studies under the project were conducted in the scientific–diagnostic laboratory of Kazakhstani–Japanese Innovation Center and the anti-bacteriologic laboratory of Kazakh National Agriculture University.

Results and Discussion

We have conducted the epizootological and epidemic statistical analysis of the prevalence of the emergent pathogens amongst animals and people all over Kazakhstan during 2012-2014 and this analysis certifies the annual broad dissemination of emergent infections (salmonellosis, colibacillosis, listeriosis, yersiniosis, clostridiosis, etc.) amongst animals and human population.

It was found that 350 samples gave positive results for the presence of emergent infection pathogens out of 8,109 samples taken from animals living in regions of Kazakhstan. Mainly, these were pathogens of salmonellosis, colibacillosis, listeriosis, and clostridiosis.

The prevalence of emergent infections amongst people averages 8.1% of 4,020 cases of diseases. More often the disease occurred in the form of acute enteric infection, salmonellosis, dysentery, shigellosis, and enteritis, caused by *Yersinia enterocolitica*.

With an aim to define the degree of emergent infection pathogens' prevalence amongst animals and birds, we have conducted the study of the head region in more than 1,635 animals (545 beef cattle, 460 sheep, 220 pigs, 150 horses, 260 poultry) in the farms of Almatinskaya, Aktyubinskaya, Karagandinskaya, and Southern Kazakhstani regions.

As a result of the studies conducted on the organs of healthy and forcibly killed animals, we isolated and identified the following cultures that are, in certain conditions, capable of causing emergent foodborne infections and toxicoinfections: 185, *Salmonella*; 85, *Escherichia*; 58, *Listeria*; 19, *Yersinia*; 29, *Campylobacter*; 62, *Staphylococcus*; and 18, *Clostridium* (Table 1). Of the total amount of cultures isolated from animals, the majority of emergent-infection pathogens have been found in beef cattle and poultry.

Control over environmental objects plays a significant role in the implementation of the tasks faced by veterinary and healthcare bodies to prevent enteric diseases.

250 samples of raw meat and meat products taken at the slaughter house during a veterinary experiment, 100 fish samples and 100 eggs taken at market, 250 samples of milk and cream from flasks taken directly at milk farms, 50 samples of different feed and fodder, 20 samples of washings from milking machines, and 20 samples of washings from workers' hands (milkmaids) of agricultural complex (Table 2) were studied.

As a result of the studies conducted on food products and environmental objects, the following cultures were isolated and identified: 315, *Salmonella*; 159, *Escherichia*; 48, *Listeria*; 5, *Yersinia*; 12, *Campylobacter* and 138, *Staphylococcus*. The results of the research have shown that the highest prevalence of the emergent food infections pathogens is in poultry (38%), in meat and meat products (36%), and milk products (31%). The emergent pathogens have been found in the washings from the equipment and workers' hands, and feeds. Detection of the emergent pathogens in food products and workers' hands is the direct indication to organize and carry out the focused complex actions

for preventing the ways by which pathogens spread in cattle breeding complexes—the suppliers of the products.

From the results of studies on 1,635 samples of different organs from healthy and forcibly killed animals and poultry, we have isolated and identified the following 456 cultures that are, in certain conditions, capable of causing the emergent foodborne infections and toxicoinfections: 185 (40.6%), *Salmonella*; 85 (18.6%), *Escherichia*; 58 (12.7%), *Listeria*; 19 (4.1%), *Yersinia*; 29 (6.3%), *Campylobacter*; 6 (13.5%), *Staphylococcus*; and 18 (3.9%), *Clostridium*.

Conclusion

From the results of studies on 790 samples of food products and environmental objects, the following 677 cultures were isolated and identified: 315 (46.5%), *Salmonella*; 159 (23.4%), *Escherichia*; 48 (7.1%), *Listeria*; 5(0.8%), *Yersinia*; 12 (1.8%), *Campylobacter*; and 138 (20.3%), *Staphylococcus*. The results of the studies have shown that the highest prevalence of causative agents of emergent infections has been observed in poultry meat (38%), meat and meat products (36%), and milk products (31%). The emergent pathogens were detected in the washings from equipment, workers' hands, and feeds.

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