



American Journal of Medical Science and Innovation (AJMSI)

ISSN: 2836-8509 (ONLINE)

VOLUME 4 ISSUE 1 (2025)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Food and Water Safety in Crisis Situations in Bosnia and Herzegovina – Public Health Challenges and Perspectives

Mirsad Malkić^{1*}

Article Information

Received: September 24, 2025

Accepted: December 03, 2025

Published: July 22, 2026

Keywords

*Bosnia, Crisis Situations,
Food Safety, Herzegovina,
Public Health, Water Safety*

ABSTRACT

The purpose of this paper is to examine public health risks related to food and water safety during crisis situations in Bosnia and Herzegovina, with an emphasis on identifying the dominant contamination pathways, institutional limitations, and priority actions for strengthening the system. A review of relevant scientific and professional literature published between 2013 and 2024, covering both domestic and international sources shows that microbiological and chemical contamination, the effects of climate change, and deteriorated infrastructure represent the major threats to population health. The findings point to the need for a more comprehensive and integrated risk management approach based on international guidelines and standards (HACCP, WSP), modernization of existing systems, and improved intersectoral cooperation. Ensuring food and water safety in emergency contexts should be viewed as a unified public health objective requiring coordinated institutional action.

INTRODUCTION

Food and water safety represent essential components of public health and serve as fundamental indicators of a country's overall development and resilience. During emergencies such as natural disasters, infectious outbreaks, technological accidents, or armed conflicts, these systems become exceptionally vulnerable. Any disruption in their stability can rapidly escalate into serious health consequences and jeopardize the functioning of public health services. According to the World Health Organization (WHO), an estimated 600 million people globally suffer from foodborne diseases each year, leading to more than 420,000 deaths attributable to the intake of contaminated food. At the same time, over two billion individuals rely on drinking water that does not meet minimum safety standards (WHO, 2017).

During crises, more than 80% of infectious diseases are directly associated with unsafe water, inadequate sanitation, and contaminated food sources. In such conditions, various factors—including interruptions in supply chains, infrastructural damage, contamination of water sources, and reduced operational capacities of inspection and monitoring bodies—significantly elevate the risk of food- and waterborne infections. Microbiological hazards (bacteria, viruses, parasites), chemical pollutants (pesticides, heavy metals, mycotoxins), and structural failures within distribution systems can severely compromise the safety of these essential resources. Additionally, inadequate waste disposal, the use of unprotected or temporary water sources, and insufficient coordination among health institutions, local authorities, and utility services further intensify these risks (Turčić, Stranjik & Jozić, 2018; Vlaški & Orašanin, 2016).

Bosnia and Herzegovina faces pronounced vulnerabilities in this area due to its complex administrative structure,

aging infrastructure, and limited institutional capacity. Past crisis events—such as the major floods in 2014 and 2024, the COVID-19 pandemic, and recurring disruptions in water supply—have repeatedly demonstrated that cooperation between the health sector, civil protection, and municipal services is often fragmented and insufficiently synchronized (Bešić *et al.*, 2013; Ibrahimagić *et al.*, 2018).

A considerable portion of the water supply network is several decades old, which increases the likelihood of system failures, leakage, and secondary contamination. Furthermore, the absence of a unified framework for monitoring food safety complicates timely detection and control of contamination sources (Lazić, Jovanović & Milovanović, 2024).

Given these circumstances, strengthening the resilience of food and water supply systems in crisis conditions becomes essential. A clearer understanding of contamination mechanisms, institutional weaknesses, and priority public health risks is crucial for designing effective strategies. These strategies must combine the efforts of the health sector, environmental protection, civil protection structures, and local government, ensuring coordinated management of resources vital for protecting population health.

Literature review

Management of food and water safety in crisis situations requires a comprehensive, integrated approach that includes risk assessment, timely communication, strengthening institutional cooperation, emergency planning, and public education. International organizations and regulatory bodies—such as WHO, UNDP, the European Environment Agency (EEA), and the World Bank—emphasize that water and food safety can be effectively maintained only through preventive

¹ University of Sarajevo, Faculty of Health Studies, Bosnia and Herzegovina

* Corresponding author's e-mail: mirsad.malkic@fzs.unsa.ba

management models, such as Water Safety Plans (WSP), food safety systems, and defined crisis protocols. These mechanisms ensure the continuity of safe resource supply even under conditions where institutions are under pressure or when critical infrastructure experiences disruptions (European Environment Agency, 2020; UNDP Sarajevo, 2019).

This literature review aimed to identify the dominant public health risks, institutional gaps, and priority measures for improving the management of food and water safety in crisis situations in Bosnia and Herzegovina. Special emphasis was placed on analyzing existing scientific studies, professional documents, and reports addressing regional experiences and practices in Southeast European countries.

The literature analysis shows that crises related to natural disasters, extreme weather events, epidemiological incidents, and infrastructure failures are particularly hazardous due to the increased risk of microbiological and chemical contamination, as well as the reduced capacity of institutions to conduct routine monitoring. Numerous studies highlight the importance of assessing the vulnerability of public health systems and continuously monitoring food and water safety in order to prevent outbreaks and mitigate health impacts on the population.

Relevant international reports further underline the importance of managing climate - related risks, as climate change affects the frequency of floods, droughts, and water contamination, as well as the stability of food supply chains. In crisis conditions, the need for coordination between the health sector, water management, civil protection, and local government becomes particularly critical - representing one of the key challenges in Bosnia and Herzegovina.

Regional literature - including sources from Bosnia and Herzegovina, Croatia, and Serbia-provides valuable insights into the specific characteristics of local water supply and food control systems, as well as their level of alignment with international standards such as HACCP, Codex Alimentarius, and WSP. These sources highlight that countries in the region share similar challenges: aging water networks, limited laboratory capacities, and a shortage of qualified personnel managing crisis - related risks.

The literature review concluded that the combination of outdated infrastructure, climate change, insufficiently developed monitoring systems, and fragmented institutional responsibilities makes the food and water safety system in Bosnia and Herzegovina particularly vulnerable. Therefore, it is essential to establish integrated strategies that link the health sector with other key institutions to ensure greater resilience and better preparedness for future crises.

MATERIALS AND METHODS

This non-experimental, qualitative study employed a systematic and comprehensive review of available

scientific and professional literature to identify public health risks associated with food and water safety in crisis situations, with a particular focus on Bosnia and Herzegovina and the broader Southeast European region. The literature search was conducted electronically through relevant databases, including PubMed, Scopus, and Google Scholar, and was supplemented with domestic sources such as national laws, strategies, reports, projects, and documents from institutions responsible for public health, food safety, water supply, and crisis management. The study focused on publications addressing the following topics: public health risks of food- and waterborne diseases during crises, microbiological and chemical safety of food and water, the impact of climate change and natural disasters on water supply and the food chain, institutional and infrastructural challenges in Bosnia and Herzegovina and neighboring countries, and strategies for prevention and risk management in emergency situations.

English-language keywords were used to guide the search, including: foodborne diseases, water supply, crisis situations, climate change, public health, food safety, Bosnia and Herzegovina. The search covered publications from 2013 to 2024 to capture current knowledge and experiences while also including earlier studies relevant to the historical context of crises in the region.

Special attention was given to works and reports authored by researchers from Bosnia and Herzegovina, Croatia, and Serbia to ensure insight into local specificities, current practices, infrastructural challenges, and the degree of alignment with international standards and recommendations, including those from WHO, EFSA, UNDP, EEA, and the World Bank.

The analysis of the collected literature followed a qualitative approach, identifying key themes, patterns, and findings related to food and water safety in crisis situations. The primary objective of this analysis was to determine the main public health risks, institutional gaps, and priority measures for improving the management of food safety and water supply systems under crisis conditions in Bosnia and Herzegovina.

The research objectives of this study were to: analyze available scientific and professional sources on food and water safety in crisis situations in Bosnia and Herzegovina, identify the main public health risks and causes of food- and waterborne illnesses, assess institutional and infrastructural weaknesses within relevant systems, compare national practices with international standards, propose recommendations to enhance public health preparedness and risk management under crisis conditions.

RESULTS AND DISCUSSION

The analysis of available literature on food and water safety in crisis situations in Bosnia and Herzegovina and the wider Southeast European region reveals consistent patterns of risks, contamination sources, and institutional challenges. Crisis events-including floods,

droughts, armed conflicts, and pandemics-directly impact the quality and availability of food and water, thereby affecting population health.

Microbiological contamination is the most documented and dominant public health risk during crises. The primary foodborne pathogens reported are *Salmonella* spp., *Escherichia coli* (particularly enterohemorrhagic strains), *Listeria monocytogenes*, and *Campylobacter* spp. (Bešić *et al.*, 2013; Ibrahimagić *et al.*, 2018). In water systems, particularly rural networks and wells lacking continuous monitoring, microbiological risks are notably high. During periods of heavy rainfall and flooding, microbial concentrations increase significantly, with *E. coli* detected in up to 40% of water samples in certain cantons of Bosnia and Herzegovina (Ibrahimagić *et al.*, 2018). The 2014 floods in Bosnia and Herzegovina were associated with increased gastrointestinal infections linked to food and water contamination (Lazić *et al.*, 2024). Similar trends were observed in Croatia and Serbia, with higher rates of diarrhea and suspected food- and waterborne poisoning during crises. Contributing factors include poor hygiene conditions, interruptions in drinking water supply, and limited oversight of the food chain.

Chemical contamination constitutes another significant risk. Floods and landslides can mobilize heavy metals (arsenic, lead, cadmium) and pesticides from contaminated soils, industrial areas, and storage sites, introducing them into watercourses and the food chain (Bonacci *et al.*, 2019; Vlaški & Orašanin, 2019). Elevated levels of these contaminants have been detected in surface waters and agricultural crops following floods. Long-term exposure to such substances is associated with increased risks of cancer, liver and kidney damage, and cardiovascular diseases. In Croatia and Serbia, extreme rainfall events were also linked to higher mycotoxin levels in maize and cereals (Jakovljević, 2016), illustrating the interplay between climatic and food-related risk factors.

Physical contamination occurs frequently due to damage to storage facilities, water networks, and food processing sites. Foreign objects such as glass, metal, and plastic have been documented in humanitarian food packages and during crisis-related food distribution (Ibrahimagić *et al.*, 2018). In Bosnia and Herzegovina, aging pipelines and insufficient infrastructure maintenance further elevate contamination risks, as network age and water losses directly influence system vulnerability (Turčić *et al.*, 2018). A critical issue in Bosnia and Herzegovina is fragmented institutional responsibility. Competencies are divided among state, entity, and cantonal levels, complicating coordination, data sharing, and implementation of international standards such as Codex Alimentarius (HACCP), and Water Safety Plans (WSP). Limited laboratory capacities and surveillance resources exacerbate system vulnerability (World Bank, 2023; European Environment Agency, 2020). The implementation of WSPs remains partial, while Croatia and Serbia have demonstrated more effective integrated risk management approaches. Cross-border initiatives, such as cooperation

in the Drina River Basin, illustrate how joint risk management enhances resilience and response to climatic and hydrological challenges (UNDP, 2023).

In Bosnia and Herzegovina, public health risks from food and water arise from a combination of climate change, aging infrastructure, insufficient monitoring, and fragmented institutional structures. An integrated approach to managing food and water safety is essential to reduce risks and strengthen community resilience. Recommended measures include: strengthening laboratory and surveillance capacities, modernizing water and sanitation infrastructure, mandatory application of HACCP and WSP standards, establishing a unified coordination and information-sharing system, continuous education of health professionals and the public on contamination risks and integrating food and water safety into crisis preparedness plans. Experiences from neighboring countries indicate that systematic application of international standards, development of crisis plans, and investment in preventive infrastructure substantially reduce public health consequences (UNDP, 2023).

Overall, food and water safety in crisis situations are inseparably linked. Contamination of one resource often compromises the other, while shared factors - such as climate change, institutional inefficiency, and insufficient monitoring - exacerbate population vulnerability. Developing an integrated risk management system connecting the health, municipal infrastructure, civil protection, and environmental sectors is critical for reducing risks and enhancing public health security.

CONCLUSION

The literature analysis indicates that both the food control system and the water supply system in Bosnia and Herzegovina are exposed to significant public health risks during crises. Microbiological and chemical contamination represent the most common and hazardous threats, particularly during natural disasters, epidemics, and infrastructure disruptions. Climate change intensifies these risks by increasing the frequency of floods, droughts, and pollution events, thereby directly affecting food and water safety. Shared challenges include weak institutional capacities, fragmented responsibilities, insufficiently developed crisis plans, and limited laboratory and inspection resources. Bosnia and Herzegovina needs to strengthen an integrated risk management system linking health authorities, civil protection, municipal services, and institutions responsible for food and water safety.

Key interventions include: implementation of international standards (HACCP, WSP), modernization of infrastructure and laboratories, reduction of water losses, control of chemical and microbiological contaminants and education of the population and professionals.

Regional experiences demonstrate that a preventive, cross-sectoral, and integrated approach significantly mitigates public health consequences and improves

community resilience. Ultimately, food and water safety in crisis conditions are interdependent domains of public health. Their joint improvement is essential for protecting populations and promoting sustainable development in Bosnia and Herzegovina.

REFERENCES

- Bešić E, Obradović Z, Pašalić A, Žilić S. (2013). Microbiological composition of untreated water during different weather conditions. *J Health Sci.* 3(1):34-9. DOI: <https://doi.org/10.17532/jhsci.2011.103>
- Codex Alimentarius Commission. (2020) General Principles of Food Hygiene. Rome: FAO/WHO;2020.URL:<http://ngfrepository.org.ng:8080/jspui/handle/123456789/5547>
- European Environment Agency. Climate change, impacts and vulnerability in Europe 2020. Luxembourg: Publications Office of the European Union; 2020. DOI: 10.2800/48006
- European Food Safety Authority (EFSA). Food safety and crisis management. *EFSA Journal.* 2020;18(6):1-25. DOI:10.2903/j.efsa.2022.7215
- Ibrahimagić A, Bašić D, Idrizović A, *et al.*, (2018). Epidemiology of food poisoning in Zenica-Doboj Canton, Bosnia and Herzegovina. *JSM Clin Cytol Pathol.* 72(4):266-72. DOI: 10.24018/ejmed.2025.7.4.2348
- Jakovljević D. (2016). Assessment of water quality during the floods in May 2014, Serbia. *Geogr Inst Jovan Cvijić SANU.* 66(1):1-13. DOI: <https://ojs.gi.sanu.ac.rs/index.php/zbornik/article/view/228>
- Lazić M, Jovanović N, Milovanović M. (2024). Building reservoirs as protection against flash floods and flood basins management: the case study of the Stubo–Rovni regional water-management system. *Water.* 16(16):2242. URL: <https://www.mdpi.com/2073-4441/16/16/2242>
- Turčić I, Stranjik M, Jozić R. (2018). Food safety risks in crisis situations. Split: University of Split; 2018. DOI:10.5772/intechopen.73687
- Vlaški D, Orašanin G. (2019). The analysis of the effects of IWA methodology application on water supply systems in Bosnia and Herzegovina. *Technical sciences archive.* 1(20):47-57. DOI: <https://doi.org/10.7251/afts.2013.0508.041V>
- UNDP. (2019). Assessment of disaster risk reduction in the Western Balkans. Sarajevo: UNDP. URL: <https://www.undp.org/bosnia-herzegovina/projects/disaster-risk-reduction-sustainable-development-bosnia-and-herzegovina-phase-ii>
- World Bank. (2023). Flood protection and climate adaptation for the Drina River Basin. Washington, DC: World Bank. URL: <https://www.worldbank.org/en/results/2023/08/24/flood-protection-and-climate-adaptation-for-the-drina-river-basin>
- WHO. (2017). Guidelines for drinking-water quality. 4th ed. Geneva: World Health Organization. URL: <https://www.who.int/publications/i/item/9789241549950>