Original research

Analysis of food poisoning for the period from 2013 to 2023 in Bishkek, Kyrgyz Republic

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Abstract

Objective: Food safety is a fundamental factor in maintaining life and promoting public health. An unsafe product affects the health of the consumer and leads to loss of performance, which amounts to a certain financial expense on the part of the state and the victim.

In this regard, the purpose of this study was to assess the long-term dynamics (2013-2023) of food poisoning in the population of Bishkek, the Kyrgyz Republic.

Methods: A retrospective analysis of foodborne illnesses from 2013-2023 was conducted among the population of Bishkek, Kyrgyz Republic. The main sources of information were official reporting data from the Center for State Sanitary and Epidemiological Surveillance in Bishkek.

Results: Analysis over 11 years showed that 429 cases of food poisoning were registered as a result of the consumption of unsafe food products and dishes prepared in public catering establishments - 54.4%, which amounted to 233 cases; purchased at city retail outlets - 32.4% (139 cases) and prepared at home - 13.2% (57 cases).

Conclusion: The reason for the development of food poisoning among the population of Bishkek was non-compliance with the technological process when preparing dishes and the storage conditions of finished products. The results of laboratory tests for microbiological indicators in the secretions of hospitalized patients (gastric, intestinal and feces lavages) revealed the presence mainly (more than 80% of cases) of biological agents of the *genus Salmonella*, the species of *Salmonella enteritidis*, as well as *E. Coli, Staphylococcus*.

The main sources of foodborne toxic infections among the population of Bishkek are contaminated food products: meat and dairy products, fish and eggs.

Key words: Food poisoning, toxic infections, toxicosis, food products, salmonellosis, botulism

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Introduction

Food poisoning is an acute disease that occurs as a result of consuming food that is massively contaminated with certain types of microorganisms or contains substances of microbial and non-microbial nature that are toxic to the body. Food bacterial toxicosis is an acute disease that occurs when eating food containing a toxin that has accumulated as a result of the development of a specific pathogen. The most common symptoms of food poisoning are nausea, vomiting, abdominal cramps and pain, diarrhea, and fever. The most common causes of food poisoning are *Noroviruses, Salmonella*, and *Clostridia perfringens, Campylobacter* and *Staphylococcus aureus.*

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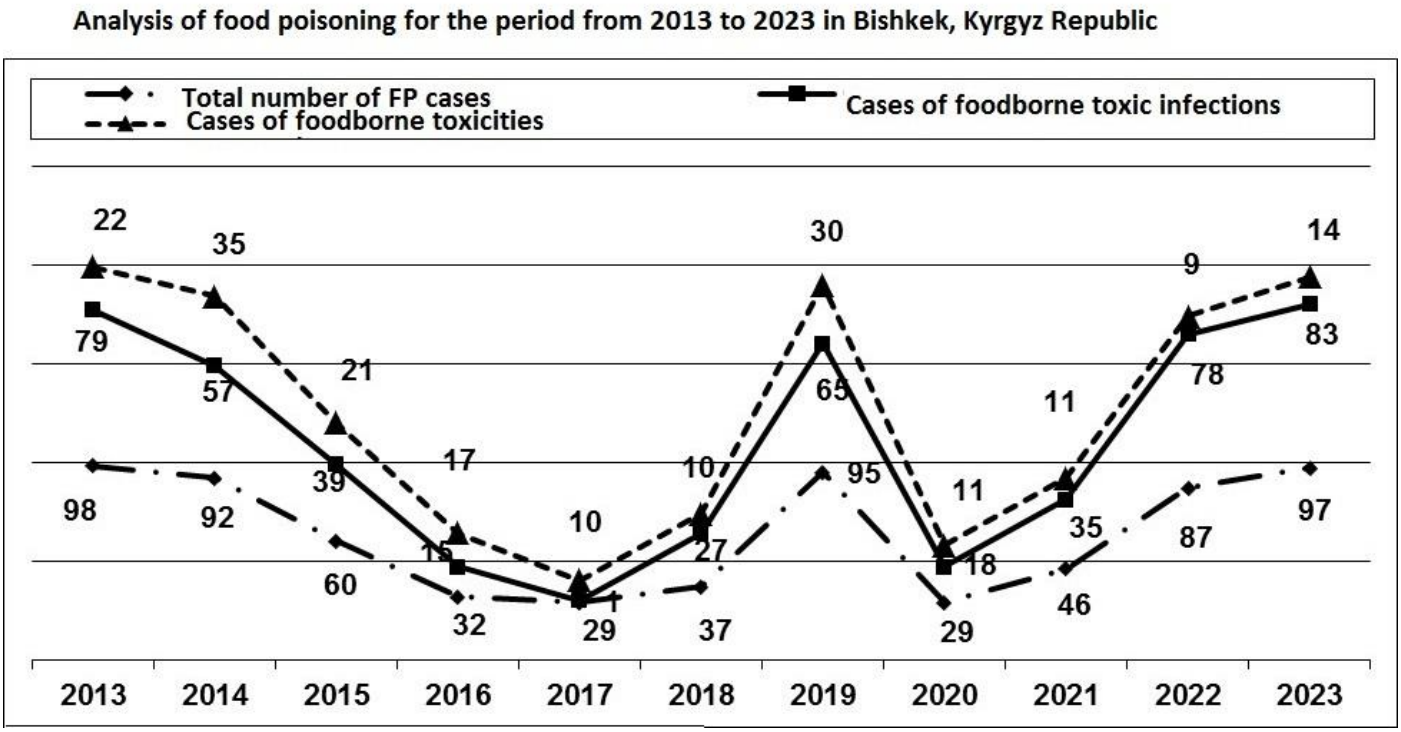
Graphical abstract



In most cases, food poisoning requires hospitalization and can also cause death.

The main food products that cause food poisoning can be eggs, meat, fish and dairy products if sanitary and hygienic requirements are violated when preparing products and dishes from them (1-4).

The food program is one of the main factors influencing the health of the population of the Kyrgyz Republic, which requires state regulation of compliance with the quality and safety of food products at the legislative and economic level. The quality and safety of food products today is a serious issue and problem in the country's healthcare. Despite political and economic changes, research and control of the quality and safety of food products for the population, from both producers and the healthcare system, should pay special attention to compliance with the principle of responsibility. Food safety plays a vital role at all stages of the production chain; violation of this factor leads to food poisoning.

Therefore, food safety is the main factor in maintaining the life and strengthening the health of the population of the Kyrgyz Republic. The activities of sanitary and epidemiological surveillance play an important role in the prevention and reduction of intestinal infections and food poisoning among the population.

In recent years, taking into account national traditions and economic opportunities of the population, catering establishments have begun to be widely used for holding family celebrations and funerals with the invitation of relatives, friends, etc. Overload of public catering facilities leads to the use of ready-made home-cooked meals, semi-finished products, and fast food products (fast foods) when serving the population. In Kyrgyzstan, previously unknown food products and the use of new technological methods for processing meat, fish, vegetables and fruits, milk and dairy products have now become popular. Foods and dishes from other countries of the world (Taiwanese, Indian, Japanese, Chinese, etc.) have also become available in the diet of the population, which may cause non-absorption by the gastrointestinal tract.

Food safety measures based on scientific principles and Codex Alimentarius standards provide an optimal level of health protection and facilitate safe trading, especially the benefits of trading perishable products, including fresh food (5).

In this regard, the purpose of this study was to assess the long-term dynamics (2013-2023) of food poisoning, foodborne toxicities and foodborne toxic infections in the population of Bishkek, the Kyrgyz Republic.

Methods

A retrospective analysis of food poisoning in Bishkek for the period from 2013 to 2023 was conducted. The main sources of information were official reporting data from the Center for State Sanitary and Epidemiological Surveillance in Bishkek. Classification of food poisoning was carried out according to ICD-10.

Inclusion and exclusion criteria

Inclusion criteria: (1) Primary reports on the registration of food poisoning by the Center for State Sanitary and Epidemiological Supervision of the population of Bishkek; (2) Official reporting data on cases of food-related State Sanitary Epidemiology Center in Bishkek; (3) Registers of food poisoning outbreaks in the Ministry of Health of the Kyrgyz Republic for the period 2013-2023; (4) Statistical reporting data from the Center for Electronic Health of the Ministry of Health of the Kyrgyz Republic; (5) All cases of food poisoning were included in the analysis, regardless of the age and gender of the patients.

Exclusion criteria: 1) The analysis does not include cases of food poisoning registered in other regions of the republic. 2) Cases of food poisoning registered before 2013 and after 2023.

Variables

We analyzed total number of exposed to unsafe food and food poisoning cases, mortality and type of toxin, for period of 2013-2023. We also analyzed food poisoning cases according to location of mass poisoning – public catering facilities, trade objects, objects of spontaneous trade and at home and foodborne toxicities and foodborne toxic infections.

Statistical analysis

Statistical processing of the obtained data was carried out using the methods of variation statistics using the Excel 2000 application package (Microsoft Co, 2000; USA) and using the ANALYSIS program (Epi info 6, USA). The generated samples were checked for normality of distribution according to the studied characteristics.

To describe quantitative (continuous variables) indicators, absolute values and percentages were used.

Results

An analysis of the prevalence of food poisoning cases was carried out using materials from primary reports from the Center for State Sanitary and Epidemiological Supervision in Bishkek, registers of food poisoning outbreaks and the Electronic Health Center of the Ministry of Health of the Kyrgyz Republic for the period from 2013 to 2023.

Over the past 11 years, 701 cases of food poisoning have been registered in the hygiene department of the Central State Sanitary Epidemiology Center in Bishkek; the number of victims annually averaged 165 people. As can be seen from Figure 1, the number of victims was highest in 2021, 366 people (20.2%) and in 2018, 324 people (17.8%).

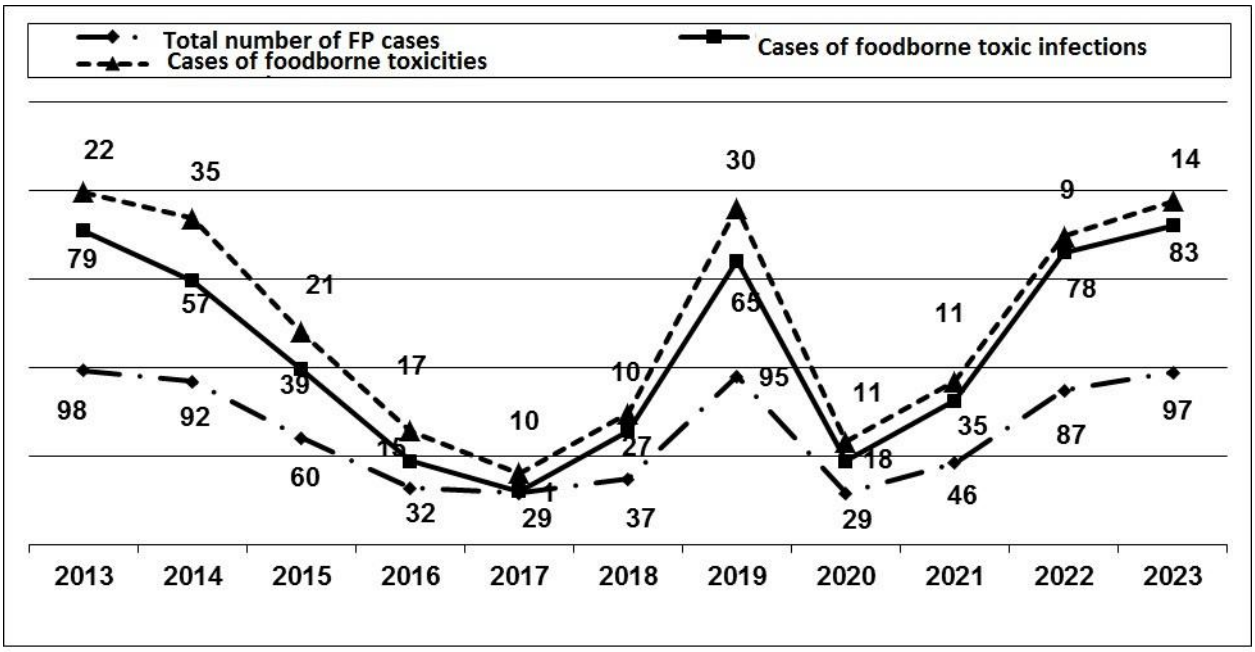


Figure 1. Number of cases of food poisoning in Bishkek in 2013-2023

From 2013 (98 cases) to 2018 (37 cases), there was a significant decrease in cases of food poisoning. And from 2020 (29 cases) to 2023 (97 cases) there was a significant increase.

Scientists of Kyrgyzstan propose to consolidate the principle of responsibility of producers and sellers of food products for their quality and safety. Government authorities must take an active part in regulation, compliance with quality control and food safety (6, 7).

In connection with the above, we studied the dynamics of food poisoning in the population of Bishkek over the past 11 years (from 2013-2023). The results of the analysis of registered food poisoning are presented in Table 1.

Table 1. Dynamics of food poisoning of population, registered in Bishkek (2013-2023)

Period (year)	Number of food poisoning cases	Number of exposed victims	Death, n
2013	98	276	-
2014	92	160	-
2015	60	91	-
2016	32	39	-
2017	29	47	-
2018	37	324	-
2019	95	137	-
2020	29	43	-
2021	46	366	1 (botulism)
2022	87	123	-
2023	97	210	1 (botulism)
Total	702	1816	2 (botulism)

From the presented Table 1 it can be seen that, during the specified period, the number of food poisoning officially reported to medical institutions and registered in the city of Bishkek was 702 cases with 1816 victims. An unsafe product leads to a negative effect on the health of a consumer of working age, loss of working days, payment of sick leave and treatment of the patient, which amounts to a certain financial expense on the part of the state and the victim (Table 1).

According to the classification of food poisoning, the dynamics of the group of foodborne toxic infections and bacterial toxicities were analyzed separately (Tables 2-3).

Table 2. Foodborne toxic infections registered among the population in Bishkek (2013-2023)

Period (years)	Happening poisoning	Total victims (people)	Number of victims (cases)			
			Public catering facilities	Trade objects	Objects of spontaneous trade	At home conditions
2013	76	252	23	30	2	21
2014	57	106	17	19	5	16
2015	39	69	16	20	1	2
2016	15	20	11	1	2	1
2017	19	36	12	6	1	-
2018	27	309	14	12	1	-
2019	65	101	42	20	1	2
2020	18	27	8	8	1	1
2021	35	355	31	4	-	-
2022	78	114	59	19	-	-
2023	83	189	60	23	-	-
Total	512	1589	293	162	14	43

The increase in cases of food poisoning is mainly observed in public catering establishments (Table 2).

Thus, in 2018, 27 cases of food poisoning with 309 victims were identified in Bishkek. Of these, 2 cases of mass food poisoning were identified in the Ala-Too restaurant with 218 victims. The reason for the development of poisoning among the population was non-compliance with the technological process when preparing dishes and the storage conditions of ready-made dishes. Laboratory tests detected the pathogenic intestinal infection *Salmonella enteritidis* in the "Thai Chicken" dish, as well as *E. Coli, Staphylococcus.*

In the restaurant of the Ak-Keme hotel, 42 training participants were injured. The cause of the poisoning was the discovery of *Salmonella enteritidis* in ready-made meals from Lunch Box, a Food House company, prepared at an unauthorized food outlet in a residential apartment.

In 2021, 35 cases of poisoning with 355 victims were identified. These included 2 cases of mass food poisoning at the Pizza Empire catering establishments with 300 victims, where the cause of mass food poisoning was a violation of the technological process for preparing sushi rolls, the use of raw Salmon fish, non-compliance with the sanitary regime at the enterprises and the rules of personal hygiene by staff. The victims noted body temperature (up to 39-40°C), severe pain in the epigastrium and intestines, repeated foul-smelling loose stools and vomiting. The results of laboratory tests for microbiological indicators revealed *Salmonella enteritidis* in raw salmon fish and ready-made sushi rolls. Analysis of the washing waters of the stomach, intestines and feces of hospitalized patients confirmed food poisoning of salmonellosis etiology.

The second case in 2021 occurred in canteen No. 1 with 13 victims; the cause was the use of raw eggs used in the preparation of the "Brizol" dish. During the sanitary inspection of this enterprise, violations of food preparation technology, insufficient heat treatment and non-compliance with sanitary requirements were discovered.

In the above-mentioned food toxic infections, biological agents of the *Salmonella genus, Salmonella enteritidis, Salmonella typhimurium species* were sown in suspected food products and dishes (more than 80% of cases), which was also confirmed in the secretions of patients (stomach, intestinal and feces lavages).

Table 3. Cases of botulism from 2013 to 2023 registered in Bishkek

Period (years)	Cases	Number of victims
2013	22	24
2014	35	54
2015	21	22
2016	17	19
2017	10	11
2018	10	15
2019	30	36
2020	11	16
2021	11	11/1 lethal
2022	9	9
2023	14	21/ 1 lethal
Total	190	238/2 lethal

Among food bacterial toxicities, cases of botulism were analyzed. The analysis revealed that all 190 cases of botulism that occurred at home were associated with the consumption of canned food prepared at home, in violation of the preparation technology and sterilization conditions. When collecting a nutritional history of patients, the consumption of canned eggplants, cucumbers, assorted salad, and tomato seasonings is noted. The rise of the disease occurs in the winter and spring seasons, i.e. for the period of maximum consumption of prepared home-canned food supplies. There were no cases of food poisoning associated with the use of industrially manufactured products or mass cases of botulism, mostly isolated cases with one or two victims.

Discussion

In the cases described in this article, the cause of the development of food poisoning among the population of Bishkek was non-compliance with the technological process when preparing dishes and the storage conditions of finished products. The results of laboratory tests for microbiological indicators in the secretions of hospitalized patients (gastric, intestinal and feces lavages) revealed the presence mainly (more than 80% of cases) of biological agents of the genus Salmonella, the species Salmonella enteritidis, as well as E. Coli, Staphylococcus.

The main sources of foodborne toxic infections among the population of Bishkek were contaminated food products: meat and dairy products, fish and eggs. An analysis of literary sources showed that, according to the World Health Organization (WHO), the main source of foodborne toxic infections are animal products, such as meat, poultry, eggs, and dairy products.

Our findings are in accordance with reported in literature on that most common pathogen was *Salmonella* and reasons not following sanitary hygienic rules (8-22).

There has been an increase in non-typhoidal *Salmonella infections* in months with higher temperatures around the world, as evidenced by the results of studies by scientists in Poland, Latvia, as well as in countries outside the EU, namely the USA, Canada and Australia (7, 9, 10).

Thus, the results of an analysis of food poisoning in Poland for 2000-2017 showed an increase in *Salmonella* infection, which is the main infection of foodborne bacterial gastroenteritis throughout the world. The main route of transmission and spread is fecal-oral from person-to-person through contaminated food. Common symptoms of salmonellosis are abdominal cramps, diarrhea, fever, headache and vomiting, which develop 12 to 72 hours after infection and usually last 4 to 7 days. This infection can be fatal in immunocompromised patients, the elderly and children (11).

Many other scientists also note a seasonal pattern with a pronounced peak in incidents of non-typhoidal *Salmonella* infection in the summer and a minimum incidence in winter (12-14).

According to WHO, non-typhoidal *Salmonellosis* is the leading cause of diarrheal diseases worldwide and causes up to 93 million intestinal infections and 155,000 deaths annually (11).

From December 2014 to April 2015, an epidemiological outbreak of foodborne illnesses occurred in the northern regions of France (41 people were affected), which was associated with the consumption of beef hamburgers contaminated with non-typhoidal *Salmonella* from a Polish manufacturer (11, 15).

According to a 17-year nationwide retrospective cohort study by Taiwanese scientists, non-typhoidal *Salmonella* infection increases the risk of subsequent hematological malignancies in patients over 60 years of age (16). In the United States, approximately 1.35 million illnesses and 420 deaths occur due to nontyphoidal *Salmonella* infections annually, but up to 5,700 cases of *Salmonella typhi* infection have been reported in the United States each year (17, 18).

Russian scientists Tikhonova et al. (12) described that the incidence rate of *Salmonellosis* in the Krasnoyarsk territory is by 74.9% higher than the incidence rate in the Russian Federation. By etiology, group D Salmonella predominates - *Salmonella enteritidis*, the proportion of which in 2018 was 88.8%, while the share of group B *Salmonella* is 33%, group C is 5.1% (12).

During a sanitary and epidemiological investigation of food poisoning in Kazakhstan (19, 20), it was found that ready-made meals served as a factor in their transmission. The cause of which was violations of the sanitary-hygienic and anti-epidemic regimes of food facilities. The products of contamination were quail eggs (38.2%), fruits (28.4%), dairy products (9.9%), chicken meat (9.9%), also ready-made meals, salads, stewed vegetables, salted fish, sushi, while the organoleptic properties of the products were not changed. However, the authors also note positive dynamics in the sanitary and epidemiological situation, i.e. decrease in incidence compared to 2010: botulism -by 4.3 times, *Salmonellosis* - by 35.6%, viral hepatitis A - by 31.1%. According to the authors, the reason for the high incidence of intestinal infections in the population is the lack of understanding by government agencies and the private sectors of their missions in the field of health protection (19, 20).

According to the results of a study by Ukrainian (21) scientists (Nikolaevo), Salmonella were isolated from 11.1% of pig carcasses and 9.1% of cattle carcasses, which, based on serological and biochemical properties, are classified as *S. typhimuzium serovars* (25.0%) , *S.enteritidis* (18.7%), *S.cholera suis* (37.5%) and *Spazatyphi* (18.7%). These results indicate that there is no meat safety control on the market and the meat sold can be a source of foodborne toxic infections of *Salmonella* etiology (21).

Polish scientists note that the incidence of botulism among rural residents was more than twice as high as among urban residents. The incidence in men was 49% higher than in women. The disease most often occurred in middle-aged and elderly people; but the highest incidence was noted in the age groups 40-49 years and 50-59 years. The most common sources of the toxin were home-canned pork and mixed or unknown types of canned meat (22). In our study, similarly source of botulism was home-made canned vegetable products.

Our study, extended knowledge by demonstrating the food poisoning, foodborne toxicities and foodborne toxic infections dynamic for 10-year period, and analysis in parallel mortality; as well as analysis of food poisoning, foodborne toxicities and foodborne toxic infections according to location and type of source.

Study limitations

Our study has several limitations as being retrospective in nature and focusing only population of Bishkek city. Future larger prospective studies are needed.

Conclusion

Thus, in order to reduce food poisoning, strengthening public health education regarding the storage and consumption of food remains a priority. Centers for state sanitary and epidemiological surveillance need to strengthen control over compliance with sanitary and hygienic standards and rules for the preparation and sale of food and ready-made meals in public catering and trade establishments.

Ethics: Ethics committee approval is not required for retrospective studies.

Peer-review: External and internal

Conflict of interest: All other authors declare no competing interests.

Authorship: D.J.B., M.K.E., F.A.K., T. A.T., R.M.A., R.G.G., A.M.U., G.K.S., S.K.K., A.D. equally contributed to the study and fulfilled authorship criteria.

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