DOI: 10.5455/msm.2017.29.286-290

Received: 13 September 2017; Accepted: 05 November 2017

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PROFESSIONAL PAPER

Mater Sociomed. 2017 Dec; 29(4): 286-290

Analysis of Food Toxin Trends in the Federation of Bosnia and Herzegovina Over Five Years Period

Salih Tandir¹, Adnan Mujezinovic¹, Suad Sivic², Aida Sivic², Lejla Lihic-Tandir³

¹Faculty of Medicine, University of Zenica, Zenica, Bosnia and Herzegovina

²Institute for Food Safety Zenica, Public Health Institute of ZD Canton, Zenica, Bosnia and Herzegovina

³Cantonal Hospital of Zenica, Zenica, Bosnia and Herzegovina

Corresponding author: prof Salih Tandir, MD, PhD. Medicinski fakultet Univerziteta u Zenici. Travnička cesta 1. Tel +387 32 44 47 80. E-mail: tandirsa@yahoo.co.uk

ABSTRACT

Introduction: Alimentary toxoinfections represent a significant public health problem. Globalization of the market and food production, significant impoverishment of a large part of the population, and traditional approach with food preparation and consumption, cause a significant increase in the rates of population infections around the world. The epidemiological surveillance of the illness occurrence plays a significant role in monitoring and controlling the population's burden of diseases caused by unhygienically prepared and stored food. **Aim:** The aim of the article is to determine the rates and trends of food related diseases in the Federation of Bosnia and Herzegovina. **Results:** The results of the analysis have shown that the rate of illness in the Federation of Bosnia and Herzegovina is declining but is still significantly higher than in developed western countries. Particularly great burden is on the population of the Zenica-Doboj Canton (ZDC), which can be due to the traditional relation to the preparation and storage of food, as well as to the relatively poorer economic situation in ZDC. **Conclusion:** We can conclude that the strengthening of the monitoring system, laboratory capacities, the availability of monitoring guides will enable responsible FBiH/ Bosnia and Herzegovina institutions to better control and implement safer food practice.

Key words: food poisoning, salmonella, epidemics.

1. INTRODUCTION

After consuming hygienically defective food or water, digestive tract diseases may occur, which manifest themselves in the form of acute gastroenterocytosis, which are caused by bacteria and viruses or bacterial toxins. According to the mechanism of action, we can classify them as:

Alimentary infections, which occur after the intake of a sufficient number of live microorganisms that multiply in the digestive tract and thus cause invasive infection;

Toxicoinfections that occur after the introduction of hygienically incorrect food containing living microorganisms into the digestive tract, which those in the digestive tract are multiplied and produce toxins that damage individual organs;

Food poisoning resulting from the ingestion of specific toxins produced by bacteria in contaminated food.

The clinical picture of these illnesses depends on the type and the infectious dose of the pathogen. The infectious pathogen or toxin dose depends on the immunological status of the host and the pathogen's natural pathogen potential (1). An infectious dose is reduced if the pathogen enters the digestive tract by liquid food because it passes very quickly through the gastric barrier or is introduced with food that neutralizes stomach acid (milk or cheese).

Bacteria that cause toxicoinfections first colonize the mucous surface of the digestive tract and then begin production of exotoxins in the intestine. The toxins produced have their toxic effects induced on local cells or tissues, and in some cases, they penetrate the bloodstream and cause systemic disease. Examples of such toxins are cholera toxins produced by *Vibrio cholerae*, enterotoxin by *E.coli* and *Clostridium perfringens*. In some cases, toxins kill polymorphonuclear leukocytes, which helps develop and spread bacteria by developing a gas gangrene as with *Clostridium* species. Bacteria produce two types of toxins. Exotoxins are secreted into the environment or they are released by the lysis of bacteria such as Botulinum toxins or Shiga toxins. Endotoxins are part of the cellular structure of bacteria and are released only when bacteria are destroyed. Some

Canton	2010		2011		2012		2013		2014	
	N	Mb	N	Mb	N	Mb	N	Mb	N	Mb
Una-Sana	23	7.99	21	7.30	24	8.34	7	2.43	7	2.44
Posavina	3	7.59	0		0		0		0	
Tuzla	60	12.02	63	12.62	31	6.21	16	3.21	41	8.21
Zenica-Doboj	486	121.46	382	95.53	368	92.12	231	57.94	233	58.57
Bosnia-Podrinje	0		0		0		0		0	
Middle Bosnia	9	3.54	26	10.24	5	1.97	10	3.95	11	4.36
Herzegovina-Nertva	21	9.32	14	6.22	15	6.68	15	6.68	5	2.23
West Herzegovina	1	1.23	1	1.23	3	3.68	1	1.23	0	
Sarajevo	69	15.80	178	40.57	199	45.15	165	37.27	126	28.32
Canton 10	0		0		0		0		0	
FBiH	672	28.75	685	29.30	645	27.58	445	19.04	423	18.10

Table 1. Toxiinfectio alimentaris (infectious food poisoning unknown cause), number of diseased and morbidity per 100,000 inhabitants, in the period 2010 -2014 in the Federation of Bosnia and Herzegovina.

toxins are labeled as enterotoxins because they are responsible for bowel diseases, such as cholera toxin or toxin of *E. coli*. Cytotoxins are responsible for cells or tissues damage, such as neurotoxins, leukotoxins, hepatotoxins, cardiotoxins.

The clinical picture of the disease depends on the bacteria and its toxin, on virulence and infectious dose, and about the immunological status of the host. By bacterial action infection occurs, due to the presence of toxins, symptoms of intoxication of various organic systems appear. They can range from mild gastrointestinal disorders with bloody stool, nausea and vomiting to profuse bloody stools, stomach cramps, explosive frequent vomiting, neurological, cardiological, and neuromuscular disorders all up to death. Often there is a general infectious syndrome, such as fever, thrombosis, general weakness and diffuse pain (2). Epidemiological studies indicate that there is a trend in the USA, the United Kingdom and Europe showing a rise in the incidence of digestive tract disease caused by hygienically improper food, or food contaminated by pathogenic bacteria and their toxins (3). According to FoodNet data, it was estimated that in the USA, between 2000 and 2007, there were 47.8 million of these diseases per year (16,000 per 100,000 inhabitants), 3,037 of whom died (1 case per 100,000 inhabitants) (4).

In France, the rate is 1,210 cases per 100,000, while the rate in Australia is similar to one in the United States. In Great Britain each year, about one million people suffer from food toxin infections, about 20,000 are hospitalized and about 500 cases have lethal outcome. Every year, the treatment of these diseases and the consequences of illness in the United Kingdom cost £ 1.5 trillion (5).

To establish etiologic diagnosis, it is necessary to isolate and identify the pathogens. However, in most cases it is not possible to determine the etiological diagnosis, but it is based on clinical criteria that define a certain disease, and most common are diarrhea, stomach pain, fever and vomiting. In cases where we suspect an infectious agent that can cause illness in more persons, epidemiological surveys examine the existence of epidemiological criteria: human-to-human

Figure 1. Toxiinfectio alimentaris (infectious food poisoning, unknown cause), morbidity, in the period 2010 -2014 in the Federation of Bosnia and Herzegovina.

transmission, exposure to a common source, animal trans-plantation, exposure to the environment, exposure to contaminated food or drinking water.

Epidemiological surveillance in the Federation of Bosnia and Herzegovina is based on compulsory reporting of contagious diseases (Law on Protection of the Population from Infectious Diseases, Official Gazette FBiH No. 29/05 and the Ordinance on Communicable Infectious Diseases, FBiH Official Gazette No. 101/12).

The health institution and the private practitioner submit the report of the communicable disease to the competent cantonal institute for public health, which groups data and sends it to the Public Health Institute of the Federation of Bosnia and Herzegovina. The Epidemiology Department of the Public Health Institute of FBiH continuously collects and analyzes the trends of infectious diseases in the Federation of Bosnia and Herzegovina, evaluates the epidemiological situation, evaluates prevention and suppression measures and transmits relevant data to the Federal Ministry of Health, Ministry of Civil Affairs, which unifies data for Bosnia and Herzegovina, and report to ECDC and WHO.

Toxiinfectio alimentaris, belong to the group of intestinal infectious diseases and are listed on the list of 84 contagious

Canton	2010		2011		2012		2013		2014	
	No d.	Mb	No d.	Mb	No d.	Mb	No d.	Mb	No d.	Mb
Una-Sana	14	4.86	25	8.69	18	6.25	13	4.52	19	6.61
Posavina	0		0		0		0		0	
Tuzla	22	4.41	19	3.81	17	3.41	13	2.61	18	3.61
Zenica-Doboj	35	8.75	13	3.25	12	3.00	17	4.26	65	16.34
Bosnia-Podrinje	3	9.11	0		0		0		0	
Middle Bosnia	16	6.29	11	4.33	8	3.15	6	2.37	13	5.15
Herzegovina-Nertva	35	15.54	48	21.34	27	12.02	27	12.03	36	16.07
West Herzegovina	8	9.82	18	22.11	6	7.36	5	6.13	4	4.91
Sarajevo	220	50.39	246	56.07	202	45.83	136	30.72	89	20.01
Canton 10	13	16.18	9	11.27	1	1.26	8	10.15	17	21.69
FBiH	366	15.66	389	16.64	291	12.45	225	9.63	261	11.17

Table 2. Salmonellosis, in period, 2010-2014, number of affected and morbidity per 100,000 inhabitants, in the Federation of BiH

Year	0-6		7-14		15-24		25-49		50-64		65->		Unknown	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
2010	53	64	74	62	56	72	73	84	42	32	20	36	4	
2011	79	92	69	53	68	66	84	83	28	27	14	16	4	2
2012	58	47	48	53	86	76	88	66	35	34	20	28	4	2
2013	40	37	28	25	44	53	61	70	25	27	16	19		
2014	30	31	29	22	48	48	62	56	31	32	14	18	2	

Table 3. Toxiinfectio alimentaris (contagious food poisoning, unknown cause), by sex and age in the period 2010 -2014 in the Federation of Bosnia and Herzegovina

diseases that must be reported. Most often, the cause is not proven, and according to the Act and the Ordinance are reported as: Toxiinfectio alimentaris, Cause is not proven and Salmonellosis.

2. GOAL

Identify the number of reported food toxicoinfections and salmonellosis in the Federation of Bosnia and Herzegovina and by cantons from 2010 to 2014;

Calculate rates of illness per 100,000 inhabitants and determine the trend of disease progression.

3. MATERIAL AND METHODS

This is a descriptive, analytical, epidemiological, retrospective study, which analyzes the collected data from the FBiH Public Health Institute for reported cases of food toxicoinfections and salmonellosis, grouped by cantons for the period from 2010 to 2014. Also presented are reported epidemics of food toxicoinfections and salmonellosis for the aforementioned period.

Statistical analysis

The material was processed by calculations for descriptive analysis. The rates of illness per 100,000 inhabitants were calculated, and the results were presented in tables suitable for comparison and on charts showing the relationships and trends of the cases.

4. RESULTS

A list of registered cases of food poisoning (Toxiinfectio alimentaris) in the period from 2010 to 2014, in the Federation of Bosnia and Herzegovina. In the period, 2010-2014, a

total of 2870 cases of contagious food poisoning have been reported to the Public Health Institute, the cause of which is unknown (Toxiinfectio alimentaris). The highest morbidity was registered in 2011 (29.3/10000) and the lowest in 2014 (18.1/10000) (Figure 1)

Table 1 shows that the highest number of patients with the highest morbidity per 100,000 inhabitants was registered during the observed years at the ZDC with the highest number in 2010 and amounted to 121.4‰

The majority of patients are registered in the Sarajevo Canton, the number of patients ranging from 89-246‰ of the population with the morbidity of 20,01‰ to 56,07‰

By presenting the results in Table 3, we notice that there is no difference in morbidity in relation to gender, while there is a marked increase in disease in the age group of 25 to 49 years.

Table 4 shows a more frequent occurrence of salmonella in a child's age from 0 to 6 years. There is no difference in morbidity compared to the sex of the respondent.

A total of 11 epidemics of contagious food poisoning were reported. Epidemics were reported in Una-Sana, Zenica-Doboj and Sarajevo Cantons. The largest number was reported in 2010 (6 epidemics).

Table 5 shows that the largest number of reported epidemics caused by food poisoning were recorded in 2010, a total of 6 epidemics.

5. DISCUSSION

Alimentary toxoinfections represent a major public health problem, which imposes the establishment of acceptable standards in the chain of production, control, distribution and use of food products. These are the result of hygieni-

Year	0-6		7-14		15-24		25-49		50-64		65->		Nepoz.	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
2010	62	52	37	23	16	11	30	48	16	32	15	22		2
2011	40	36	20	18	22	21	75	83	17	24	15	17	1	
2012	45	50	32	11	21	12	28	31	14	21	8	18		
2013	52	32	19	16	14	12	19	23	8	13	6	10		1
2014	46	40	29	15	27	11	28	21	10	10	6	17	1	

Table 4. Salmonellosis in period, 2010 - 2014, by age and sex, in FBiH

Year	Illness	Patient no	Died	Onset date	Municipality	Canton
2010	Toxiinfectioalimentaris	6		17.2.2010	Zenica (household)	Zenica-Doboj
	Toxiinfectioalimentaris	3		4.6.2010	Velika Kladuša (household)	Una-Sana
	Toxiinfectioalimentaris	17		28.6.2010	Zenica (Prevent doo.-factory restaurant)	Zenica-Doboj
	Toxiinfectioalimentaris	4		23.8.2010	Bihać-Izačići (household)	Una-Sana
	Toxiinfectioalimentaris	4		23.8.2010	Cazin (Konzum-mall)	Una-Sana
	Toxiinfectioalimentaris	5		4.11.2010	Bihać (household)	Una-Sana
2011	Toxiinfectioalimentaris	86		28.5.2011	Stari grad (private restaurant)	Sarajevo
2012	Toxiinfectioalimentaris	33		8.4.2012	Ilidža- restaurant "Panera"	Sarajevo
	Toxiinfectioalimentaris	8		7.7.2012	Ilidža-Fast food "Bistro"	Sarajevo
2014	Toxiinfectioalimentaris	4		10.1.2014	Ilidža	Sarajevo
	Toxiinfectioalimentaris	33		27.8.2014	Zenica	Zenica-Doboj

Table 5. Registered food poisoning epidemics in the FBiH/BH area, period 2010-2014. *2013 there was no food poisoning epidemics

cally incorrect preparation, storage and consumption of food products. Hygienic defective paths can be due to the tradition, ignorance or lack of certain technologies, i.e. the socioeconomic inability to comply with acceptable standards in relation to food products.

As a result, epidemiological surveillance of the occurrence of these diseases is very important both as a condition indicator and as an alarm to take certain activities to eliminate unwanted factors and take preventive action. For the purpose of epidemiological surveillance of the situation in FBiH, the Act on the Protection against Infectious Diseases stipulates that every case of a food-borne illness must be recorded (reported) in the control chain at health facilities. Salmonellosis is reported as a particular clinical entity. Analyzing data from the FBiH Public Health Institute we found that in the period 2010-2014 was reported a total of 2870 cases of contagious food poisoning, the cause of which is unknown (Toxiinfectio alimentaris). The highest morbidity was registered in 2011 (29.3/10000), and the lowest in 2014 (18.1/10000) (Figure 1). A total of 11 epidemics of contagious food poisoning were reported. Epidemics were reported in Una-Sana, Zenica-Doboj and Sarajevo Canton. The largest number was reported in 2010 (6 epidemics). The analysis of laboratory-isolated pathogens reveals that among the iso-

lated pathogens, salmonella is most common. Although the number of reported laboratory infectious pathogenic agents cannot be directly compared with the number of reported cases of illness (cloning, repeated trials), laboratory results confirm that the low incidence of some etiologic entities is not the consequence of low reporting rates (6).

Analyzing the data from Table 1, we can see that the rate of illness is highest in Zenica-Doboj and Sarajevo Cantons and that the rate in Zenica-Doboj Canton significantly decreases from 2010 to 2014. While in the developed western society there has been a noticeable increase in the rate of illness, whether the FBiH has experienced a trend of falling rates due to the global food market or the economic repression of neoliberal capitalist planning (7,8). This downward trend can be explained by the establishment of stronger mechanisms for controlling production, transport and consumption of food by setting standards of European Union in this area. Although there is a trend of decline in food infections in FBiH, the rate of illness is still higher than in the Western European countries.

6. CONCLUSION

- There has been a noticeable decrease in the rate of illnesses in the food caused infections in the FBiH, and

especially in ZDC;

- In FBiH data are analyzed weekly and are presented through monthly/annual Bulletin (web and regular e-mail, Cantonal institutes of public health);
- Data analysis points to routine monitoring weaknesses: complex reporting, weaknesses in reporting, difficulty in obtaining accurate data, weakness of laboratory diagnostics;
- Weaknesses in coordinating activities across different sectors.

Recommendation: Strengthening the monitoring system, laboratory capacities, and the availability of surveillance guides will enable FBiH/BiH to be an equal member of the international network for the control of food infections.

- Conflict of interest: None
- Author Contribution: All authors participated in each step of article.
- Salih Tandir revised it critically and gave final approval of the version to be submitted.

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Current Issue

Amblyopia in Children: Analysis Among Preschool and School Children in the City of Tuzla, Bosnia and Herzegovina

Amra Nadarevic Vodencarevic, Vahid Jusufovic, Meliha Halilbasic, Emina Alimanovic, Svjetlana Terzic, Emir Cabric, Alda Driljevic, Mufid Burgic Abstract Aim: This study measured the prevalence of amblyopia in preschool and school children between 4 and 15 years of age in Tuzla, Bosnia and Herzegovina and as well to examine its relations with anisometropia and strabismus...

October 2, 2017

Assessment of Hygiene Habits in Acrylic Denture Wearers: a Cross-sectional Study

Georges Aoun, Elie Gerges Abstract Objectives: To assess the denture hygiene habits in a population of Lebanese denture wearers. Materials and Methods: One hundred and thirty-two (132) patients [71 women (53.8%) and 61 men (46.2%)] wearing their acrylic dentures for more than two years were included in this study. The hygiene methods related to their...

October 2, 2017

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ISSN: 15986-597X (Online)

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