

# The assessment of environmental health status in the route of Arbaeen pilgrims at Shalamcheh border in southwestern Iran

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## ABSTRACT

The negligence of health regulations in the preparation of the foods, services, and sanitary and welfare facilities provided in religious borders could increase the risk of waterborne infectious intestinal diseases. Therefore, the continuous monitoring and control of health indicators is essential in mourning borders. This descriptive, cross-sectional study was conducted on the Mawkebs of Shalamcheh border (n=267). In total, 186 samples were evaluated in terms of the microbial quality of water, and 66 samples were evaluated in terms of the microbial quality of food. The studied parameters in drinking water included the residual free chlorine, pH, turbidity, total coliform, and fecal coliform, and the studied parameters in foodstuffs included the total count and fecal coliform (*Escherichia coli*). According to the findings, these indicators were appropriate in terms of accommodation hygiene and preparation and distribution of crew hygiene by 99.9%. On the other hand, there were zero cases where the food sampling results were undesirable for the measurement of the total count and fecal coliform. The number of the contaminated water samples was 46 (24.7%) out of 186 water samples. Therefore, the proper implementation and continuous control of health instructions seem critical for these borders, and it is suggested that special regulations and indicators be enacted for the crew in charge, so that they would attend training courses, obtain medical examination cards, and practice personal hygiene.

**Keywords:** Environmental health, Food hygiene, Drinking water, Water quality, Arbaee

## Introduction

The World Health Organization (WHO) defines mass human gatherings as the

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presence of more than 1,000 people in a specific location at a specific period. Accordingly, the largest mass gatherings in the world are Hajj and Arbaeen rituals, both of which are related to Muslims, with the latter performed for the martyrdom of Hazrat Aba Abdullah Al-Hussein (AS).<sup>1</sup>

Arbaeen pilgrimage is one of the largest religious gatherings in the world, which takes place 40 days after the anniversary of the

martyrdom of Imam Hussein (AS), the third Shiite Imam. Every year, a huge crowd of pilgrims travel to the city of Karbala for pilgrimage to Imam Hossein holy shrine in Karbala on Arbaeen day, with the main route starting within 80 kilometers from Najaf.<sup>2</sup> According to the statistics reported in 2019, the number of the Iranian pilgrims attending Arbaeen pilgrimage was 3,800,000, while more than 3,000 foreign pilgrims from across the borders of Iran also attended Arbaeen pilgrimage.<sup>3</sup> Along the route, free service stations (Mawkebs) are voluntarily set up in order to provide services and medical and welfare facilities to the pilgrims. These stations are highly important from the health and economic perspective, and it is essential to properly determine the environment health indicators based on weather conditions, zone climate, location conditions, and saved food types.<sup>4, 5</sup>

Free service stations are roofed spaces with terraces or canopies and an elongated yard (with or without fence). These stations could be categorized by factors such as size, facade, and language. They are located at the intersections of battle zones, important checkpoints, and entrances/inside of cities. In war-torn cities, these stations are mainly located in the side places of mosques, while in the suburbs, temporary buildings (mainly single-storey) are built or second-hand containers are used to set up the stations. However, the facilities of these stations are not the same everywhere, and the space and quality vary.<sup>6</sup>

Infectious diseases are a common health issue in mass gatherings, especially in case of the lack of preparedness in healthcare systems. Since Iran is one of the most important countries on the walking path of Arbaeen and plays a key role in the provision of the health services to pilgrims, the experience of health challenges by pilgrims is of utmost importance.<sup>7</sup> Several studies have been focused on the environmental health of various locations.<sup>8</sup> During the inspection of the environmental health of the food stores and warehouses related to the military units in Tehran province (Iran), the status was

reported to be unacceptable, while indicators such as the location and duration of storage were considered favorable.<sup>5</sup>

Another research in this regard aimed to assess the bacterial quality of the drinking machines of the intercity buses in Bushehr port in 2010 within a three-month period, and it was reported that the level of residual chlorine was zero in 97% of the cases. On the other hand, the fecal coliform and total coliform values were above the threshold in 8.8% and 12.5% of the cases, respectively.<sup>9</sup> The inspection of the food and salad samples of four military restaurants also indicated that five sample cases were infected by *Escherichia coli* (*E. coli*), while none of the samples was reported to contain salmonella.<sup>10</sup>

Given the discussed background regarding the health of Mawkebs and its importance, the exact investigation, inspection, and continuous control of the production, distribution, and presentation centers of edible, drinkable, cosmetic, and health materials conforming the Article 13 amendment regulation are paramount. In the current research, we investigated the environmental health indicators of Mawkebs to determine the health status of drinking water<sup>11</sup> in terms of the microbial quality, wastewater disposal and collection,<sup>12</sup> disposal methods of solid wastes, sanitation of sanitary facilities (e.g., drinking machines, WCs, bathrooms, wash basins),<sup>8</sup> the presence of vectors in temporary settlements and along the routes, and microbial characteristics of the food distributed in Mawkebs at Shalamcheh border as one of the marching routes of Arbaeen, so that we could take a step toward maintaining the health of the pilgrim community by providing a clear scientific and statistical picture of the environmental health status and presenting the results to the relevant organizations to develop effective interventions for the improvement of the status and comparison of the results with the standards.

The present study aimed to assess the environmental health status on the route of Arbaeen pilgrims on the Shalamcheh border.

## Materials and Methods

This descriptive, cross-sectional study was conducted on 267 Mawkebs on the Shalamcheh boarder. Fig. 1 depicts the geographical location of the study area.

Shalamcheh border terminal is located in Khuzestan province in southwestern Iran on the common border between Iran and Iraq. The distance of this border to Khorramshahr in Khuzestan province is 15 kilometers and 150 kilometers from Ahvaz, the capital of the province. Notably, Basra is the nearest city of Iraq to this border, which is located at the distance of 30 kilometer.<sup>2</sup> In the present study, we visited the location to evaluate the health conditions conforming to the standard checklists of the Iranian Ministry of Health (Article 13 of the law on foods, beverages,

cosmetics, and hygiene). The amendment to the Article 13 of the law on foods, beverages, health, and cosmetics was approved by the Islamic Consultative Assembly in December 2000 and contains five chapters, 95 articles, 54 notes, and 46 paragraphs. Chapter one is on personal hygiene, chapter two is focused on the construction and health conditions for food preparation, production, distribution, storage, and sale of restaurants and public places, chapter three is on work equipment, chapter four is on the duties of local health officers, supervisors, and duty officers, and chapter five is focused on the classification of places, centers, workshops, and factories in terms of the inclusion of materials in this regulation.

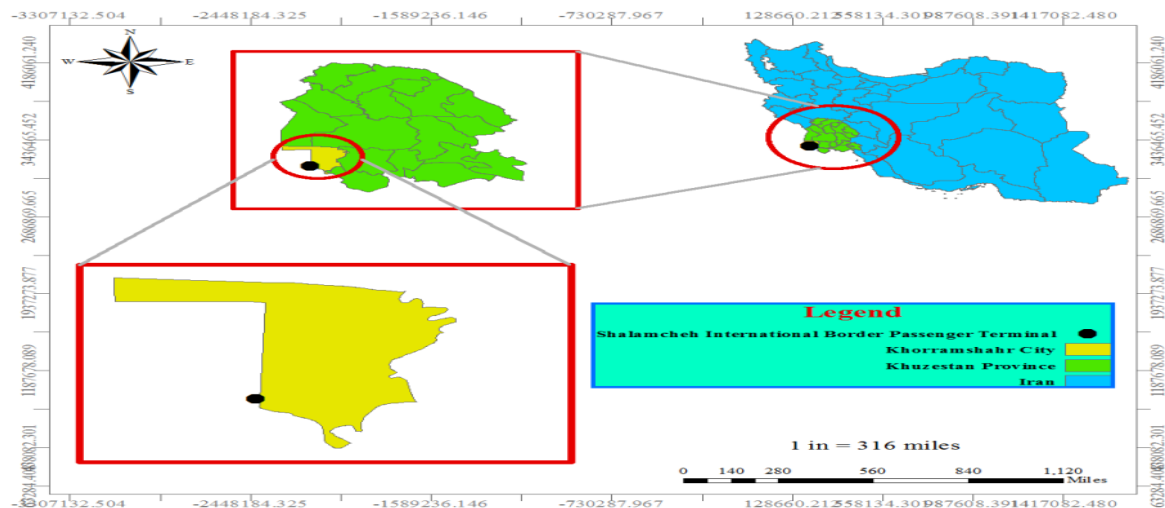


Fig. 1. Location of study area

Data were partly collected via direct sighted reports and interviews with authorities and crew. The Mawkebs were assessed by four general indicators, including: 1) the food production and distribution hygiene, 2) drinking water hygiene, 3) accommodation hygiene, and 4) health of crew on food production, processing and distribution. The health status of the pantries and kitchens and their crew, toilets, sewage disposal conditions, and food production and distribution was evaluated, as well as the awareness of the crew and servants regarding the environmental health concerns and presence of health verification cards.<sup>8</sup>

In the present study, 186 water samples and 66 food samples from the Mawkebs were sent to the laboratory for microbial tests. The

studied parameters of drinking water included the residual free chlorine, pH, turbidity, and total and thermoduric coliform. In addition, the studied parameters of food were the total count and *E. coli*. At this stage, portable equipment such as salinity meter, injection thermometer, pH meter, hygrometer, oil, and surface and aflatoxin evaluators were used to evaluate food hygiene.

### Total Polar Material (TPM)

In the present study, the oil evaluator device (Atago, Japan) was used, which is a manual equipment for the rapid testing of cooking oils and is capable of measuring the polarity, fatty acid value, and temperature of oil. Total polar material (TPM) shows the aging of oil due to temperature. As the

polarity increased along with oil aging, the ranges presented in Table 1 were categorized by the TPM percentage value.

Table 1. TPM waste oil range

Qualitative Interpretation	Percentage
Without contamination	0-14%
Warning limit	14%-24%
Contamination	More than 24%

The researchers confirmed that the polar parts that were removed from the oxidized oil exerted poisoning effects on animals, and it is recommended that oils with more than 24-27% of TPM be removed. The legal limit point for the oils has been set at 25%.<sup>13</sup> On the other hand, free fatty acids are used for the evaluation of oils during the storage period and are not suitable for assessing the impact of temperature on the oil.

#### Salt/TDS tester

As the standard salinity of bread is limited to 1% and bread is one of the major sources of salt intake in Iran, the salt value was rapidly tested using Salt/TDS tester. In case of high salinity, the consequences of the excessive use of salt (e.g., hypertension) were described to decrease their prevalence in the long run.

#### Surface contamination

Rapid surface analysis was performed using rapid portable surface test equipment. The ranges of microbial contents were categorized based on the RLU, and RLU of less than 10 was defined as a non-contaminated environment, while the RLU of 15-40 was defined as an alarming level, and RLU of  $\geq 40$  was described as contaminated.

#### Injection thermometer

An injection thermometer is used to measure food temperature. The critical range for food products is 4-60 °C, and the products should be preserved at temperatures below 4 °C or above 60 °C.

#### pH Meter

To detect the baking soda in food products, the pH of below 6.4 in the samples was considered acceptable, and the pH of above 6.4 was considered unacceptable.

#### Aflatoxin

Due to the poisonous effects and carcinogenicity of aflatoxins, these compounds must be evaluated and detected in various food products. The permissible limit of aflatoxins in human food has been set at 50 ppm by the Food and Drug Administration (FDA).

#### Hygrometer

According to the findings, the optimal humidity of the food stores that have been detected with Hygrometer was within the range of 55-65%. The Microsoft Excel software was used to describe the obtained data.

#### Results and Discussion

The present study aimed to assess the environmental health status on the route of the Arbaeen pilgrims at Shalamchek border. To maintain the health of the pilgrims who travel to holy shrines, the supply of healthy water, food, and settlement in accordance with health indicators is critical.<sup>14</sup> Fig. 2 depicts the number of the free service stations versus the inspection visitors per day. As can be observed, the number of the stations increased while nearing to Arbaeen day.

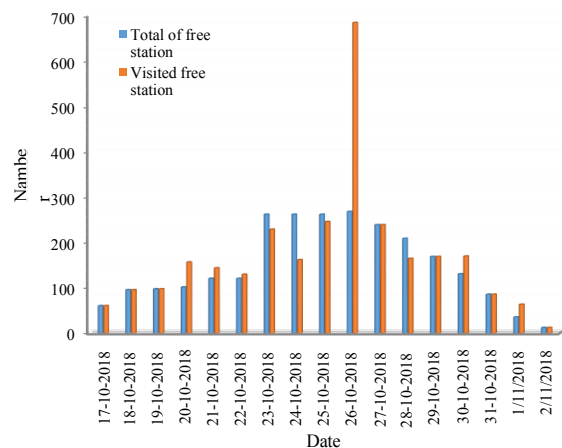


Fig. 2. Number of free service stations and number of visits per day

As there were Mawkebs with more than one visit per day, the number of the visited station per day was observed to be more than the stations on the same day in the current research. In general, the obtained results indicated the proper status of Mawkebs in

terms of health. Fig. 3 shows the number of the inspections from the accommodations per day. As is depicted, the number of the settlement areas varied depending on the population. In addition, spacious tents were set up for settlement in each Mawkeb, and the difference in the number of the inspections with the number of the Mawkeb was due to the multiple inspections of the Mawkeb per day. The inspections also revealed that 99.9% of the accommodations were healthy.

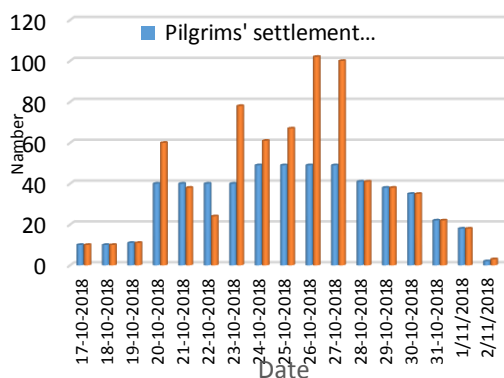


Fig. 3. Total number of pilgrim accommodations and inspections per day

In the current research, the inspections indicated that all the WCs were cleaned on a daily basis and had proper health conditions. Furthermore, the recommendations of the health manager were properly implemented, and 99.9% of the WCs and bathrooms were properly healthy. In the studied stations in the present study, some disinfectants (e.g., halamid and perchlorine powders) were also used to disinfect and remove the surface contaminations of the sanitary services. In order to control insects, rodents, and vectors, 2.5% permethrin and 10% cypermethrin poisons were used.

In a study in this regard, Masoumbeigi *et al.* assessed the sewage disposal, reporting its proper status in some military centers. The presence of a sewage network was a proper indicator of health in the studied cases of the current research. This was also considered to be the highest scored indicator in the WHO evaluations in this regard.<sup>15</sup> In the current research, each Mawkeb or adjacent Mawkebs implemented septic tanks to dispose of the sewage that was discharged by sludge trucks when needed, and the status was observed to be properly healthy.

To maintain the health of the pilgrims, some health recommendations about the disinfection of WCs and bathrooms, solid waste collection, discharge of septic tank, firefighting equipment of station and first-aid kit, and water chlorination were also presented in addition to direct control.<sup>8</sup> The results obtained by Zazouli *et al.* regarding the environmental health status of mosques and holy places in Amol city demonstrated that 69.9, 68.7, and 47% of the mosques, mourning places, and holy shrines had a favorable status, respectively.<sup>16</sup> Also, the results of the evaluation of the health status of the mosques and holy places in Sari (Iran) in 2016 revealed that the private health level of the individuals in the mosques was relatively low although it is highly critical. Furthermore, the mosques in Sari are structurally moderate and have moderate equipment. In general, the mosques in Sari have been reported to have a lower health level than expected.<sup>17</sup>

### Foodstuffs

Food hygiene and safety is an important principle for the prevention of human diseases and protection of the environment against contamination. The foodborne diseases caused by microorganisms are a major public health concern.<sup>18</sup> Unhealthy foodstuff preparation, production, and distribution, as well as the lack of food evaluation and supervision systems could lead to gastrointestinal diseases.<sup>7</sup>

Considering the high prevalence of foodborne diseases and their increased importance during distribution in public, the negligence of health recommendations increases the risk of intestinal diseases and may even lead to epidemics among pilgrims, and the consequences not only harm these individuals, but they also threaten their local community when they return home.<sup>14, 2</sup> Therefore, the managers of mourning boards are expected to care about the food production process using simple, yet important health issues. During the current research, direct supervision by the managers was recommended for the food production process. The practice of personal hygiene and having health registration medical

examination cards were also evaluated in the managers of food distribution.

As huge places such as Mawkeb kitchens produce large amounts of corruptive wastes, constant control must be imposed for the disposal of these wastes.<sup>19</sup> In the current research, special solid waste trucks equipped with leachate gathering systems were employed for this purpose on a daily basis. Considering the direct correlation between the implementation of health regulations by the crew and the corruption of food,<sup>4, 5</sup> the limited knowledge regarding food protection could damage the pilgrim crowd irreparably. As such, the crew in charge of food production

and distribution must be extremely careful of health.

Fig. 4 shows the total number of the food production places and daily inspections in the studied area. The public food production centers also varied as they may have been inspected several times per day.

The results of the present study indicated that the health status of the food production centers was suitable in 99.9% of the cases, and the crew in charge practiced personal hygiene, and the food production and distribution procedures were completely healthy as well. Fig. 5 depicts the results of food sampling.

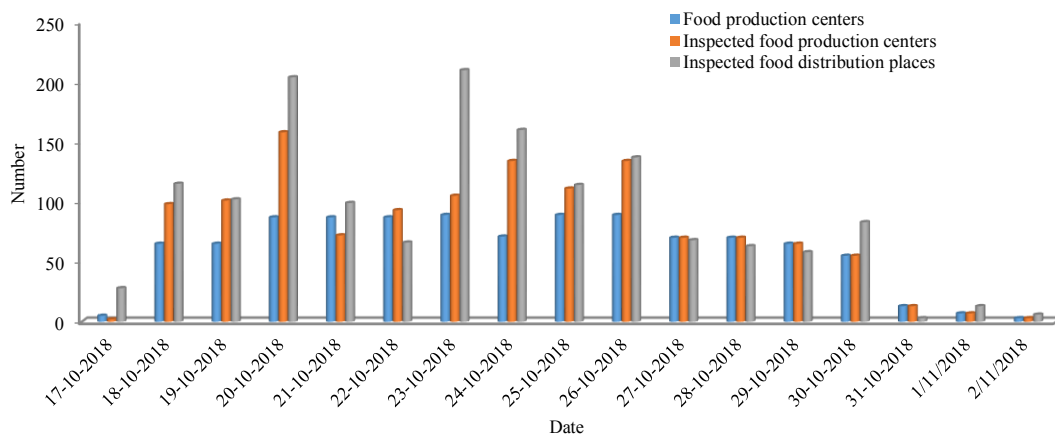


Fig. 4. Number of food production centers and inspections

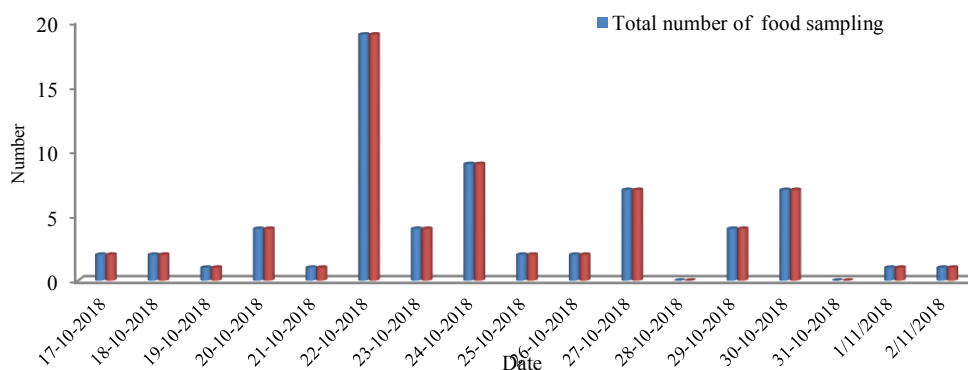


Fig. 5. Number of food samples and samples with favorable results

As is shown in Fig. 5, all the samples are evaluated as proper, and no unacceptable cases were reported. During the inspections, no suspicious food was eliminated, and the statistics recorded no cases of food poisoning. In the study by Faramarzi *et al.*, the assessment of food production for mesophilic bacteria demonstrated that salads (50%) and protein products (36.6%) had the highest

contaminated cases, while the highest to lowest contamination rates were observed in sweets (13.46%) and protein products (1.73%) for coliform contamination, salads (58.33%) and diaries (9.84%) for *E. coli* contamination, and sweets (4.81%) and diaries (0.39%) for severe staphylococcus contamination, respectively<sup>20</sup> In addition, the evaluation of the health indicators at the

hotels in Qom (Iran) indicated that 35.5% of the cases had a proper health status, while 54.8% were included in the rehabilitation indicators, and 9.7% were considered to be undesirable.<sup>21</sup>

According to the information in Table 2, approximately 88.8% of the oils had a suitable status, which was equal to 175 out of 197 cases with the TPM of less than 14%. And also, the results detected by Salt/TDS tester show the salinity exceeded 1% in 27 (21%) out of 128 samples. Investigation for surface contamination revealed the

contamination level of the equipment and environment was suitable in 40.5% of the cases. In addition, 21 out of 57 samples had acceptable humidity. According to the information in this Table, the food samples were considered suitable in terms of aflatoxin production. In the current research, the percentage of desirable results measurement with injection thermometer was achieved in 74.7% of the cases. In total, 96.3% of the samples were properly included in this range for pH.

Table 2. Tests implemented on food products, number of samples, and percentage of desirable samples

Parameters	Total number of samples	Number of desirable samples	Percentage of desirable results
Total Polar Materials (TPM)	197	175	88.83249
Salt/TDS Tester	128	101	78.90625
Surface contaminate	158	64	40.50633
Injection thermometer	776	580	74.74227
pH meter	55	53	96.36364
Hygrometer	57	36	63.15789
Aflatoxin	3	3	100
Food contamination	17	11	64.70588

In another research conducted in Isfahan (Iran), Zangiabadi *et al.* evaluated hotels with restaurants, and the environmental health status in 9% of the units was reported to be excellent, while favorable status was observed in 45%, moderate status was reported in 36, and 9% of the units had a poor status.<sup>22</sup>

### Water

Water is the most important and most consumed material during a trip, which mainly contributes to digestive diseases among travelers if contaminated. Fig. 6 shows the number of the drinking water reservoirs for the pilgrims and inspected reservoirs per day.

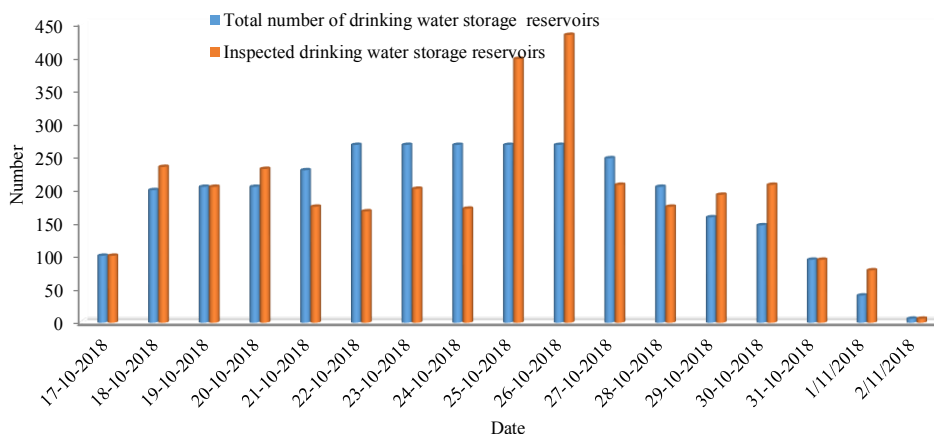


Fig. 6. Drinking water reservoirs and number of inspected reservoirs per day

In the current research, the water reservoirs were polyethylene barrels, and the Water and Wastewater Organization (ABFA) trucks distributed water in the Mawkebs. The water was used for both drinking and sanitary purposes and supplied from the water

treatment plant in Khorramshahr. Every reservoir was inspected several times per day. After sampling, the routine tests of drinking water were performed on the samples for the measurement of the free residual chlorine, pH, turbidity, total coliforms, and thermodynamic

coliforms.<sup>23</sup> Fig. 7 depicts the number of the water samples in the studied area and undesirable samples. Accordingly, 46 (24.7%) out of 186 water samples were considered undesirable. In most of the water reservoirs, the residual chlorine was acceptable, and the inspection of chlorine was performed constantly.

According to the study by Masoumbeigi *et al.* regarding the bacteriological and chemical water quality of some military centers, water hygiene was excellent in 60% of the cases, while it was moderate in 20%

and poor in 20% of the samples. Furthermore, the mentioned study indicated that with the exception of one case, the rest of the samples had exceeding contents of nitrate, and the other indicators of water quality control were also suitable. Previous findings and direct observations have also shown that 99.9% of the food, water reservoir, production, and distribution location health status and the health status of the crew in charge of food production and distribution have been proper.<sup>15</sup>

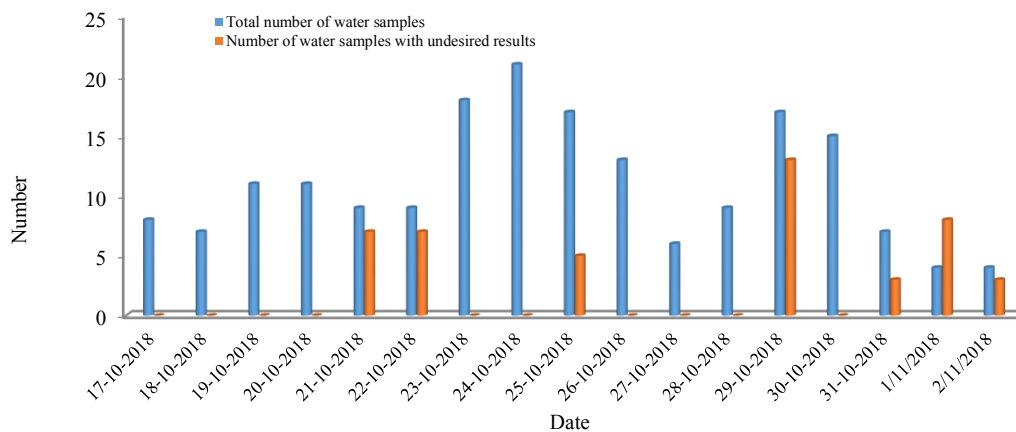


Fig. 7. Number of water samples and their results

## Conclusion

According to the results, the environmental health status, food, and drinking water hygiene used for Arbaeen pilgrimage along the Shalamcheh road was proper. It is recommended that special health criteria and indicators be considered for setting up free service stations and all the employees take the required training courses to obtain medical examination cards and practice personal hygiene as a priority.

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## Conflicts of interest

None declared.

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