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Evaluation of food safety and health risk factors in food service establishments: a case study in Qom province, Iran

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ABSTRACT

Foodborne diseases still occur and affect 30 % of people in the world annually. Existing data related to the status of food safety and health indicators of food services facilities in Qom province indicate that a low percentage of these centers have the necessary criteria in the principles of food safety. According to the factors affecting the promotion of food health and safety indicators, this study was conducted to identify and investigate the factors affecting the risk of food safety in food supply centers in Qom in 2018. In this cross-sectional study, the required data were obtained through validated questionnaires about food safety and environmental health of food services facilities (n=380). Also, the effectiveness of variables such as training on food safety principles through designing before and after study, educational certification, having trading licenses, ownership, urban health status and the age of operators, have been assessed by food safety factors based on relevant tests. The results showed that the training of food handlers in improving and upgrading food safety conditions has had a significant increase. (49 %, mean 5.44 %, SD 3.20 ±, $p < 0.001$) Also variables such as education level ($p < 0.05$) and educational certification ($p < 0.001$) have been effective in increasing food safety and health standards. In order to improve the level of food safety, reviewing the process of educational programs, strengthening educational equipment and media and inter-sectorial coordination to strengthen the role of education should be planned. The food holders, managers of the food establishment and local health experts should enhance the food safety practice.

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1. Introduction

Food safety is one of the most important issues in all the countries regarding people health, food industries and food control authorities (1).

In recent years, increasing problems related to the food supply and distribution chain as well as food control structures have become very important. Food safety is actually an important part of public health. Although most countries around the world have advanced

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monitoring systems, water and foodborne illnesses continue to occur (2).

Based on the Centers for Disease Control and Prevention (CDC) report, an estimated of 9.4 million frequencies of foodborne diseases happen each year, with 55,961 hospitalizations and 1,351 deaths (3). Foodborne diseases has remained as an important public health problem in both developed and developing countries (4). Regarding with supplying sufficient amounts of food products to meet the food needs of the community, maintaining the safety, hygiene, and quality of these products is also of particular importance. Microbial contamination, unauthorized additives, fungal contaminations, pesticide residues, incomplete packaging, wrong labeling, physical hazards, etc., are among factors that endanger food safety on the supply side (5). Around 70% of diarrhea caused in developing countries origins from food-borne contamination. Moreover, 2.1 million people dies annually all over the world due to food-borne diseases (6). United States estimation about the cost of food-borne illnesses are 1.4 trillion dollars annually (7). Unfortunately, due to the lack of an active surveillance system on food poisoning, comprehensive information is not available in Iran (6,8). Achieving and maintaining food safety depends on the ability and knowledge of stewards of monitoring foodstuffs about the principles of food safety and hygiene (9,10). Also, food safety issues have been related to five fundamental variables, consisted of unsafe food sources, insufficient cooking, unsuitable holding temperatures, contaminated utensils, and lack of individual hygiene (5,6).

Health-oriented approaches and methods for providing safe foodstuff generally include three areas: (a) physical factors, which contain buildings, workplaces, and tools; (b) Application factors (procedural or practical), which contain hygiene principles of working when contacting food; and (c) and individual factors, which include personal hygiene and people's education (11). According to the available statistics, in the city of Qom, the food supply chain comprises more than 20,000 active centers with about 36,000 employees. This issue indicates the importance of safety and hygiene of foodstuff in these centers, including the responsibilities of staff and those working in this sector in the city of Qom. Based on what was mentioned before, the current study was performed in order to appropriately plan to promote food safety and hygiene, to evaluate the education of promoting food hygiene and safety, and investigating the effect of provided educations in training centers.

2. Materials and Methods

Regarding the importance of safety principles and health risk factors related to foodstuff in centers the provide sensitive and perishable foods, in this cross-sectional study, necessary criteria were extracted by a questionnaire and standard checklists (A food law entitled "Article 13: Food, Beverage, Cosmetics, and Hygienic Materials" was developed by the Ministry of Health and Medical Education in Iran). The reliability and validity of the questionnaire were evaluated and confirmed. In the Table 1 some of the main questions summarized in five sections were presented.

The sample size was estimated as 380 subjects (12). Using the following formula and by considering a confidence interval of 95% (Z1-a), test accuracy of 5% (d), and P=54%, the sample size was estimated: n= (Z_{1-a}) 2*P (1-P)/d2

In this study from the perspective of foodborne disease and with the characteristics of sensitive and perishable food, 4 groups of food handlers in food preparation and sales groups including: Juice and ice cream, Restaurant, Sandwiches and pizza and Confectionery were followed and evaluated. Inclusion criteria included having an active trade union file and over 18 years of age for food handlers and Exclusion criteria including being a female, (for instability in employment) inactivity of the union unit or lack of union license and age under 18 years were considered. In this study, the effect of training on food safety risk factors was investigated According to the plan and regulatory guidelines food handlers were invited for the training course. Educational tools in this study included instructional videos and topics on personal hygiene, tool hygiene and food safety for 248 hoursIn order to evaluate the effect of the given trainings, the status of the conditions and criteria of food safety principles through an inspection program, before and after the training was implemented.

Statistical analysis

Data were analyzed using SPSS version 12. The paired t-test was used to compare the mean status of hygiene criteria and safety principles both before and after providing the intervention. In another part of the study the $\chi 2$ and independent t-test were used to investigate the effect of other variables as food safety risk factors in food supply centers.

3.Results

Results of study are shown based on the method described in Tables 2 to 4. Table 2 shows the assessment of food safety status and process factors based on the level of compliance with the questionnaire (%) before and after training. Table 3 also shows the improvement of health indicators in the study groups after training and in Table 4 the impact of other variables affecting food safety were described.

Table 1. Summarized questionnaire of Article 13: Food, Beverage, Cosmetics, and Hygienic Materials.

No	Food Hygiene Item	Summarized questions
1	Personal	Have public health and clinical certificate.
2		Pay attention to EHIs orders
3		Wear white apron, gloves, white hair cover
4		Wardrobe for clothes and shoes
5		Work of others is prohibited. Managers should take money.
6		No smoking. Board of no smoking
7	Building	Appropriate circumstances of floor, ceiling, sink, doors, windows
8		Insect and rodent proof.
9		Sanitation water, wastewater collection, toilet, central system of liquid soap, warm and cool water and bathroom.
10		Good ventilation, complete combustion of fuel
11	Tools	Washing and dry tools in two stages
12		Warm and cool tap water in the kitchen
13		Use of stainless steel tools, forceps and disposable gloves for transport of row and cooked food.
14		Have dish washing machine.
15		Clean shelves, tables, chairs, showcases, refrigerators (have thermometer), fire fighter cylinders.
16		Clean rubbish bin (washable, portable) suitable volume
17	Food Safety principals and process	Existence of proper storage of raw materials with suitable conditions
18		Refrigerator equipped with a healthy thermometer
19		Keeping the cold chain within the required range and proper storage in the refrigerator
20		Necessary health certificate and license for utensils, tools and accessories
21		Cook and heat food thoroughly
22		Supply of products with health licenses
23		Refrigerator equipped with a healthy thermometer
24		How to freeze and get out of food freezing raw materials
25		Use of paints and other unauthorized additives

Table 2. Criteria for food hygiene principles and process factors before and after training

Row	Criteria for food hygiene principles and process factors	Mean (%) before training	Mean (%) after training	P_{value} (paired-t-test)
1	Existence of proper storage of raw materials with suitable conditions	68	70	P_{value} <0.001
2	Refrigerator equipped with a healthy thermometer	25	31	P_{value} <0.001
3	Keeping the cold chain within the required range and proper storage in the refrigerator	87	97	P_{value} <0.001
4	Necessary health certificate and license for utensils, tools and accessories	46	51	P_{value} <0.001
5	Cook and heat food thoroughly	95	100	P_{value} <0.001
6	Supply of products with health licenses	81	88	P_{value} <0.001
7	Refrigerator equipped with a healthy thermometer	42	43	P_{value} <0. 01
8	How to freeze and get out of food freezing raw materials	69	72	P_{value} <0.001
9	Use of paints and other unauthorized additives	90	100	P_{value} <0.001

Table 3. Average of food health index (personal - tools - process factors) in the studied guild groups after training

Row	Food preparation and sales groups	Overall improvement of health indicators after training (%)	P_{value}
1	Juice and ice cream	11.3	P_{value} < 0.001
2	Restaurant	6.61	P_{value} < 0.001
3	Sandwiches and pizza	5.76	P_{value} < 0.001
4	Confectionery	4.36	P_{value} < 0.001

Table 4. Evaluation of other variables affecting food safety risk factors in food supply centers

Examined variables	Type of test	P value
Relationship between environmental health status of urban areas and compliance with food safety standards	Chi-Square (χ2)	Pvalue > 0.05
The relationship between having a trade union license and adhering to food safety standards	Chi-Square (χ2)	Pvalue< 0.001
Relationship between the type of union unit ownership and compliance with food safety standards	Chi-Square (χ2)	Pvalue > 0.05
Relationship between education level and food safety standards	Chi-Square (χ2)	Pvalue < 0.05
The relationship between having a school certificate and observing food safety standards	T-test	Pvalue < 0.015
Relationship between the age of the union manager and compliance with food safety standards	Chi-Square (χ2)	Pvalue > 0.05

4. Discussion

As shown in Table 1, regarding the status of safety principles criteria and food processing related factors, the results showed that training the principles of food safety and related factors could significantly promote the status quo (49%, mean=5.44%, and standard deviation= ±3.20) (p-value< 0.001). Also, among the studied criteria, maintaining the cold chain in the necessary range, proper maintenance of upgrade status, and cold storage equipped with a functional thermometer had the lowest level of improvement. The following criteria were also improved: confirmation hygiene of commodities and specifications of tools, cooking and heating, and providing products with hygiene licenses. The results of this study in the Table 2 also show that the health indicators in the studied guild groups after training, increased. The training process was more effective in the juice and ice cream groups than in the other groups. (11.3%). Accordingly, restaurant, sandwich, pizza and confectionery groups with 6.61%, 5.42% and 4.36% had the lowest effectiveness in the training process, respectively. These findings can be compared with those reported by Venter et al. and Alomirah et al. (12,13). The findings also showed that the provided training was effective in promoting awareness of subjects concerning principles related to the safety and hygiene of foodstuff (p < 0.015). The findings of the present study are consistent with studies conducted in other provinces. PirSaheb- Meghdad et al. reported that the awareness, attitude, and performance of trainees was increased by 18.47% (14). The study by Kadivar, conducted in Shiraz, has also shown that the overall situation of food preparation, distribution, and sales centers after the training process was improved by 16.9% (15). Heidari et al., in a study on investigating the effect of education provided by training centers in the city of Shiraz, reported a significant difference concerning awareness of those working in the food supplying centers before and after providing the training, but there was no significant difference in their performance before and after education (16). Dehgani et al., in a study on the effect of education on the health knowledge of those working in the food supply centers in the city of Yazd, also reported similar results (17). Ansari et al., in a study on evaluating attitudes and performance of employees of processing and packaging centers towards health behaviors, have investigated 74 subjects and reported that 97.9% of employees were familiar with the key role of hygienic observance in the workplace. They also reported that 78% of subjects were not aware of microbial risks. Moreover, they found a significant inverse correlation between knowledge and practice (rs=-0.02, p=0.04), which is not consistent with the findings of the present study (18). This issue indicates that increasing awareness does not always lead to the promotion of food safety indicators (19). The findings of the present study also showed that variables such as level of education (P<0.05) and having a license contribute to enhanced safety and hygiene criteria. However, variables like age of the participant, the environmental health status of the urban area, the location and activities of the food supply centers in terms of suitability of waste management, sewage collection, surface runoff draining, etc., were not associated with increased safety of foodstuff (P>0.05). Concerning the impact of environmental health, Bruno et al. and Tauxe et al. also reported similar results (20,21).

5. Conclusion

Considering the factors involved in the potential threat caused by foods that including poor hygiene at any stage of the food chain, lack of preventive controls during processing and preparation of the food, incorrect use of the chemical materials, contaminated raw materials, food and water and inappropriate storage , It is expected that we will encounter cases of food-borne diseases in the city of Qom. The authors recommend performing the following interventions in order to improve the level of food hygiene and safety indicators of food preparation and distribution centers in the city of Qom: reviewing the process of providing educational programs of training centers based on changes in the content and headings of education as well as licensing method; reviewing the educational policies of the ministry of health; and holding special coordination meetings for teachers of training centers; and strengthening facilities, equipment, and educational media. Also, intra-sectional coordination meetings of trade unions and related executive agencies should be planned and implemented to strengthen the role of education.

Conflict of interests

The authors of this article declare that they have no conflict of interests.

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