



A Systematic Review of the Nutritional Consequences of the 2012 East Azerbaijan Earthquake, Iran

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ABSTRACT

Introduction: Concerns about nutrition and food constantly affect different communities following natural disasters. The present study aimed to investigate the nutritional consequences after the East Azerbaijan earthquake in Iran in 2012.

Methods: This systematic review was conducted via searching for relevant surveys in databases such as PubMed, Scopus, Google Scholar, Cochrane Library, ScienceDirect, Web of Science(English studies), Google, Yahoo, and Persian information and library resources (Persian studies) using various keywords. The collected data were analyzed, summarized, and reported manually by content analysis.

Results: Out of 975 studies identified in the scientific databases, 21 were reviewed in order to address the research subject. The consequences of the earthquake were classified into three categories of food safety, food security, and nutritional consequences.

Conclusion: Despite the fulfilled efforts after the 2012 East Azerbaijan earthquake, diverse nutritional problems and consequences have arisen in the community, especially among women and children.

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Introduction

Iran has experienced about 181 disasters, which have led to approximately 160,000 deaths and over 170,000 injuries, affecting more than 44 million people. Iran is one of the most seismically active countries in the world. Over the past century, Iran has undergone more than 20 devastating earthquakes with the overall magnitude of ≥ 6 on the Richter scale, which have led to nearly 500,000 deaths(1).

One of the most destructive earthquakes in Iran during the past decade was the twin earthquakes occurring on 11 August 2012 in East Azerbaijan province, in which 272 villages and nearly 50% of rural healthcare centers were destroyed according to official

reports. In addition, 300 people were killed in this disaster, and the number of the injured victims was estimated to be more than 3,000 (2).

Every natural disaster affects the nutritional status of the people, such as flood, landslides, cyclone, tsunami, hurricane, and earthquake(3). Earthquakes intensely affect the nutritional status of vulnerable groups through direct impacts such as physical injuries and economic problems and indirect impacts such as mental and health difficulties, water resource scarcity, food supply disruption, limited nutrition access (4-7), livestock losses, and food storage mass destruction. Newborns may even suffer from restricted breastfeeding. Therefore, the lack

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of timely nutritional interventions could lead to extremely detrimental nutritional consequences with short-term and long-term effects on the community (8).

Malnutrition has been reported to account for 23% of the pediatric mortalities in displaced populations(9). For instance, formula-fed infants may be exposed to infectious agents due to the consumption of contaminated water to prepare milk(10). Several studies have globally indicated that natural disasters such as earthquakes adversely affect children's growth (11-14). After the 2003 Bam earthquake on Friday December 26, weight and height loss and various nutritional difficulties were observed in children(15).

Several studies were conducted after the 2008 Wenchuan earthquake, indicating that the affected urban and rural areas had more nutritional problems(16, 17). Most of these cross-sectional studies were performed on the small groups that were available in the affected areas, and none extensively evaluated nutritional consequences using comprehensive and systematic approaches. After any incident, a proper understanding of the subsequent nutritional problems is essential as it could contribute to designing effective interventions to prevent disastrous events in the future.

The present study aimed to combine the results of quantitative and qualitative studies using a coherent and integrated approach and identify the consequences of the East Azerbaijan earthquake in terms of the nutritional status of the affected population. We have also provided a comprehensive and clear view of the nutritional consequences of the East Azerbaijan earthquake by comparing and summarizing the results of valid studies and reports in this regard.

Materials and Methods

This study was designed and conducted in 2019 in the form of a systematic review (18).

Literature Search Strategy

Data were collected directly from databases such as PubMed, Scopus, Google Scholar, Cochrane Library, ScienceDirect, Web of Science(English studies), Google, Yahoo, and other Persian information and library resources (Persian studies), such as Magiran, Civilica, SID,

and Iran Medex using various English/Persian keywords based on the objective of the study, including East Azarbaijan OR East Azerbaijan OR Azerbaijan Sharghi OR Ahar OR Haris OR Heris OR Varzequan OR Varzegan OR Varzagan AND Earthquake OR Quake OR Shake. In order to ensure the identification and review of all the published articles in this regard, the references of the relevant articles were also searched. In addition, letters to the editor, conferences papers, and evidenced department reports were selected for the review.

Inclusion Criteria

The inclusion criteria of the study were the organizational reports and papers published during 2012-2019 based on the verified documents on the post-earthquake consequences and malnutrition problems of the affected community.

Exclusion Criteria

The exclusion criteria of the study were the articles focused on the other aspects of the natural disaster, such as geological, social, economic, and physical aspects.

Papers Reporting Quality Evaluation

The quality of the article reports was evaluated after extraction from the searched databases using the mentioned keywords. Following that, the articles were evaluated using in accordance with the checklist of the Strengthening the Reporting of Observational Studies in Epidemiology(STROBE)(18). The checklist consists of 22 items, and we eliminated the items regarding case studies and cohorts. In total, 18 items remained in the survey checklist, which were scored zero, one, and two to show the lack of relevant content to the checklist criteria, intermediate agreement, and complete agreement with the checklist criteria, respectively. The score range of the entire checklist was 0-36, with scores 0-24, 12-24, and 24-36 interpreted as weak, moderate, and favorable, respectively. The primary evaluation process was conducted by two experts on five articles in order to reach consensus. After reaching high consensus, the remaining articles were evaluated by one researcher. Notably, the unclear problems that had to be removed were referred to a second expert with greater skills about the methodology of the research.

The reporting quality of the qualitative articles was assessed by two evaluators in accordance

with the Critical Appraisal Skills Program checklist (CASP) with 10 items; the first two items were intended for screening (Yes/No). Article evaluation would continue if both answers were affirmative. The next eight items should be answered as Yes/No/Not Known based on the opinion of the evaluator (19). Scores three, two, and one were assigned to the Yes, Not Known, and No answers, respectively, and the score range of the checklist was 8-24. Studies without affirmative screening answers were also selected for the review. In case of

disagreement between the two evaluators, a third party would judge.

Data Extraction

A checklist layout was designed manually in Microsoft Word for data extraction, which included data on the authors' names, publication year, sample size, subjects, and study design. Initially, data were extracted from three studies in a pilot study. Afterwards, the observed problems and shortcomings were eliminated from the primary checklist.

Table 1. Data Analysis and Encoding

Code	Parameter
1	Studying article texts (deliberating study results)
2	Primary context recognition and extraction (food safety, food security, nutritional consequences)
3	Article categorization in determined contexts
4	Over viewing and completing final results in each context based on study results in each context
5	Checking contexts and reliability of extracted results in each context (by debating and removing controversies between two researchers during article encoding)

Data Analysis

After data extraction using the designed checklist, data analysis was performed using content analysis, and the data were summarized and reported manually. In addition, thematic analysis was used to recognize, analyze, and report the patterns (themes) investigated in the texts. This methodology has been frequently applied in qualitative data analysis (20-23). In our study, data analysis was carried out by two researchers in order to decrease selection bias.

The main stages of data analysis were reading the extracted texts several times (data immersion), identifying and extracting the basic codes, creating primary themes (classifying the initially extracted code in the created themes), completing and revising the themes, and ensuring the reliability of the codes and themes (reaching agreement between the two coders). Table 1 shows the analysis and data encoding processes.

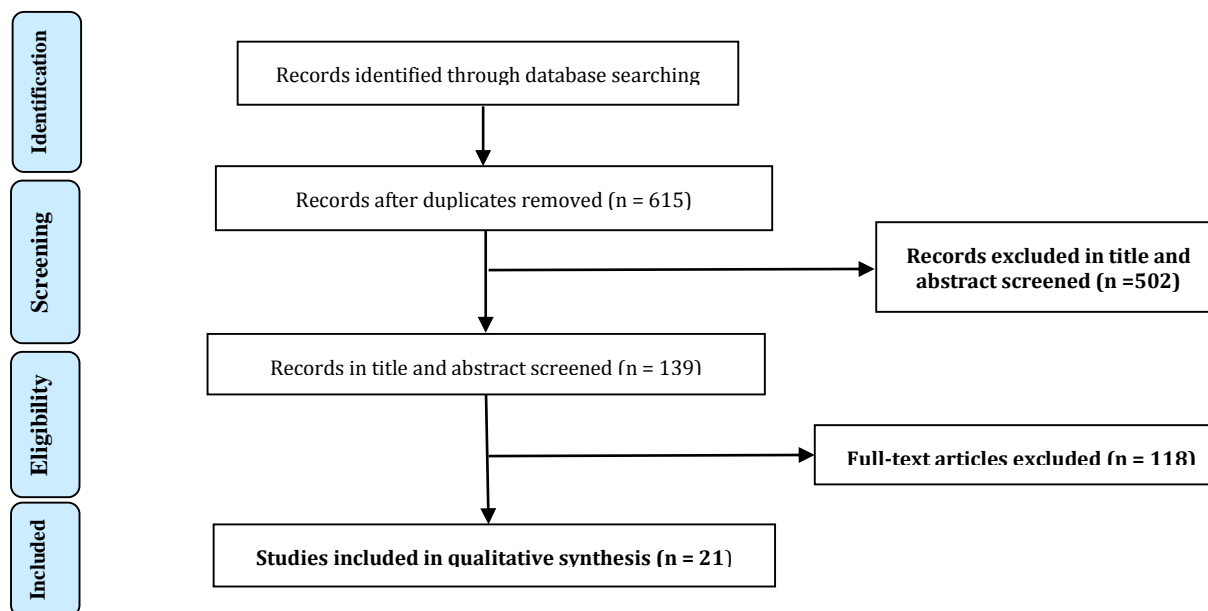


Figure 1. Flow diagram of the search and selection of studies

Results

Figure 1 depicts the PRISMA flow diagram of the article selection process in the current review. As can be seen, 975 articles and reports were identified via the database search, and 360 papers with shared records were eliminated. After investigating the remaining papers (titles and abstracts only), 139 papers were selected for the final review. The full text of these articles was studied, and 118 records were excluded. At the end of the process, 21 papers were screened in order to address the research complications. These papers were also eliminated since they were focused on other aspects of health (mental, physical, social, vulnerable groups) and management problems without reporting any data on nutritional status.

Among the selected articles, only four were related to post-earthquake nutritional consequences. In addition, nutritional problems and consequences were mentioned indirectly in 18 studies. Table 2 shows the characteristics of the reviewed articles. Three contexts were also surveyed based on the research objectives regarding food safety, food security, and nutritional consequences.

Food security is defined as food adequacy for all the people in order to live a healthy life, which is measured based on three main factors, including food availability, food access, and sustainable food supply(24). Food safety refers to the reliability of food health in the production-consumption cycle(25). In this regard, food safety surveys the risk of waterborne outbreaks and food with various causes, including inappropriate food storage in terms of temperature and maintenance, limited cooking time, and the microbial contamination of food and cookware (26).

Food Security

With regard to food security in the East Azerbaijan earthquake, 15 surveys were reviewed; six studies investigated inappropriate food and drinking water access and their incorrect distribution by the relief forces in the affected regions (27-31). Furthermore, post-incident economic problems were identified as the key contributing factor to the development of nutritional consequences in two studies. The

study by Sohrabizadeh et al. (2017) revealed that the incident led to disturbances and job losses among the regional residents who were involved in agriculture and livestock farming. Consequently, a high poverty rate was reported in this affected population (32).

In another study, Fallahi et al. (2013) reported some of the factors affecting the regional people, including job losses, wasted food storages, and decreased income(33). Two other studies also reported the damage caused by the incident to the drinking water resources of the affected areas. Babaei et al. (2014) investigated the status of drinking water in the earthquake-stricken regions(34), while Zeinalzadeh et al. (2017) studied health status in 95 destroyed rural regions after the earthquake (35), reporting that drinking water resources and water distribution networks underwent serious destruction in the affected regions, thereby leading to disruptions in food and drinking water security.

Bahman-Janbeh et al. (2017) stated that women's involvement in regeneration and finding solutions to the post-incident problems would result in their low self-care as they would forget to follow their supplement therapy in adherence to the prescribed and delivered medical medication due to their mental occupation(36). Three studies were also focused on vulnerable populations with limited or no access to food and drinking water due to potential disability. Ahmadi et al. (2018) designed a qualitative study on 18 elderly subjects(37), Sohrabizadeh et al. (2016) studied pregnant women(38), and Pakjoui et al. (2018) evaluated physically disabled subjects in this regard (39). The need assessments of vulnerable and poor population are also recognized as the contributing factors to decreased food and drinking water access in these affected groups in the aforementioned studies. On the other hand, Babaei et al. (2014) investigated the post-earthquake need assessment in Azerbaijan incident and the lack of accelerated need assessments, which led to the low awareness of individual nutritional requirements in the affected regions(2).

Table 2. The specification of studies mentioned to the nutritional consequences

Study	Sample size and Subjects	Study type	Post-accident nutritional dimensions	Summary results
Nader Oveisi 2014	Relief and rescue workers	qualitative	Food security	Inappropriate food access and distribution(27)
Aghaamiri, et al. (2012)	491 persons of the affected people	descriptive-analytical	Food security	Inappropriate food and drinking water access and distribution (31)
Bahman-Janbeh, et al. (2017)	Fertile Women	qualitative	Food security	Forgotten food supplements consumption due to high mind occupation and running a busy life after the accident (36)
Sohrabzadeh, et al. (2017)	11 women, 2 men recruited from the affected residents	qualitative	Food security	Disturbance of agriculture and livestock farming in the region, farmers' low-incomes, job losses, and increased poverty in the region (32)
Golzari, et al. (2012)	-	A descriptive report	Food security	Inappropriate food access and distribution(28)
Fallahi, et al. (2013)	-	A descriptive report	Food security	Job losses, wasted food resources, decreased household income(33)
Golzari, et al. (2012)	-	A descriptive report	Food security	Concerns about the contaminated water and foods in the affected regions and occurrence of diseases(57)
Mosaferi, et al. (2012)	Healthcare workers	A descriptive-qualitative study	Food security	Inappropriate food and drinking water distribution, lack of state surveillance on public support (58)
Sheghaghi, et al. (2012)	-	A descriptive report	Food security	Inappropriate distribution, decreased level of access (30)
Babae, et al. (2014)	31 persons recruited from the affected region	qualitative	Food security	Damaged drinking water resources and reservoirs, the destructed water distribution network (34)
Pakjouei, et al., 2018	18 affected disable persons	qualitative	Food security	Decrease access to the required food and water among the vulnerable people (with movement problem) (59)
Sohrabzadeh, et al. (2016)	Pregnant women	qualitative	Food security	Decrease access to the required food and water among the vulnerable people (with movement problem) (38)
Bahman-Janbeh, et al. (2016)	Recently labored women	Descriptive-qualitative	Nutritional consequences	The increased consumption of baby formula compared to pre-accident years (43)
Dolatkhah, et al. (2013)	Consumed Meat specimens	descriptive	Food security	The consumption of contaminated meat with Yersinia enterocolitica in the affected regions (40)
Mokhtari, et al. (2016)	169 children aged 6-48 months recruited from the affected regions	Descriptive-qualitative	Nutritional consequences	The raised prevalence of slimness, low-weight, and stunting among children aged below 5 years old, the increased malnutrition prevalence(10)
Esfandiyari, et al. (2018)	486 medical records belonged to women in the low-damaged region, 94 medical records belonged to the high-damaged region	Retrospective descriptive	Nutritional consequences	The decreased access to the required foods amongvulnerable people (pregnant women) in the first days, decreased BMIs in pregnant women in the affected regions, mild malnutrition (slimness and low-weight) in children aged below one years old and pregnant women, stunting (according to age) in children aged below two years old (60)
Ahmadi, et al. (2018)	An interview with 18 old subjects	qualitative	Food security	The decreased access to drinking water among the vulnerable people (the elderly), because the relief services were not provided according to the elderly's needs (37)
Kohan, et al. (2016)	Healthcare workers and the affected women	Qualitative	Nutritional consequences	The psychological stresses due to the accident with the decreased willingness to eating food, the decreased breast milk, the decreased baby weight at the birth (61)
Kusha, et al. (2012)	128 children aged below 5 years old	Descriptive-analytical	Nutritional consequences	The raised developmental disorders (developmental retardation and depression) due to nutrition(9)
Mosaferi, et al. (2013)	Healthcare workers	Descriptive-analytical	Food security	Over-distribution of mineral water drinking and their undesirable storage(62)
Zeinalzadeh, et al. (2017)	95 earthquake-affected villages	Descriptive-analytical	Food security, food safety	Damaged drinking water resources and reservoirs, the destructed water distribution network, the microbial water sampling in the affected regions due to water contamination in many villages(35)

Food Safety

Two of the reviewed articles evaluated food safety. Dolatkhan et al. (2013) assessed the consumed meat specimens by the people of the earthquake-stricken regions, reporting that 13% of the studied meat specimens were contaminated with *Yersinia* bacteria, which was associated with a potentially high risk of gastroenteritis and other gastrointestinal diseases in the affected residents(40). Moreover, Zeinalzadeh et al. (2017) observed that drinking water resources had microbial contamination cases even for 200 days after the incident in numerous rural places, and only 50% of the affected villages had access to healthy water. The researchers also claimed that the discrepancy of the rural sites caused major difficulties for reconstruction workers to access the water distribution systems of villages(35).

Nutritional Consequences

Five studies evaluated post-earthquake nutritional consequences, and three studies investigated incident-induced nutritional consequences in pregnant women and those with recent childbirth. Esfandyari et al. (2018) designed a retrospective study on pregnant, recently labored women, and their newborns after the earthquake(41, 42). According to the findings, low access to warm foods among the pregnant women within the first days after the earthquake, low access to fruits and milk during pregnancy, undesirable nutritional status during pregnancy, and lack of awareness regarding proper nutrition in the pregnant women led to reduced weights and BMI in the residents of the affected regions, which justified the high rates of low-birth-weight newborns and premature infants.

In another research, Bahman-Janbeh et al. (2016) investigated pregnant and recently labored women as vulnerable groups, observing that formula was consumed by the newborns with a rising trend(43). Moreover, Kohan et al. (2016) evaluated the post-earthquake consequences in pregnant women, recommending that post-incident psychological effects were responsible for the reduction of breast milk in the recently labored women. Another psychological aspect was the increased number of low-birth-weight infants(44). Additionally, Esfandyari et al. (2018) assessed the newborns and infants aged less than two

years, reporting that the prevalence of malnutrition, age-related stunting, slimness, and low birth weight increased among the infants aged less than one and two years compared to the pre-incident statistics in this regard.

According to the findings of Kusha et al. (2012), the rate of developmental disorders (developmental retardation and depression) increased among children due nutritional factors after the earthquake(9). Furthermore, Mokhtari et al. (2016) proposed that the prevalence of slimness, low birth weight, stunting, and malnutrition increased among the children aged less than five years after the incident (10).

Discussion

According to the results of the present study, the consequences of this natural disaster regarding the nutritional status of the earthquake-stricken areas have been widely assessed by numerous researchers. In total, 21 reports and articles have been published in various journals, and some of these articles have discussed the nutritional consequences affecting the residents of the earthquake-stricken areas. Moreover, several studies around the world have reported the nutritional consequences after an earthquake, including the Bam earthquake. Accordingly, the most important nutritional problems of the infants affected by the Bam earthquake were the increased prevalence of low body weight, stunting, and slimness (45, 46). In addition, the nutritional problems and significant prevalence of malnutrition in vulnerable populations(e.g., infants and children) were reported to increase after the Wenchuan earthquake in China(47).

In the Haiti earthquake, the health and nutritional conditions of the affected areas were reported to be poor(48); nevertheless, timely actions prevented a nutritional disaster. Appropriate actions after natural disasters could reduce malnutrition, low body weight, and increased health indicators in children. Our findings in this regard are consistent with the results of the previous studies regarding the research subject, which demonstrated that residents of the affected areas by natural disasters experience grave nutritional consequences. Water and food security after the East Azerbaijan earthquake were reported to declined due to reduced food access, lack of self-

care and proper nutrition, inappropriate food distribution, inattention to nutrition of the victims and those around, increased economic problems (e.g., low income, job loss), and waste water and food storage.

Monitoring the food security of children after the Haitian earthquake indicated that post-disaster food insecurity was intensified in children due to the declined household income as a major influential factor in this regard (49). Self-neglect is one of the examined dimensions of food security, which has been identified in the self-care behaviors of women due to their mental occupation and co-involvement with men in seeking solutions for post-disaster regeneration, and nutritional status is considered to be largely responsible for this issues (36). After the 2008 Sichuan earthquake, the affected women paid more attention to their health, dietary status, and water and food safety (50). Therefore, it could be inferred that potentially vulnerable groups with special nutritional needs should be identified in post-disaster periods. If vulnerable people pay special attention to their food requirements, the nutritional status of the entire affected populations may be positively influenced (51). Although different relief teams are involved in the recovery of the needs of the residents of affected areas, needs assessment are not performed effectively, and this issue leads to poor access to essential foods, thereby further increasing food insecurity. Therefore, it is crucial to develop appropriate nutrition monitoring systems during the post-disaster phase (52). Economic issues have been established as another aspect of food security, which were investigated in the current research as well. The mentioned natural disaster in Iran occurred in the harvest season during the summer when the rural residents of the affected areas were occupied with their crop and livestock products. Consequently, the earthquake prompted the recognition of the subsequent economic problems, such as the reduced access of the regional people to various resources and demolish of food products and storage in the region. Therefore, needs assessment and plans also depend on the time of the incident and the agricultural condition of the affected areas (53).

One of the dietary issues occurring after natural disasters is food contamination with hazardous microbiological and chemical agents during food

transport, maintenance, and storage, which could increase the incidences of waterborne and food borne diseases. The Great East Japan Earthquake was one of the earthquakes after which food safety was extensively investigated (54, 55). Our findings indicated that few studies have been focused on water and food safety after the East Azerbaijan earthquake, most of which have only evaluated food security. Therefore, more investigations are required about water and food safety after this earthquake. On the other hand, no incidents and challenging flooding were reported in the affected areas due to the care and control quality delivered by the healthcare workers after the incident. In addition, the efficacy of concentrated care was high in controlling food safety after this earthquake (56).

Conclusion

Evidence overview, analysis, and data collection from relevant studies indicated that poor dietary status was observed in different populations after the 2012 East Azerbaijan earthquakes, especially in children and women. Although various teams and volunteers oriented their efforts toward the overall improvement of the situation for the people affected by the earthquake, food safety and security indicators were observed to decline after the incident. Therefore, EOP programs must be developed and revised with the aim of nutrition interventions in emergencies in line with designated functions in order to maintain food safety and security indicators. These issues are mostly preventable in case of natural disasters. Further studies should be conducted in this regard to select other indicators of nutritional problems by expert judgment, and the studies regarding nutritional status in emergencies should be promoted as well. By assessing the nutritional status in different regions of Iran using such designated tools, appropriate data could be obtained by health managers and decision-makers for effective policymaking and developing the required regulations to solve nutritional problems in natural disasters and emergencies.

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