Review Article

Impact of Lebanon's Economic Crisis on Food Poisoning: A Study of Demographic Disparities, Knowledge, Attitude and Practice in North Lebanon Community

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ABSTRACT

The ongoing economic crisis in Lebanon has significantly impacted public health, particularly in relation to food safety and foodborne illnesses. This cross-sectional study aims to assess the knowledge, attitudes, and practices (KAP) concerning food poisoning among the North Lebanon community during the crisis. Data were collected from 349 participants aged 18 and above through a structured online questionnaire from March to May 2023. The findings revealed a decline in food safety awareness since the crisis, with only 26.6% of participants reporting being well-informed, compared to 73.4% prior to the crisis. Social media emerged as the primary source of food safety information (75.6%), while healthcare workers were underutilized (16.9%). Dairy products (12.6%) and poultry (11.7%) were identified as the leading causes of food poisoning, particularly from collective catering sources (83.7%). Participants expressed growing concerns over food quality in restaurants (80.5%) and new food brands entering the market (36.1%). Despite heightened public awareness, gaps in food hygiene practices persist, underscoring the need for enhanced food safety education and regulatory oversight. These results highlight the urgent necessity for public health interventions to address food safety risks exacerbated by the ongoing economic challenges in Lebanon.

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Introduction

As defined by the World Health Organization (WHO), and the Centers for Disease Control and Prevention (CDC), food poisoning results from consuming contaminated foods or drinks, leading to symptoms such as nausea, vomiting, diarrhea, fever, abdominal pain, and headaches [1,2]. The severity varies based on the contaminant and individual health. Contamination can occur at any stage from production to storage. Effective food hygiene practices, including proper handling, thorough cooking, and safe storage, are crucial for reducing these risks.

Since 2019, Lebanon has experienced a multi-pronged crisis impacting different sectors in the country. Following Coronavirus disease in 2019, Lebanon has experienced an economic meltdown where it has been reclassified, by the World Bank, as a lower-middle income country [3]. Among the various sectors impacted by the crisis, food poisoning presents a significant concern that could affect the entire country and pose serious risks to societies at large [4].

The study of food poisoning has become increasingly important in Lebanon following the economic crisis [5]. Deteriorating socioeconomic conditions have compromised food quality and safety standards across production, handling, and storage processes. Limited access to healthcare and resources has heightened the population's susceptibility to foodborne illnesses. Investigating food poisoning within this context is vital for developing robust public health strategies, improving food safety regulations, and safeguarding the well-being of Lebanon's population amidst ongoing economic challenges.

Given the economic loads that the Lebanese suffer from, it is crucial to assess the extent of food poisoning in Lebanon, as it poses a direct threat to public health. The current study underscores how the economic crisis has influenced food safety awareness, knowledge and practices, underscoring the need to address these issues comprehensively in Lebanon's current climate.

Materials and Methods
Study Design
This study is an observational cross-sectional study aimed at assessing the population's knowledge and experiences regarding food poisoning during the ongoing economic crisis in Lebanon.

Study Population
The study targeted individuals aged 18 and above, excluding children and adolescents. A total of 349 respondents from various regions in North Lebanon participated in the survey, which was conducted over two months (March–May 2023).

Data Collection
Data were collected using a detailed questionnaire designed to gather information on dietary habits, food sources, symptoms experienced, and reported cases of food poisoning. The questionnaire

was disseminated via Google Forms and distributed through social media channels, ensuring a diverse and representative sample of the Lebanese public.

Questionnaire Structure
The questionnaire consisted of 20 questions, including 13 mandatory and 7 optional, employing closed and semi-closed formats for clear and concise responses. It covered key topics such as food poisoning awareness, contaminated foods, sources of contamination, symptoms, treatments, and testing. The questionnaire for this study was developed by reviewing data from the WHO, as well as the studies by Faour-Klingbeil and Todd and Kharroubi et al. The questionnaire was also available in Arabic [6-8]. A pilot study involving 10 participants, who met the same criteria as those in the main study, was conducted to pre-test the instrument. Feedback from this pilot led to revisions in wording, question order, and answer options, enhancing clarity and structure. Participants showed positive interest in the study topic and found the questionnaire manageable, taking about five minutes to complete.

Data Analysis
The collected data were analyzed using SPSS software, version 25. Descriptive and inferential statistics were applied to assess the population's knowledge and experience with food poisoning and to identify potential trends in the responses.

Results
The study encompassed a diverse demographic, with 73.1% female and 26.9% male participants, evenly distributed across age groups: 43.0% aged 25-50, 40.1% aged 18-25, and 16.9% over 50. Geographically, Batroun led with 42.4% respondents, followed by Koura (12.6%) and Akkar (7.3%).

In terms of awareness about food poisoning and sources of information, our study shows that knowledge was significantly higher before the economic crisis, with 73.4% of respondents being informed, compared to only 26.6% during the crisis. As shown in Figure 1, the primary source of information was social media (75.6%), followed by family and friends (45.6%). Surprisingly, healthcare workers—the most reliable source—were the least utilized, accounting for just 16.9% of the information sources.
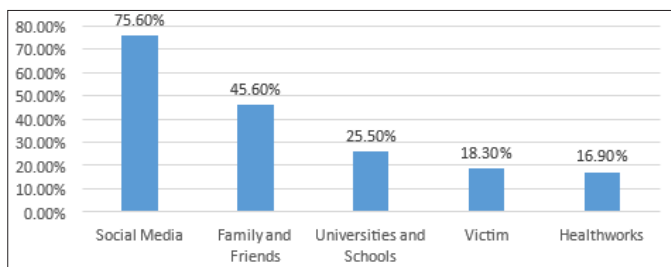

Figure 1: Sources of Information about Food Poisoning

Regarding the perception of impact, 58.7% of respondents anticipated significant effects, with the main causes identified as contaminated water (72.8%) and raw foods (62.2%). In response, common behavioral changes included avoiding foods of unknown origin (65.3%), washing fruits and vegetables (63.3%), and practicing good hygiene, such as washing hands with soap and water (55.6%).

29.8% of participants were contaminated by mainly diary 12.6% and poultry 11.7%. Clinical symptoms like diarrhea (26.1%) and vomiting (21.5%) were common, prompting treatments such as antiemetics (13.5%) and antibiotics (9.7%). The majority of those who were contaminated and infected were not hospitalized (77.9%) with only

22.1% who did actually go to the hospital.

In addition, collective catering presented the main source of food poisoning (83.7%) compared to food prepared at home (16.3%). This result aligned with the opinion of the participants that agreed to the decline of food quality in Lebanese restaurants (80.5%). Public perception implicated new brands in food poisoning (36.1%). Thus, resulted in 40.7% change in the source of food market after the crisis.

Contamination by Specific Food among North Lebanon Residents
A cross-tabulation analyzed contamination by specific food across various regions of North
Lebanon (Table 1). Results varied by region: Batroun (16.9%), Koura (5.2%), Tripoli (4%), Akkar (2%), Minieh Denniyeh (1.1%), Zgharta (0.3%), and Bsharri (0.3%). Statistical analysis found no significant association between residency and contamination by specific food (p = 0.156 > 0.05).

Table 1: Association between Residency and Contamination by a Specific Food

Variable	Yes	No	Total	P value
N (%)				
Residency				0.156
Batroun	59 (16.9)	132 (37.8)	191 (54.7)	
Koura	18 (5.2)	39 (11.2)	57 (16.3)	
Tripoli	14 (4.0)	18 (5.2)	32 (9.2)	
Akkar	7 (2.0)	26 (7.4)	33 (9.5)	
Minieh Denniyeh	4 (1.1)	9 (2.6)	13 (3.7)	
Bsharri	1 (0.3)	14 (4.0)	15 (4.3)	
Zgharta	1 (0.3)	7 (2.0)	8 (2.3)	

Association between Food Types and Intoxication Rates
The study found a significant association between food type and intoxication rates (p = 0.000 < 0.05) (Table 2). Dairy products had the highest contamination rate at 12.6%, followed by poultry at 11.7%, animal products at 9.2%, pastry at 8.6%, seafood at 4.3%, vegetables at 3.4%, and pork at 2.0%. These findings highlight varying levels of contamination across different food categories, influencing the incidence of foodborne intoxication.

Pastry from collective catering sources (27.9%) presented a significant association with contamination (p=0.022) (Table 3).

Table 2: Association between Food Type and Intoxication Rate

Variable	Yes	No	Total	P value
N(%)				
Food type				
Poultry	41 (11.7)	63 (18.1)	104 (29.8)	
Dairy	44 (12.6)	60 (17.2)	104 (29.8)	
Pork	7 (2.0)	97 (27.8)	104 (29.8)	0.000
Pastry	30 (8.6)	74 (21.2)	104 (29.8)	
Seafood	15 (4.3)	89 (25.5)	104 (29.8)	
Animal	32 (9.2)	72 (20.6)	104 (29.8)	
Vegetables	12 (3.4)	92 (26.4	104 (29.8)	

Table 3: Association between Food Type and Origin of the Contaminated Dish

Variable	Food prepared at home	Collective catering	Total	P value
N (%)				
Food type				
Poultry	6 (5.8)	35 (33.7)	41 (39.4)	0.703
Dairy	6 (5.8)	38 (36.5)	44 (42.3)	0.522
Pork	1 (1.0)	6 (5.8)	7 (6.7)	0.879
Pastry	1 (1.0)	29 (27.9)	30 (28.8)	0.022
Seafood	4 4(3.8)	11 (10.6)	15 (14.4)	0.243
Animal	5 5(4.8)	27 (26.0)	32 (30.8)	0.895
Vegetables	4 (3.8)	8 (7.7)	12 (11.5)	0.091

Sources of Knowledge about Food Poisoning across different Age Groups

The study analyzed how different age groups acquire knowledge about food poisoning (Table 4). Social media was not significantly associated with age ($p = 0.297$), but was most used by those aged 25-50 years (33%) and 18-25 years (31.2%). Family and friends also showed no significant age association ($p = 0.120$), being most prevalent among 18-25 years (20.9%). Conversely, universities and schools were significantly age-related ($p = 0.000$), utilized most by 18-25 years (16.6%), followed by 25-50 years (8.0%) and over 50 years (0.9%). Health workers showed a trend ($p = 0.051$) among 18-25 years (9.2%). Brochures and flyers were non-significant ($p = 0.714$), popular with 25-50 years (6.3%). Being a food poisoning victim showed no significant age link ($p = 0.147$), common among 18-25 years (9.2%).

Table 4: Association between Age and Sources of Knowledge

Variable	Social Media N(%)			
	Yes	**No**	**Total**	**P value**
Age groups				
18-25	109 (31.2)	31 (8.9)	140 (40.1)	0.297
25-50	115 (33.0)	35 (10.0)	150 (43.0)	
>50	40 (11.5)	19 (5.4)	59 (16.9)	
Variable	Family and Friends N(%)			
	Yes	No	Total	P value 0.120
Age groups				
18-25	73 (20.9)	67 (19.2)	140 (40.1)	
25-50	63 (18.1)	87 (24.9)	150 (43.0)	
>50	23 (6.6)	36 (10.3)	59 (16.9)	
Variable	Universities and Schools N(%)			
	Yes	No	Total	P value
Age groups				
18-25	58 (16.6)	82 (23.5)	140 (40.1)	0.000
25-50	28 (8.0)	122 (35.0)	150 (43.0)	
>50	3 (0.9)	56 (16.0)	59 (16.9)	
Variable	Health Workers N(%)			
	Yes	No	Total	P value
Age groups				
18-25	32 (9.2)	108 (30.9)	140 (40.1)	0.051
25-50	20 (5.7)	130 (37.2)	150 (43.0)	
>50	7 (2.0)	52 (14.9)	59 (16.9)	
Variable	Brochures and Flyers N(%)			
	Yes	No	Total	P value
Age groups				
18-25	16 (4.6)	124 (35.5)	140 (40.1)	0.714
25-50	22 (6.3)	128 (36.7)	150 (43.0)	
>50	8 (2.3)	51 (14.6)	59 (16.9)	
Variable	Victim N(%)			
	Yes	No	Total	P value
Age groups				

18-25	32 (9.2)	108 (30.9)	140 (40.1)	0.147
25-50	25 (7.2)	125 (35.8)	150 (43.0)	
>50	7 (2.0	52 (14.9)	59 (16.9)	

Analysis of Age-Related Contamination Rates

The study explored the relationship between age groups and contamination rates. Findings showed the highest contamination rate among participants aged 18-25 years (14.3%), followed by those aged 25-50 years (10.3%), and those over 50 years (5.2%). However, statistical analysis indicated that there was no significant association between age group and contamination (p = 0.092 > 0.05).

Analysis of Age-Related Consumption Patterns and Food Contamination Sources

The study analyzed eating habits across different age groups, focusing on the preference for collective catering versus food prepared at home. It found significant disparities: 40.4% of participants aged 18-25 years opted for collective catering, contrasting sharply with 7.7% who chose home-prepared food. Similarly, in the 25-50 years age group, 27.9% preferred collective catering compared to 6.7% for home-prepared meals. Among those over 50 years old, 15.4% favored collective catering, with only 1.9% preferring home-prepared food. Despite these differences, statistical analysis revealed no significant association between age and the source of contaminated dishes (p = 0.734 > 0.05), indicating that age did not impact whether food from collective catering or home preparation was more likely to be linked with contamination.

Relationship between Food Contamination and Perceptions of New Brands in the Lebanese Market

The study found a significant association between experiencing contamination from specific foods and attributing it to new brands entering the Lebanese market (p = 0.001) (Table 5). Among contaminated individuals, a majority (14.9%, n = 52) believed new brands were responsible for food poisoning, while a smaller proportion (14%, n = 49) did not share this belief.

Table 5: Association between Perceived Cause of Food Poisoning from New Brands and Contamination by a Specific Food

Variable	Yes	No	Total	P value
		N (%)		
Perceived Cause of Food Poisoning from New Brands				
Yes	52 (14.9)	74 (21.2)	126 (36.1)	0.001
No	21 (6.0)	49 (14.0)	70 (20.1)	
No idea	31 (8.9)	122 (35.0)	153 (43.8)	

Discussion

The demographic distribution in our study provides valuable insights into food poisoning awareness and experiences in North Lebanon. A significant majority of respondents were female (73.1%), reflecting women's heightened health awareness and central role in household food management. The largest age group was young adults aged 18-25 years (40.1%), followed by those aged 25-50 years (43%) and individuals over 50 years (16.9%). Younger adults showed a higher incidence of food poisoning, likely due to their frequent dining out and exploration of various food venues.

Geographically, our survey in North Lebanon revealed uneven participation rates, with Batroun leading at 42.4%, possibly due to higher population density or better digital access. Conversely, Zgharta (1.8%) and Minieh Denniyeh (2.9%) had lower response rates, indicating regional disparities in survey engagement. Interestingly, residency showed no significant association with food poisoning, highlighting its widespread impact across the region. Comparatively, a recent study by Kharroubi et al, highlighted significant geographical disparities in food safety standards across Lebanon's governorates, with higher rates of rejected food samples in the North and South regions compared to Beirut [5].

Our study identified dairy products (12.6%) and poultry (11.7%) as leading causes of food poisoning, primarily from collective catering settings (83.7%). Similarly, Kharroubi et al, found high percentages of unacceptable samples in these categories across various governorates, underscoring the need for stringent food safety practices [5].

During the economic crisis, 26.6% of respondents reported heightened awareness of food poisoning, reflecting a notable increase in public consciousness. Our findings, consistent with previous studies in Lebanon, suggest Lebanese consumers generally possess a high level of awareness, likely influenced by their educated and health-focused backgrounds [9].

Social media (75.6%) emerged as the primary source of information during the crisis, followed by family and friends (45.6%), underscoring the crucial role digital platforms play in disseminating health-related information. In contrast, educational institutions (25.5%) and healthcare workers (16.9%) played smaller roles in spreading food safety knowledge, despite educational settings significantly influencing food safety awareness among younger adults (p = 0.000). This suggests that schools and universities have great potential to improve food safety education, particularly for youth. To maximize outreach, health departments should integrate social media into their communication strategies. By doing so, they can combine the reliability of healthcare professionals with the accessibility of social media, ensuring that accurate, evidence-based information reaches the public, especially the younger generation who heavily rely on these platforms for their information.

Our study revealed significant insights into participants' perceptions and behaviors regarding food safety. Most participants cited contaminated water, raw foods, and expired foods as primary causes of food poisoning, indicating gaps in public understanding of food handling and hygiene practices. Despite some awareness, misconceptions persisted, including underestimating the risks of storing food at room temperature and the importance of proper hand hygiene. In response, the WHO advocates a comprehensive approach to food safety, emphasizing thorough handwashing before and during food preparation, after using the toilet, and maintaining cleanliness of food preparation surfaces to prevent contamination [1,10]. It is crucial to use separate utensils and cutting boards for raw and cooked foods to prevent cross-contamination. Cooking food thoroughly to safe temperatures is essential for eliminating harmful bacteria, pathogens, and toxins. Properly storing cooked and frozen foods to prevent bacterial growth, and using clean, treated water for food preparation and washing fresh produce are vital steps to reduce the risk of bacterial contamination and promote safer consumption practices overall.

Furthermore, our study aligns with prior research, highlighting Lebanese consumers' concerns about food safety amid the economic crisis [9,8,11]. A significant number of respondents (36.1%) attributed food poisoning incidents to new brands entering the market.

Additionally, 80.5% expressed apprehensions about compromised food quality in Lebanese restaurants during this period, reflecting widespread anxieties over product safety and regulatory oversight. These concerns stem from uncertainties about the quality control of new, cost-cutting products, underscoring broader worries about food safety in an economically challenging environment with potentially weakened regulatory supervision.

Lastly, the economic crisis in Lebanon has exacerbated challenges in water hygiene and electricity supply, particularly affecting infrastructure maintenance. Limited resources for essential services have strained water treatment facilities, risking waterborne diseases due to compromised hygiene standards. Frequent power cuts further disrupt water purification processes, reducing access to clean water. Additionally, inadequate refrigeration from electricity shortages heightens the risk of food contamination in restaurants and homes, contributing to increased incidences of foodborne illnesses. Addressing these public health concerns necessitates comprehensive strategies such as infrastructure investments, rigorous regulatory enforcement, and community education on water and food safety practices.

This study has important limitations. Its cross-sectional design limits our ability to establish causal relationships, highlighting the need for future research using longitudinal designs. The online survey method used to gather our sample may not fully represent Lebanon's population, especially affecting older adults without internet access. Furthermore, reliance on self-reported data introduces potential biases. Despite these limitations, our study offers significant strengths. It provides valuable insights for policymakers and health experts to develop effective strategies for enhancing food safety knowledge and practices throughout Lebanon. The study's large sample size, spanning diverse regions of Lebanon, enhances its reliability and relevance.

This study underscores the complex interplay of demographic factors, geographic disparities, and knowledge sources influencing perceptions and experiences of food poisoning in North Lebanon. By leveraging effective communication strategies, enhancing regulatory frameworks, and promoting comprehensive food safety education, public health efforts can effectively mitigate the risks associated with foodborne illnesses, thereby safeguarding community health amidst economic challenges.

References
1. World Health Organization (2015) WHO estimates of the global burden of foodborne diseases: Foodborne disease burden epidemiology reference group 2007-2015. Geneva: World Health Organization https://www.who.int/publications/i/item/9789241565165.
2. Agency for Toxic Substances and Disease Registry (2022) Case studies in environmental medicine (CSEM) https://www.atsdr.cdc.gov/csem/csem.html.
3. World Bank (2020) Lebanon economic monitor https://documents1.worldbank.org/curated/en/474551606779642981/pdf/Lebanon-Economic-Monitor-The-Deliberate-Depression.pdf.
4. Grace D (2015) Food safety in low- and middle-income countries. Int J Environ Res Public Health 12: 10490-10507.
5. Kharroubi S, Nasser NA, El Harakeh, Sulaiman AA, Kassem II (2020) First nation-wide analysis of food safety and acceptability data in Lebanon. Foods 9: 1-1717.
6. World Health Organization (2008) Foodborne disease outbreaks: Guidelines for investigation and control. Geneva: World Health Organisation https://iris.who.int/bitstream/handle/10665/43771/9789241547222_eng.pdf.
7. Faour Klingbeil D, Todd ECD (2019) Prevention and control of foodborne diseases in MiddleEast North African countries: Review of national control systems. Int J Environ Res Public Health 17: 1-70.
8. Kharroubi S, Naja F, Diab El, Harake M, Jomaa L (2021) Food insecurity pre- and post the COVID-19 pandemic and economic crisis in Lebanon: Prevalence and projections. Nutrients 13: 1-2976.
9. Haidari RE, Fahes F, Makke F, Nouredine F, Baydoun K, et al. (2022) Sociodemographic determinants of knowledge, attitude and practices towards food safety among Lebanese population during the economic crisis: A cross-sectional study. BMC Public Health 22: 1-2329.
10. Morya S, Amoah AEDD, Snaebjornsson SO (2020) Food poisoning hazards and their consequences over food safety. In: Microorganisms for sustainable environment and health. Elsevier 383-400.
11. Hoteit M, Al Atat Y, Joumaa H, Ghali SE, Mansour R, et al. (2021) Exploring the impact of crises on food security in Lebanon: Results from a national cross-sectional study. Sustainability 13: 1-8753.