Retrospective epidemiological study of foodborne illnesses during the period 2013-2024 in the southwestern Algerian region

HAMANI Zineb[1]*, BOULANOUAR Ali[1], BENLARBI Larbi[1], SAHEL Nafissa[1], GUENAIA Abdelkader[1]

[1]laboratory for the valorization of biological resources and food safety, BP 417, University of Bechar, Algeria

HAMANI Zineb, Teacher Lecturer, biology department, Tahri Mohamed University of Bechar, Algeria,

Mail ID: hamani.zineb@univ-bechar.dz

BOULANOUAR Ali, Teacher Lecturer, biology department, Tahri Mohamed University of Bechar, Algeria,

Mail ID: boulanouar.ali@univ-bechar.dz

BENLARBI Larbi, Teacher Lecturer, biology department, Tahri Mohamed University of Bechar, Algeria,

Mail ID: Benlarbi.larbi@univ-bechar.dz

SAHEL Nafissa, Teacher Lecturer, biology department, Tahri Mohamed University of Bechar, Algeria,

Mail ID: nafissa.sahel@univ-bechar.dz

GUENAIA Abdelkader, Teacher Lecturer, biology department, Tahri Mohamed University of Bechar, Algeria,

Mail ID: guenaia.abdelkader@univ-bechar.dz

Corresponding author: HAMANI Zineb hamani.zineb@univ-bechar.dz

ABSTRACT

Background: Collective foodborne illnesses (CFI) are a growing concern due to their frequent increase, public anxiety, potential health deterioration, and potential impact on a population's life prognosis.

Aim: The objective of this research is to present the epidemiological profile of foodborne illnesses in the wilaya of Bechar over atwelve-year period.

Methods: We conducted an epidemiological and retrospective study of poisonings recorded in southwestern Algeria during the period from 2013 to 2024, using data collected from the Directorate of Health and Population.

Results: The commune of Bechar records half of the cases of CFI, the other most affected communes are Abadla (32%) and Beni Abbés (12.37%).Thus, significant fluctuations are recorded from one year to another, with a peak in 2024, where the incidence rate stands at103.12 cases per 100000 inhabitants.With a sex ratio M/F of 33.36, the male sex is predominant and associated with the age group between 16 and 35 years. The assessment of the severity of cases is based on the hospitalization rate of patients, which reaches82.70%, and the mortality rate, which is approximately0.2%. Minced meat tops the list of perishable food products incriminated with 96% of reported cases, followed by Cachir and cheese; with the exception of a single episode, the pathogen has not been identified in almost all cases.

Conclusion: Food poisoning cases can be minimized by implementing preventive measures and increasing public awareness, promoting better hygiene standards and increased adherence to prevention recommendations.

Keywords: Collective Food Poisonings, Bechar, Descriptive Analyses

---

How to Cite: HAMANI Zineb, BOULANOUAR Ali, BENLARBI Larbi, SAHEL Nafissa, GUENAIA Abdelkader, (2025) Retrospective epidemiological study of foodborne illnesses during the period 2013-2024 in the southwestern Algerian region, *Journal of Carcinogenesis*, *Vol.24, No.9s*, 456-464.

---

1. INTRODUCTION

Food provides pleasure and well-being, but it also poses health risks due to potential contamination by pathogens throughout production, processing, transport, and handling.The environment can play a role in food contamination; it is the cause of approximately 24% of global deaths(1). Given its chemical complexity, food is particularly susceptible to contamination from both environmental and industrial origin (2). This complexity stems from various food components, processing methods, and contaminants such as heavy metals and pesticides, heightening food safety concerns. Effective risk assessment, management, and communication are essential.

Foodborne infections can cause epidemics that are challenging to manage and may be classified as emerging diseases. They may even be involved in a malicious situation (3). Food poisoning, a common foodborne illness, results from consuming food contaminated by pathogenic microorganisms, their toxins, non-microbial agents, or chemical toxins (4). This acute poisoning is characterized by multiple symptoms, primarily affecting the digestive system, from the same contaminated food source.The most common clinical manifestation of foodborne illnesses includes transient gastrointestinal symptoms like nausea, vomiting, diarrhea, abdominal cramps, and stomach pain (5). Additionally, food toxicity can lead to long-term illnesses such as kidney and liver failure, cancer, neurological disorders (6), and psychiatric disorders (7), significantly impacting disability and mortality.

Foodborne illnesses (FBIs) are common and closely linked to community food hygiene. They represent a permanent threat to public health and socioeconomic development.Worldwide, approximately 600 million people fall ill annually from contaminated food, a significant issue also affecting Algeria (8). Foodborne illnesses are categorized as communicable diseases that necessitate mandatory notification to health authorities per the Ministerial Decree of November 17, 1990 (9). This framework demonstrates the authorities' dedication to collecting precise epidemiological data to track and reduce incidence, particularly during summer, when these illnesses pose a significant public health threat.

Foodborne and waterborne diseases are notably more prevalent in Africa, where foodborne illness incidence and mortality rates are high (10). Developing countries face a fourfold higher risk of food poisoning compared to developed nations(11), attributed to weaker public health systems. In Algeria, the National Institute of Public Health (12) reported a nearly doubling of collective food poisoning cases from 12.73 to 23.64 per 100,000 inhabitants between 2022 and 2024.

Food poisoning significantly risks consumer health, motivating a study to define the epidemiological profile of collective food poisoning cases in Bechar over twelve years. The study aims to reduce morbidity and mortality associated with this issue and to identify related risk factors, utilizing a survey of the Directorate of Health and Population of Bechar's archives.

2. MATERIALS AND METHODS

The objective of this study is to study the risk of foodborne illness in the population of Bechar through a retrospective, descriptive epidemiological investigation of foodborne illness cases recorded in the province of Bechar over a period of 12 years and to formulate recommendations based on scientific evidence for CFI surveillance and prevention.
In this study, after reviewing and analysingCFI files, we aim to answer the following questions:
• What is the prevalence of foodborne illness in the province of Bechar?
• Which age groups are most affected in the population?
• What is the most critical time of year and requires more precautions?
• What are the most implicated foods in CFI?
• What are the most common germs?
• What are the most common outbreaks?
• What are the factors that cause foodborne illnesses?

Study methodology:
Data collection
This study was conducted by processing data collected from the Department of Health and Population (DHP) of the Bechar Province during a period from January 1, 2013, to December 31, 2024. The DHP provided us with statistics based on reports of cases of collective foodborne illnesses in the province.

Study variables
The files consulted include data allowing the analysis of several epidemiological parameters, such as:
- Geographic distribution (municipalities).
- Temporal distribution (annual).
- Number and characteristics of the poisoned patient (gender, age)
- Characteristics of the food in question (product family)

- Severity of cases (type, progression and clinical signs, hospitalisation, death)
- Factors contributing to GIAC (causative germ or pathogen)

Data processing and analysis

We performed statistical data processing and analysis using Microsoft Office Excel 2019. The results were compiled and presented in the form of tables and histograms.

General information on the wilaya of bechar

Geographic location

The Wilaya of Bechar is considered the largest wilaya in southwestern Algeria, with an area of 161,400 km^2, ranking 6th overall among the country's wilayas. The vastness of the territory and the dispersion of its populations increase the distances between localities. It is located in the western Algerian Sahara, bordered to the east by the wilaya of El Bayadh, to the west by the Kingdom of Morocco, to the north by the wilaya of Naama, and to the south by the wilayas of Adrar and Tindouf.

Demographic distribution

The population of the entire wilaya was estimated at 267,308 inhabitants in 2014, then increased to 353,591 inhabitants in 2020, with a density of 2.19 inhabitants/km².

3. RESULTS

Geographic distribution

Analysis from 2013 to 2024 indicates that collective foodborne illness cases were reported in only 8 out of 21 municipalities, with a total of 1170 cases (figure 1). The study indicates that CFI rates vary significantly across municipalities, cases of CFI are more frequent in the commune of Abadla with 1761 cases per 100,000 inhabitants, followed by the communes of Beni Abbès and Bechar with 902 and 304cases per 100,000 inhabitantsrespectively.The lowest notification rates are noted in Kerzaz and Tabelbala, at 125.44 and 103.44 cases per 100,000 inhabitants, respectively.
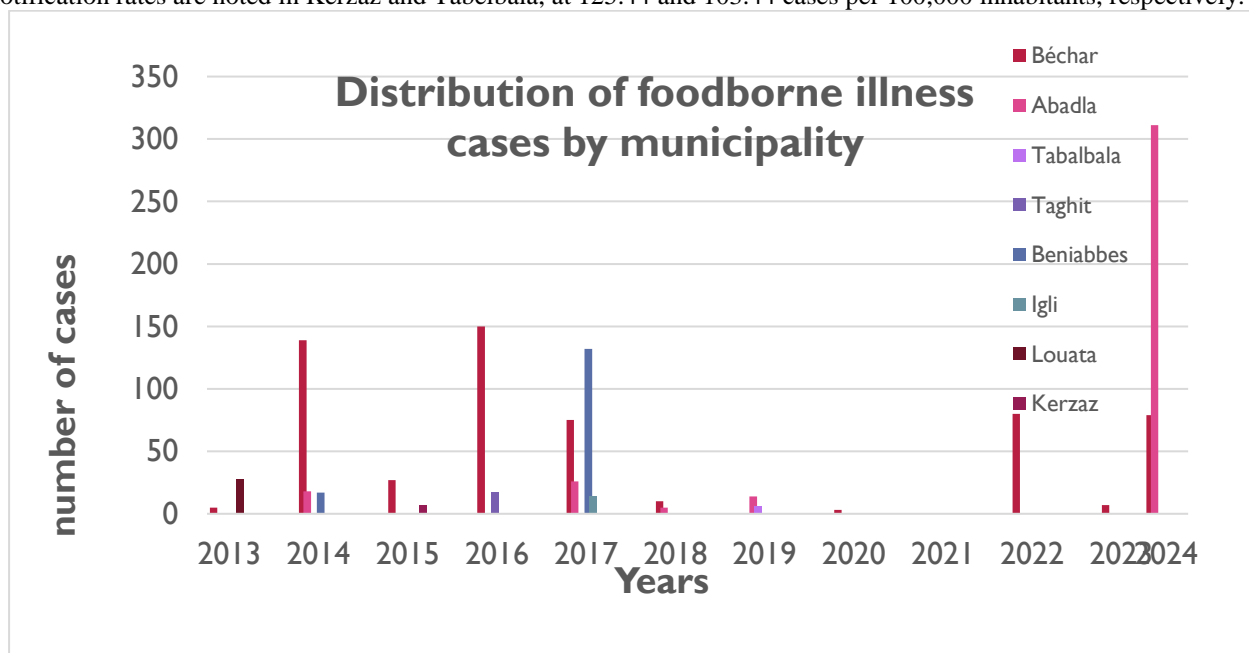

Figure 01 Distribution of foodborne illness cases by municipality

During the study period, comparisons were made with national incidence rates of collective foodborne illness (according to data published by the National Institute of Public Health from 1993 to 2023), foodborne illnesses in our region reached very high rates: 164.45 cases per 100,000 inhabitants versus 250.43 cases per 100,000 inhabitants.

Temporal distribution

During the first five years of the study, the incidence of CFI at the wilaya level was higher than that at the national level, and the reverse was true for the following five years (figure2).
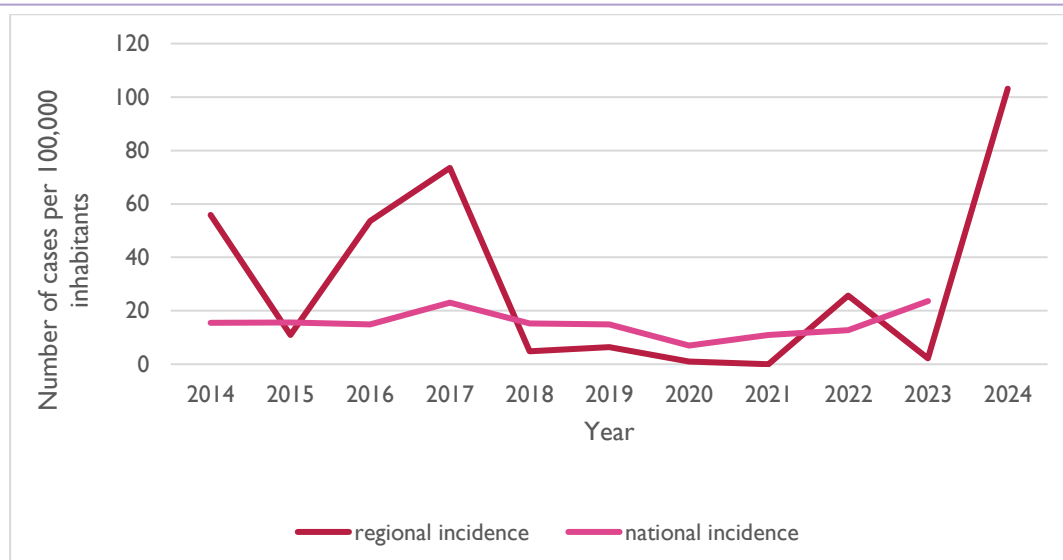
Figure 02: Changes in the annual incidence of CFI at the national and regional levels during the period from 2013 to 2023

According to the annual trend in foodborne illness incidence in the province of Bechar, significant fluctuations in foodborne illness rates are observed from one year to the next. Four epidemic waves were recorded: the first was noted in 2014 with an incidence of 55.86 cases per 100,000 inhabitants; the second peak occurred in 2017 with a frequency of 73.43 cases per 100,000 inhabitants, and in 2022 and 2024, the number climbed again, with 25.68 and 250.38 cases per 100,000 inhabitants respectively, continuing the trend observed before the emergence of the Covid-19 pandemic.

Due to lack of data, the study of the following parameters only covers the last five years.

Demographic distribution
Gender
Regarding general data, the distribution of CFI cases by sex, analysis of the distribution of cases by sex reveals that the number of CFI incidents reported among men was 466, representing 97. 08%, while among women it was 14 cases, representing 2.91%. Males predominate, with an M/F sex ratio of 33.36.

Age group
According to figure 03, the age group between 16 and 20 years is the most affected by CFI, followed by the age groups 21-25, then 31-35, with clear decreases in the other age groups.
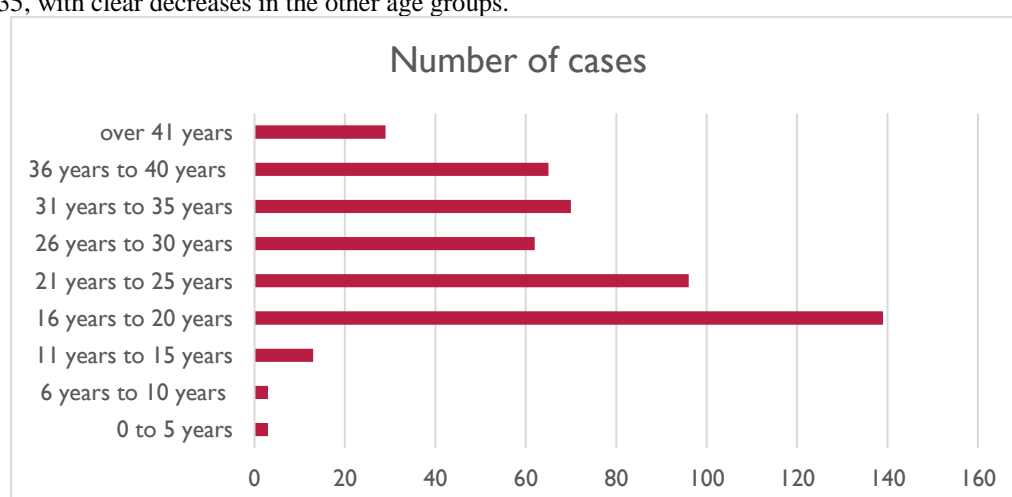
Figure 03: Distribution of CFI by Age Group

The most vulnerable age group is 16-35 years, with 76.45% of those poisoned being between 20 and 40 years old. On the other hand, the lowest-risk category is those under 10 years old, and those over 40 are less affected.

Severity of cases

The severity of CFI is generally assessed based on the hospitalisation rate and associated mortality. Therefore, this research involved 397hospitalised patients out of a total of 480 patients, which represents a hospitalisation rate of 82.70%. In addition, one death was recorded, which corresponds to a case fatality rate of 0.2%.

Incriminated foods

Figure 04 shows the distribution of cases of foodborne illness by suspected food. It highlights five types of suspected food in reported cases of foodborne illness, the most significant of which is minced meat, accounting for 96% of reported cases, followed by Cachir and cheese. Drinking water accounted for the lowest number of cases (0.41%).

Figure 04 Distribution by Incriminated Food

Clinical signs

Common symptoms of gastrointestinal disturbances in poisoned individuals include acute gastroenteritis, abdominal colic, vomiting, and diarrhea, with some patients also experiencing asthenia and headaches, depending on the cause.

Causative agent

In the Bechar province, DHP statistics indicate that, with the exception of a single episode, the pathogen was not identified in any all-other recorded episodes, where the laboratory was able to identify coagulase-positive Staphylococcus aureus.Although microbiological food testing can identify specific germs, most have not been confirmed in this study due to the unavailability of control dishes and insufficient laboratory resources.

4. DISCUSSION

Examination of the regional epidemiological profile shows significant variations in food poisoning cases, linked to control challenges and potential underreporting. This raises concerns regarding food safety and security, which are tied to the efficiency of agri-food systems. Underreporting often stems from public and medical personnel's lack of awareness, causing patients to delay reporting until symptoms worsen.

The issue of misjudging food poisoning cases persists even in developed countries. In Belgium, food poisoning surveillance focuses on selecting outbreaks that are widespread, those originating from restaurants, or those linked to social events (13). The number of food poisoning cases reported depends on stakeholder collaboration and patient cooperation.Underreporting and varying reporting methods and diagnostic techniques across countries complicate the comparison of food-related disease incidence rates, particularly in developing nations where these may be lacking (14).

Some Gulf regions experience higher rates of foodborne and waterborne diseases, attributed to varying regulatory standards, local enforcement, educational programmes, and surveillance systems, along with adverse environmental and economic conditions (15).

Enhancing organisation and coordination among health institution stakeholders is crucial for effectively detecting, reporting, identifying causative agents, and tracing the origins of foodborne illnesses.

Between 2013 and 2017, the incidence of CFI in Algeria rose annually, peaking in 2017 at 23.03 cases per 100,000 people. From 2018 to 2020, a downward trend was observed. However, 2023 marked the highest number of food poisoning incidents reported since mandatory reporting began in 1990, following low rates during the Covid-19 pandemic years of

2021 and 2022. In response to the pandemic, Algeria enforced health measures, including social distancing and lockdowns, disrupting many commercial activities and contributing to food poisoning cases. The surge in reported incidents post-pandemic is attributed to enhanced epidemiological investigation efforts by the Ministry of Health.

This difference in frequency between the sexes regarding food poisoning is likely attributed to the location of occurrence, with all cases recorded outside of family homes and women visiting restaurants infrequently.

In the Kenitra region of Morocco, 39.34% of poisoned individuals were female and 66.66% were male (16), similar results are found during the period 2011 to 2020 in the wilaya of Tlemcen (17). however, several epidemiological studies carried out in the wilayas of northern Algeria have shown that both sexes are affected at very similar rates and found no difference between the number of cases reported in men and those reported in women, including the wilaya of Tiaret (18), Bouira(19), Ain Temouchent (20), and Djelfa (21). This may be due to lifestyle, where the trend over the last decade has been toward restaurants instead of home cooking.

The majority of foodborne illnesses are reported in the working population, particularly among adults under 40 years of age, who frequent restaurants and consume dishes prepared under poor hygienic conditions. In contrast, the 0-10 age group experiences fewer foodborne illnesses, likely due to stringent monitoring of the food intended for them.

Our findings are closely consistent with studies carried out in the wilayas of Djelfa(21), Tlemcen (survey from 2011 to 2020)(17) and El Oued (22), which showed that the most affected age group is between 20 and 44 years old.

Our hospitalisation results are significantly higher than those reported in Bouira Province (19), where the rate was 16.31%. In Jijel Province (from 2015 to 2017) (23), the hospitalization rate was 18.8%. According to a study in Morocco, between 2008 and 2017, the hospitalization rate was 32% and the mortality rate was 0.41%, the rate peaked in 2009 (1.04%) (24). In the wilaya of Bejaia, the results of a study over a period of 9 years (2007 to 2015) (25) show that the hospitalization rate is 4%, and no deaths were reported. The authors report that this rate is indeed low compared to the severity of the disease, but it is probably not to be underestimated, as hospitalized patients generally benefit from better exploration than non-hospitalized patients. Results indicate that foodborne incident figures are not entirely accurate due to insufficient reporting, particularly regarding family environments. Many patients decline hospitalization and instead choose traditional treatments with medicinal plants.

Minced meat is primarily linked to gastrointestinal upsets due to factors such as poor restaurant hygiene, high summer temperatures, and inadequate storage practices. Increased consumption of industrial meals and institutional catering necessitates regular monitoring of these establishments, especially those with prior gastrointestinal issues. Each reported case aids in preventing further outbreaks.

Several studies corroborate our results, including research conducted in Tunisia (26), and in France (2022 statistics) (27), as well as statistics from the annual report on cases of food poisoning recorded in Quebec published by the Ministry of Agriculture, Fisheries and Food (MAPAQ) (28) who incriminated meat as the main contaminant with respective percentages of 30.9%,14%, and 29.5%. However, according to the results of the epidemiological study conducted in the wilaya of Bidjaia[28], the foods most often implicated in CFI were: Drinking water (41%), followed by pastries. Our results are similar to those obtained in the province of Tlemcen(29), where investigations confirm that the main foods implicated in reported cases of foodborne illness between 2011 and 2021 were classified as follows: Meat and chicken were the main contaminated foods, accounting for 46.15% of reported cases. Pastries accounted for 27.7%, followed by other foods (dairy products, mayonnaise, cheese).

The majority of food-related outbreaks stem from consuming meat, eggs, milk, and dairy products, which are primary sources of pathogens causing foodborne illnesses. Contamination often originates from animal-based raw materials infected with Salmonella or E. coli, or from environmental sources like Staphylococcus aureus (30). Poor hygiene practices, such as not adhering to food preparation and storage protocols, contribute to the risk, particularly when affected individuals handle food.

Food poisoning diagnosis is uncertain due to imprecise symptoms like fatigue, headaches, and malaise (31). Clinical assessments of foodborne illness can be biased; thus, any suspicion should be treated as an emergency to prevent spread. The detection and reporting of foodborne outbreaks depend on the surveillance system's structure and elements, including case definitions, outbreak types, diagnostic techniques, and food analysis methods, along with standardized laboratory methods between public health and food safety domains (32).

In 2015, the WHO indicated that more than half of the costs of foodborne illnesses stem from diarrheal diseases, affecting

550 million people and causing 230,000 deaths annually. Children are particularly vulnerable, with 220 million affected and 96,000 deaths each year, making them in epicenter of some epidemics. During the study, a 7-year-old child died after presenting diarrhea, vomiting, acute gastroenteritis, and abdominal colic.

In Morocco, from 2008 to 2017, 80% of cases did not have an identifiable causative microbe, while 14% identified agents in food or human samples, with Salmonella, staphylococcus, and fecal coliforms being the most common pathogens detected30.

In Morocco, out of 1,577 cases of CTI in 2001, 96 were directly linked to Salmonella, with another 259 likely attributed as such37. From 2001 to 2012 in the Gharb Chrarda Bni-Hssen region, foodborne illness pathogens were identified through human samples, revealing Staphylococcus aureus in 72% of cases and Clostridium perfringens in 28% (33).

In a study from the Kenitra region of Morocco, 90.70% of cases did not have a determined causative agent 19. Poor hand hygiene in food contact can lead to contamination by pathogenic faecal microorganisms, potentially causing foodborne illnesses. Poor hand hygiene in food contact can lead to contamination by pathogenic faecal microorganisms, potentially causing foodborne illnesses. According to a survey conducted in Kasserine (Tunisia), the pathogens identified were strains of non-typhoidal Salmonella (S. typhimurium, S. enteritidis) and Staphylococcus aureus. He detected this pathogen in three outbreaks, while the presence of Salmonella was observed in seventeen of them (26).

in France, between 2006 and 2008, cases of CFI for which the agent could be identified in the incriminated meal or in a biological sample constituted only 26.5%. In 36.5% of cases, no agent was found or investigated, and in 37% of outbreaks, there was only a suspicion of the causative agent, while cases of salmonellosis constituted nearly half (46.8%) of confirmed outbreaks, with S. Typhimurium accounting for 40% of outbreaks identified as being caused by Salmonella (34).

The failure to identify the microorganism responsible for CFI stems from the medical biologist's lack of sufficient information or expertise, particularly concerning stool samples and key concepts related to foodborne infections (35). Due to the diversity of infectious agents and identification challenges, many toxic infections have unknown or presumed origins.

5. CONCLUSION

Food poisoning from microbial sources poses a significant public health risk, exacerbated by the agri-food sector's expansion and fast-food prevalence. A study analyzing data from southwestern Algeria (2013-2023) highlights trends in foodborne illness outbreaks, identifying implicated foods such as minced meat, Cachir, and cheese. Although reported cases of foodborne illness (CFI) have surged, many remain underreported, necessitating improved reporting and public awareness to enhance data accuracy and epidemic management. Effective identification and prevention depend on advanced monitoring and alert systems, favoring real-time response to outbreaks through rapid detection and predictive modeling.

REFERENCES

[1] World Health Organizaion. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks.[Internet]. https://www.who.int/publications/i/item/9789241565196

[2] Onyeaka H, Ghosh S, Obileke K, Miri T, Olumide A, Odeyemi, Nwaiwu O, Tamasiga P. Preventing chemical contaminants in food: Challenges and prospects for safe and sustainable food production, Food Control 2024; Volume 155, https://doi.org/10.1016/j.foodcont.2023.110040.

[3] Malvy D. Infections and food and waterborne toxic infections. Diagnostic orientation and management approach. EMC (Elsevier Masson SAS, Paris) : Pathologie professionnelle et de l'environnement, 16-087-A-10 ; 2011.[Internet]. https://www.em-consulte.com/article/12912/infections-et-toxi-infections-d-origine-alimentair.

[4] Hernández-Cortez C, Palma-Martínez I, Gonzalez-Avila LU, Guerrero-Mandujano A, Colmenero Solís R, Castro-Escarpulli G.Food Poisoning Caused by Bacteria (Food Toxins). In: Malangu N, Poisoning - From Specific Toxic Agents to Novel Rapid and Simplified Techniques for Analysis. London: IntechOpen; 2017.doi:
   a. 10.5772/intechopen.69953

[5] Sonawane RA, Dhavan YA, Birhade AS, Saknure AP, pawade SL.The Food Posioning. Int J of Novel Resear and Develop 2025;10(3):259-275.https://ijnrd.org/papers/IJNRD2503434.pdf

[6] Almaary KS. Food-Borne Diseases and their Impact on Health. Biosci Biotech Res Asia 2023; 20(3): 745-755. https://doi.org/10.13005/bbra/3129

[7] BoltonDJ, Robertson JL. Mental Health Disorders Associated with Foodborne Pathogens, J of Food Protec 2016; 79(11): 2005-2017.https://doi.org/10.4315/0362-028X.JFP-15-587.

[8] World Health Organizaion. Foodborne Diseases Estimates.[Internet].https://www.who.int/data/gho/data/themes/who-estimates-of-the-global-burden-of-foodborne-diseases

[9] Algeria. Executive Decree No. 22-250 of June 30, 2022. fixing the list of notifiable communicable diseases. Official Journalofthe Algerian Republic No. 47, 2022; 11 July. [Internet]. https://www.joradp.dz/FTP/jo-francais/2022/F2022047.pdf

[10] World Health Organizaion. WHO's first ever global estimates of foodborne diseases find children under 5 account for almost one third of deaths. [Internet].https://www.who.int/fr/news/item/03-12-2015-who-s-first-ever-global-estimates-of-foodborne-diseases-find-children-under-5-account-for-almost-one-third-of-deaths

[11] Ahmed A, AlJamal AN, Ibrahim MIM, Salameh K, AlYafei K, Abu Zaineh S, et al. Poisoning Emergency Visits among Children: a 3 Years Retrospective Study in Qatar. BMC Pediatrics 2015; 15:(104)7. doi: 10.1186/s12887-015-0423-7.

[12] National Institute of Public Health (NIPH), Monthly epidemiological reports'MER': Algeria epidemiological situation for the year 2023 based on cases reported to the NIPH;2023. 31p. [Internet]. https://www.google.com/search?sca_esv=2fb4a8e283a3786e&sxsrf=AE3TifO0ZyCRrYloUrUjQx2hmyOlhnhpuQ:1760091389153&q=efaidnbmnnnibpcajpcglclefindmkaj/https://insp.dz/images/PDF/Epidemio/rem+vol+34_2023.pdf&spell=1&sa=X&ved=2ahUKEwjKhZews5mQAxWmU0EAHWdJPY8QBSgAegQIDhAB.

[13] National Reference Laboratory for Foodborne outbreaks. Annual Report on foodborne outbreaks in Belgium, Sciensano. Numéro de dépôt : D/2021/14.440/71, 2020.[Internet].https://www.sciensano.be/fr/biblio/toxi-infections-alimentaires-en-belgique-rapport-annuel-2020

[14] Food and Agriculture Organisationaf the United Nations.Statistics on Food-borne Illnesses in Europe Microbiological and Chemical Risks.FAO/WHO Pan-European Conference on Food Safety and Quality Budapest (Hongrie), 25-28 February 2002, https://www.fao.org/4/x6865f/x6865f.pdf

[15] Ewen Todd CD. Foodborne disease and food control in the Gulf States. Food Control 2017; Volume 73, Part B: 341-366.doi: 10.1016/j.foodcont.2016.08.024

[16] Elkhal A, Attarassi B, Aujjar N, Jayche S, Lahmam M. Epidemiological study of food poisoning during the period 2001-2018 in the province of Kenitra. E3S Web of Conferences International Congress on Health Vigilance (VIGISAN) 2021;**319**, 01055, https://doi.org/10.1051/e3sconf/202131901055.

[17] Ouared B, Smail M. Studies of collective foodborne illnesses in Tlemcen [thesis]. Tlemcen: Aboubekr Belkaid University - Algeria; 2021.http://dspace.univ-tlemcen.dz/bitstream/112/16680/1/smail_mustapha.pdf

[18] Benhammadi A, Chibani AY. Prevalence and causes of food poisoning [thesis]. Tiaret: Aboubekr Belkaid University - Algeria; 2020. http://dspace.univ-tiaret.dz:80/handle/123456789/7372

[19] Boukarou L, Boulhares Z. Investigation of a foodborne illness outbreak in the Bouira province [thesis]. Bouira: Akli mohandOulhadj University - Algeria; 2018.https://theses-algerie.com/2986933822653410/memoire-de-master/universite-akli-mohand-oulhadj---bouira/investigation-d-une-toxi-infection-alimentaire-au-niveau-de-la-wilaya-de-bouira-

[20] Sekina Mohamed A, Taamourt A,Mohamed Abid Y. Epidemiological profile of collective foodborne illnesses (CFI) in the Ain Temouchent province (Retrospective study 2017-2021) [thesis]. Ain Temouchent: Belhadj Bouchaib University - Algeria; 2022.https://dspace.univ-temouchent.edu.dz/handle/123456789/2646

[21] Guerzou F.Contribution to a descriptive epidemiological study of cases of collective foodborne illnesses (CFI) recorded in the Wilaya of Djelfa (2013 - 2018) [thesis]. Djelfa: Ziane Achour University - Algeria; 2019.http://dspace.univ-djelfa.dz:8080/xmlui/bitstream/handle/123456789/3291/Contribution%20%C3%A0%20une%20%C3%A9tude%20%C3%A9pid%C3%A9miologique%20descriptive.pdf?sequence=1

[22] Ferhat H, Ghrissia Aloui M, Khaldi D,Mehellou S. Study of food poisoning in the El Oued region [thesis]. El Oued: Echahid Hamma Lakhdar University - Algeria; 2022.https://dspace.univ-eloued.dz/items/4ab41a11-bcfd-4fa1-b475-c16af614d7ac

[23] Khelalef K, Khellaf MS. Study of the Epidemiological Profile of Collective Foodborne Illnesses in the Wilaya of Jijel: Case Study [thesis]. Jijel : Mohammed Seddik Benyahia University - Algeria; 2018. http://dspace.univ-jijel.dz:8080/xmlui/handle/123456789/12062?show=full

[24] Haour M. Collective food poisoning, overview (example of Morocco 2008-2017) and focus on the specific case of listeriosis [thesis] Diploma of Doctor of Pharmacy. Rabat : Mohammed V University – Morocco ;2018. http://ao.um5.ac.ma/xmlui/handle/123456789/17029

[25] Adjtoutah M,Mabed S. Contribution to a descriptive epidemiological study of cases of food poisoning recorded in the wilaya of Bejaia (2007 - 2015) [thesis]. Béjaïa: Abderrahmane-Mira university - Algeria; 2016. https://theses-algerie.com/2478016356505250/memoire-de-master/universite-abderrahmane-mira---bejaia/contribution-%C3%A0-une-%C3%A9tude-%C3%A9pid%C3%A9miologique-descriptive-des-cas-de-toxi-infections-alimentaires-enregistr%C3%A9s-au-niveau-de-la-wilaya-de-bejaia-2007-%E2%80%93-2015-

[26]   Hassine KH. Epidemiology of collective food borne diseases in the area of Kasserine. twelve years of follow up (1993-2004). Rev Tun Infectiol 2007, Avril 07, Vol 1, N°2,11 – 15   .
www.infectiologie.org.tn/pdf_ppt_docs/revues/revue2/epidemiologie.pdf, Accessed: April 03; 2025.

[27]   Dilange L, Fournier L, Laurent E, Billecoq I, Jones G, Mathieu Tourdjman, etal. Directrice de publication : Caroline Semaille. Surveillance des toxi-infections alimentaires collectives (TIAC). Données de la déclaration obligatoire, 2022. Édition nationale. Saint-Maurice : Santé publique France ; 2024.https://www.santepubliquefrance.fr/content/download/607637/4207123?version=2

[28]   Ramsay D, Delisle MF. Food Toxi-Infections: April 1, 2013 to March 31, 2014. Quebec Ministry of Agriculture, Fisheries and Food (MAFFQ). Québec.2014. 33 p.https://www.bibliotheque.assnat.qc.ca/DepotNumerique_v2/AffichageFichier.aspx?idf=164998

[29]   BouhassinaFZ, Bendiabdellah R.Bacteriological Profile of Food Poisoning in the Wilaya of Tlemcen[thesis]. Tlemcen, Aboubekr Belkaid university –
Algeria; 2021.http://dspace.univ-tlemcen.dz/bitstream/112/16687/1/BOUHASSINA_BENDIABDELLah.pdf

[30]   Buisson Y, TeyssouR. Collective foodborneillnesses.Rev. francoph. lab, 2002, december 2002, N° 348. https://www.   Yves_Buisson/publication/250703127_Les_toxi-infections_alimentaires_collectives/links/5f1360fe299bf1e548c1a066/Les-toxi-infections-alimentaires-collectives.pdf

[31]   Whiley H, Clarke B, Ross K. Knowledge and attitudes towards handling eggs in the home: An unexplored food safety issue? Int J Environ Res Public Health, 2017;14(1):48. https://www.mdpi.com/1660-4601/14/1/48

[32]   European Food Safety Authority, European Centre for Disease Prevention and Control (ECDC), 2018. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2017. EFSA Journal, 2018;16(12):5500, 262pp. https://www.efsa.europa.eu/en/efsajournal/pub/5500

[33]   Belomaria M, Khadmaoui A. Retrospective Study of the Collective Food toxi-infections in the Region of the GharbChrardaBni-Hssen, Morocco of 2001 to 2012.Nutr and food toxicol 2017; 1(5): 198-204. https://www. net/publication/320010384_Study_of_the_Collective_Food_toxi-infections_in_the_Region_of_the_GharbChrardaBni-Hssen_Morocco_of_2001_to_2012

[34]   Delmas G, Jourdan N, Pihier N, Weill F X, Vaillant V, et al. 2010. Collective food poisoning outbreaks in France between 2006 and 2008. Bulletin EpidémiologiqueHebdomadaire 2010: 31(32) 344-348.https://pasteur.hal.science/pasteur-02047871/document

[35]   Denis F. Diagnosis and control of human food poisoning outbreaks. Bull AcadNatleMéd 2012; 196(8): 1673-1682.
https://www.sciencedirect.com/science/article/pii/S0001407919316929/pdf?md5=6084744be57f3bdf5a08584f98db75a7&pid=1-s2.0-S0001407919316929-main.pdf