

IMPLEMENTATION OF HAZARD ANALYSIS AND CRITICAL CONTROL POINTS REQUIREMENTS IN NUTRITION DEPARTMENTS OF SELECTED HOSPITALS IN IRAN

¹Fereshteh Farzianpour, ²Ali Namati, ³Ahmad Reza Raeisi, ⁴Mina Torabi, ⁵Kaivan Rahmani, ⁶Fatameh Manafi, ⁷Milad Shafii, ⁸Saeid Shojaei and ⁹Kobra Bamdad Mehrabany

^{1, 2, 5, 6, 7, 8}Department of Health Management and Economic,
School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

³Department of Health Care Management School of Public Health,
Isfahan University of Medical Sciences, Isfahan, Iran

⁴Department of Health Management Information, School of health Management Information,
Isfahan University of Medical Sciences, Isfahan, Iran

⁹Department of Immunology, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

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ABSTRACT

Nutrition department is one of the most important parts in a hospital since the performance of it has great impact on patients' satisfaction. HACCP standard is one of tools for management and monitoring of the nutrition department. The aim of this study was reviewing the condition of HACCP standard requirements in nutrition departments of selected hospitals of Isfahan University of Medical Sciences. In this cross-sectional study, nutrition department of 12 hospitals of Isfahan University of Medical Sciences were studied. Data was gathered using questionnaires including 156 questions covering 5 domains through observation and interview. Statistical analysis was done using SPSS v16 and Kruskal-Wallis test. In total, rate of adherence to HACCP standard requirements in the studied hospitals was found as following: Modares (53.7%) and Seyedoshohada (53.1%) Hospitals, unacceptable conditions; Azahra (56.5%), Feiz (60.7%) and Amin (57.9%) Hospitals, moderate; Noor (68.2%), Ali-Asghar (68.2%), Eisabnmaryam (68.7%), Chamran (70.1), Shahid Beheshti (70%), Imam Musa Kazem (69.3%), Farabi (68.2%) and Kashani (68.5%) Hospitals, acceptable conditions. According to Kruskal-Wallis statistical test, scores from the five studied domains were not significantly different while the scores of the 12 hospitals were significantly different ($p < 0.001$). Using HACCP system as a food safety management system in nutrition departments of the hospitals, not only leads to safe and healthy food production, but also results in improved patients' satisfaction, decreased complaint rates, preventing food poisoning episodes and avoiding unnecessary costs. Hospitals must work to establish HACCP standards. Educational courses for staff and enforcement of the prerequisites are recommended.

Keywords: Hospital, Nutrition Department, HACCP Standard

1. INTRODUCTION

Hospital food-service systems and nutrition departments have significant impact on the performance of hospitals by focusing on more than just food itself but also preparing and distribution of food services to clients (Ohlsson, 2004; Farzianpour *et al.*, 2011b). Performance and functioning of

this department has a major effect on patients' satisfaction level (Farzianpour *et al.*, 2011a; 2012). Moreover, balanced high quality nutrition is of great health care for patients and moreover, it affects their evaluation of the hospital or the ward they are staying in (Farhadfar, 2007).

Quality of food preparation and delivery to the patients is an important part of hoteling services of the

Corresponding Author: Fereshteh Farzianpour, Department of Health Management and Economic, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran Tel: +98(21)44648943, Fax: +98(21)88989129

hospitals and higher quality of these services will lead to higher satisfaction among patients increasing the probability of their recurrent referral to that hospital (Farzianpour *et al.*, 2013a). From a nutritional point of view, reducing the food wastes causes higher access to nutrients and thus improved public health and food safety (Schenker, 2001; Farzianpour *et al.*, 2013b). Given the main issue in food production and processing is the health and safety of the final product, implementation of Hazard Analysis and Critical Control Points (HACCP) in nutrition departments and food-service establishments is one of the most effective methods to ensure safety and quality control of the food (Manesh, 2008).

The HACCP system have seven principles including hazard analysis, identifying critical control points, establishing critical limits, monitoring requirements, establishing corrective actions, record keeping procedures and verification and ensuring of the system (Schenker, 2001). This system is a method to secure the safety of food supply by monitoring all stages of a food chain. In this method, first critical control points that are effective in food production process are determined and analyzed and then proper approaches are introduced and programmed to modify the defects related to the critical points. Meanwhile, associated controls are applied on these stages and in order to ensure the effectiveness of the applied controls, all stages are continuously under supervision and monitoring (Ghavam and Derakhshani, 2004).

Before initiating to design or implementing any program, it must be ensured that all HACCP requirements are considered; the program is already documented with an independent system and it is in consistent with current provisions and product production rules (MHME, 1999). Taylor (2008) in his study titled "A new method of HACCP for the catering and food industry" stated that implementing HACCP system in several domains including required tools and facilities, using correct and modern methods of cooking and appropriate supervision in nutrition departments of the hospitals have been significantly effective in assessment of the medical centers by food standard agencies in United Kingdom. In a study by Rafati *et al.* (2010) titled "comparison of implementation requirements in nutrition department of two military and non-military health-treatment centers" showed that military center with 77.8% of the HACCP system requirements had a better condition in comparison to non-military center with 70.8% of the requirements and in general, both centers seemed to be in an acceptable level regarding the HACCP system requirement.

Findings of a study by Farhadfar (2007) with the title "nutrition sector review selected hospitals of Isfahan on HACCP prerequisite enforcement system" indicated that

nutrition departments of Fateme-Zahra Hospital of Najafabad and Doctor Gharazi Hospital had an acceptable condition applying 67.4 and 66.6% of the HACCP requirements, respectively. However, nutrition department in Doctor Shariati Hospital had 54% of the HACCP requirements and therefore was considered in a moderate condition. In conclusion, in the first mentioned two hospitals, HACCP system is able to be fully established and Dr Shariati Hospital needs further modifications in its nutrition department (Farhadfar, 2007). Kazemi *et al.* (2010) showed that hospital A having 78% of the HACCP standard requirements was superior to hospitals B and C with 63.3% and 59.4% of the requirements respectively.

Implementation of the HACCP system in nutrition sector of the hospitals will only be possible when the requirements already exist. In fact, hospitals can hire consultants and work on establishing the standard requirements to voluntarily obtain HACCP license from validated international organizations. Accordingly, this research is carried out with the aim of evaluating implementation of the HACCP standard requirements in nutrition departments of Isfahan University of Medical Sciences Hospitals in 2011.

2. MATERIALS AND METHODS

2.1. Description of Study

In this cross-sectional study, nutrition department of 12 hospitals of Isfahan University of Medical Sciences were studied. This research is carried out with the aim of evaluating implementation of the HACCP standard requirements in nutrition departments of Isfahan University of Medical Sciences Hospitals in 2011.

2.2. Sampling Method and Data Collection

Survey instrument was a standard check list which contained 156 questions in five sections of engineering and instruction condition (29 questions), equipment and facilities (61 questions), observance of the health measures (25 questions), staff (23 questions) and educational condition and supervision on food production and distribution (18 questions). Respondents were asked to choose from among five options ranging from option 1 as the least acceptable to option 5 as most acceptable. Therefore each question takes a score from 1 (lowest quality) to 5 (highest quality). Acceptance scale is defined as: Unacceptable, scores 1.81 to 2.6 (36.1% to 54%); moderate, scores 2.61 to 3.4 (54.1% to 68%); acceptable, scores 3.41 to 4.2 (68.1% to 84%) and totally acceptable, scores 4.21 to 5 (84.1% to 100%). Data

collection was performed using three methods of observation, interview and completing the check list. In the observation method, the researcher referred to the nutrition departments and completed the check list due to his direct observations. Some questions of the checklist required interviewing with the directors.

2.3. Statistical Analysis

The gathered data were entered to the software and statistical analyses were done using SPSS v16 and Kruskal-Wallis test. A probability level of $p < 0.05$ was considered statistically significant.

3. RESULTS

In the first section of the checklist (engineering and constructions condition), Seyedoshohada Hospital was found to have the lowest level of HACCP standard requirements while Noor and Ali-Asghar Hospitals had the highest level of the requirements. Seyedoshohada and Modares Hospitals were classified as unacceptable, Azahra, Feiz and Amin Hospitals had moderate conditions and Kashani, Noor, Ali-ASghar, Beheshti, Chamran, Farabi, Eisabnemaryam and Imam Musa Kazem Hospitals had acceptable conditions regarding engineering and construction standards.

Lowest and highest levels of equipment and facility requirements due to HACCP standards were recorded for Seyedoshohada Hospital and Beheshti Hospital, respectively. The three hospitals of Azahra, Modares and Seyedoshohada were considered unacceptable; Amin,

Feiz, Chamran and Farabi Hospitals were assessed to have moderate condition and the rest (Kashani, Eisabnemaryam, Noor, Ali-Asghar, Beheshti and Imam Musa Kazaem) were found to have an acceptable level of HACCP requirements in this domain.

Regarding the third domain of the checklist (observance of the health measurements), hospitals of Seyedoshohada, Azahra, Feiz, Noor and Ali-Asghar were found to be in unacceptable conditions; Modares, Amin, Eisabnemaryam, Imam Musa Kazem, Farabi and Kashani were moderate and Chamran and Beheshti Hospitals were the only ones with acceptable levels of HACCP requirements in this section. Considering the checklist of staff, Azahra, Modares, Seyedoshohada, Kashani and Amin showed moderate levels of HACCP standards while the rest of the hospitals were checked as being in an acceptable condition. The fifth section of the checklist, educational condition and supervision on food production and distribution, Modares Hospital was unacceptable; Amin, Farabi, Seyedoshohada, Azahra, Chamran and Imam Musa Kazem were found to be in a moderate condition. The rest of the hospitals were in an acceptable level of HACCP standard requirements in this domain (**Table1**).

Total scores of checklists assessed the studied hospital regarding HACCP standard requirements as following: Modares and Seyedoshohada Hospitals, unacceptable; Azahra, Feiz and Amin Hospitals, moderate; and the rest of the hospitals, acceptable (**Fig. 1**).

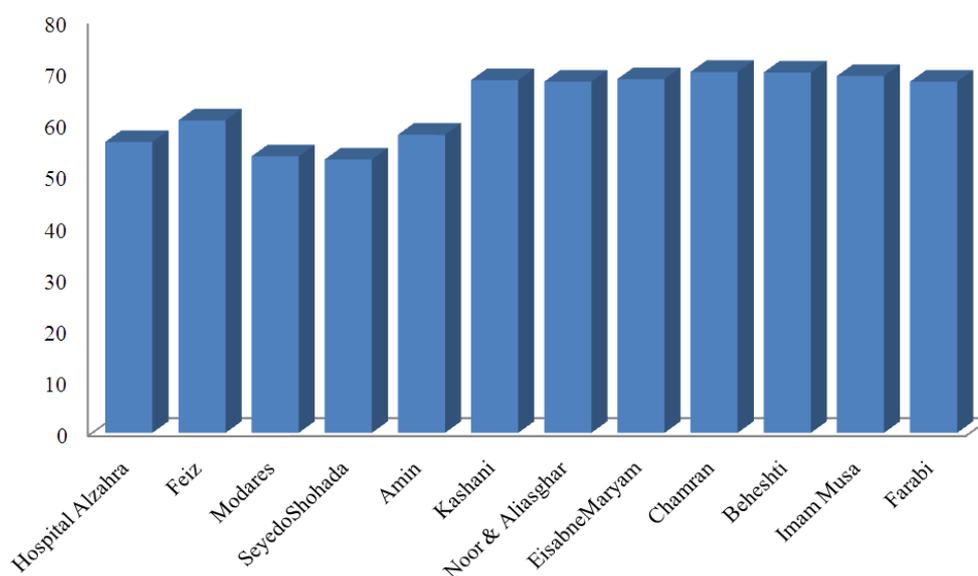


Fig. 1. Comparison of selected hospital of Isfahan University of medical sciences in compliance prerequisite HACCP standards**Table 1.** Implementation of standard requirements of HACCP in selected hospitals of Isfahan University of Medical Sciences

Hospitals	Azahra		Feiz		Modares		Seyedoshohada		Amin		Kashani	
	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)
Domain 1	2.80±1.17	56.0	2.75±1.31	55.0	2.65±1.39	53.0	2.60±1.45	52.0	2.75±1.55	55.2	3.5±1.49	74.0
Domain 2	2.54±1.38	50.8	2.77±1.57	55.4	2.45±1.57	49.1	2.29±1.41	45.9	2.78±1.55	55.7	3.5±1.47	70.4
Domain 3	2.32±1.24	46.4	2.60±1.50	52.0	2.76±1.61	52.0	2.64±1.46	52.8	2.80±1.38	56.0	3.28±1.30	65.6
Domain 4	3.30±1.91	67.1	3.43±1.75	69.2	3.08±1.59	60.0	2.82±1.64	57.8	3.52±1.64	66.4	2.91±1.67	59.2
Domain 5	3.11±1.52	62.2	3.61±1.68	72.2	2.55±1.85	51.1	3±1.49	60.0	2.77±1.69	55.5	3.66±1.60	73.3
Total	2.62±1.46	56.5	2.85±1.59	60.7	2.55±1.59	53.7	2.53±1.47	53.1	2.89±1.54	57.9	3.2±1.50	68.5
	Noor and Ali-Ashghar		Eisabnmaryam		Chamran		Beheshti		Imam Musa Kazem		Farabi	
Hospitals												
Domains	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)	Mean ± SD	(%)
Domain 1	4±1.82	80.0	3.44±1.47	71.0	3.58±1.47	71.7	3.55±1.50	71.0	3.50±1.36	76.0	3.86±1.50	77.2
Domain 2	3.45±1.62	69.1	3.40±1.50	68.2	3.2±1.56	64.0	3.42±1.64	68.5	3.57±1.56	71.4	3.22±1.49	64.5
Domain 3	2.52±1.44	50.4	3.12±1.66	62.4	3.64±1.43	72.8	3.52±1.41	70.4	3.20±1.68	64.0	3.28±1.76	65.6
Domain 4	3.69±1.49	72.8	3.56±1.59	70.7	3.73±1.62	75.0	3.34±1.72	70.7	3.60±1.58	70.7	3.52±1.59	70.0
Domain 5	3.44±1.85	68.8	3.77±1.80	78.5	3.38±1.64	67.7	3.83±1.50	76.6	3.22±1.80	64.4	3.16±1.65	64.3
Total	3.29±1.66	68.2	3.43±1.56	68.7	3.4±1.55	70.1	3.50±1.56	70.0	3.55±1.55	69.3	3.39±1.56	68.2

No significant difference was found between the scores of the five domains of the checklist using Kruskal-Wallis test ($p = 0.143$); however, scores of the hospitals were found to be significantly different ($p < 0.001$).

4. DISCUSSION

In this survey the rate of adherence to HACCP standard requirements in the studied hospitals was found as following: Azahra Hospital, 56.5%; Feiz Hospital, 60.7%; Seyedoshohada Hospital, 53.1%; Modares Hospital, 53.7%; Kashani Hospital, 68.5%; Amin Hospital, 57.9%; Noor and Ali-Asghar Hospitals, 68.2%; Eisabnmaryam, 68.7%; Chamran Hospital, 70.1%; Shahid Beheshti Hospital, 70%; Imam Musa Kazem Hospital, 69.3% and Farabi Hospital, 68.2%. Rafati *et al.* (2010) reported that military and non-military hospitals had 77.8 and 70.8% of the HACCP standard requirements, respectively. Moreover, Farhadfar (2007) study nutrition departments of Dr Gharazi and Fateme-Zahra were considered to be in an acceptable level (67.4 and 66.6% respectively) while Dr Shariati Hospital was in a moderate condition (54%) regarding HACCP requirements. Kazemi *et al.* (2010) study, Hospital A, B and C were found to have 78, 63.3 and 59.4% of the HACCP requirements, respectively. In Italy, 54% of the 36 reviewed hospitals in one study (Angelillo *et al.*, 2001) and 4 of 99 hospitals in another study (Georgia and Babatsikou, 2010) applied this system.

In total, Modares and Seyedoshohada Hospitals had unacceptable conditions, Azahra, Feiz and Amin Hospitals had moderate conditions and the rest of the studied hospitals were found to have acceptable rates of HACCP standard requirements. Although food safety management system based on HACCP principles contributes greatly to prevent food-borne diseases, this system is not accepted and applied as it should be. Issues such as low knowledge about this system and high costs of its implementation are proposed as some of the main obstacles. Murat *et al.* (2007) showed that lack of knowledge on HACCP system and other food-safety programs is the main problem in implementation of food-safety system. In addition, lack of prerequisite plans and inadequate physical space were mentioned as other drawbacks. Georgia and Babatsikou (2010) also in a study in Greece in 2003 reported lack of commitment in the management, low financial supply, inadequate equipment and physical space, false believes about HACCP principles, not following scientific validated methods of risk assessment and lack of training programs for health directors as the most important problems in implementation of HACCP system requirements in the hospitals (Georgia and Babatsikou, 2010).

Main issues related to each of the five main domains of the checklist are discussed in the following.

4.1. First Domain (Engineering and Construction Condition)

One of the main observed problems with this domain was non-separation of contaminated and non-contaminated sections. This issue was observed in Azahra, Feiz, Modares, Seyedoshohada, Amin, Chamran and Beheshti Hospitals. Kazemi *et al.* (2010) found this problem in Hospitals B and C. In none of the hospitals of Farhadfar's study this principle was considered (Farhadfar, 2007). Rafati *et al.* (2010) also found that these spaces were connected in all the studied hospitals. In Hospitals of Azahra, Feiz, Modares, Seyedoshohada, Amin, Noor and Ali-Asghar, catering manager's office was outside the hospital building. In Beheshti Hospital, the kitchen is inside the wards section; however no supervision is applied on any of the food chain processes. Eisabnmaryam, Chamran and Imam Musa Kazem Hospitals inspected the cooking process. Kashani and Farabi Hospitals, surveillance is applied on both cooking and preparation of the food. Kazemi *et al.* (2010) study, there was no office for nutrition director in any of the three hospitals and cooking and preparation of the food was not monitored adequately. Farhadfar (2007) also found that this issue is not considered in the majority of the studied hospitals.

Rafati *et al.* (2010) showed that despite the existence of nutrition director office inside the ward, still the inspection on cooking and food preparation processes was not sufficient. In Feiz and Modares Hospitals, staff entrance was not separated from the ingredients and products exit. In Azahra and Farabi Hospitals, staff entrance was the same as the products exit. In Seyedoshohada, Noor and Ali-Asghar Hospitals, entrance for staff and food ingredients is the same. In the rest of the hospitals, separated paths are considered for each purpose. Rafati *et al.* (2010) study, entrance and exit of the staff and food ingredients were common in the reviewed hospitals. In Modares and Eisabnmaryam Hospitals, food preparation equipment is placed on the edges. In seyedoshohada and Eisabnmaryam Hospitals, cooking was performed in the middle area and preparation process is performed in the edges. The two processes are performed in isolated spaces in the rest of the hospitals.

In Hospitals of Azahra, Feiz, Modares and Seyedoshohada, all walls are made from resistant and impermeable materials such as ceramics and tiles; however there are lots of defects and gaps on them. The rest of the hospitals were found to have resistance firm walls made of the same materials with intact, plain surfaces making the cleaning and disinfection processes more feasible.

Controlling the insects and harmful rodents is a major issue of the nutrition wards. Using automatic door closing systems can obviate this problem. At the entrance

of Amin, Eisabnmaryam and Farabi Hospitals the doors were automatically closed and snap up to prevent the insects and rodents entry while this facility was not provided in the rest of the hospitals. Kazemi *et al.* (2010) study only hospital B used these doors and in the two other hospitals the problem remained unsolved. Similarly in Farhadfar (2007) study in Isfahan and Rafati *et al.* (2010) in Tehran none of the studied hospitals had this standard.

Azahra, Noor and Ali-Asghar Hospitals have no windows. Modares and Seyedoshohada Hospitals have unacceptable conditions. Only Eisabnmaryam and Chamran Hospitals are in acceptable conditions with the rest of the hospitals assessed as moderate.

4.2. Second Domain (Equipment and Facilities Condition)

Feiz, Modares, Seyedoshohada, Amin, Eisabnmaryam, Noor and Ali-Asghar Hospitals lacked the accurate and validated monitoring and measurement equipment using appropriate mechanisms such as comparison controls and supervised calibration which are performed annually in Chamran and Beheshti Hospitals, every six months in Farabi Hospitals and every three months in Kashani and Imam Musa Kazem Hospitals.

One of the most important equipment in the kitchen is the chopping board for raw meat and poultry. Given the fast contamination of meat as one of the most important food ingredients leading to severe food poisonings, it can be said that after fridge stores, chopping boards are simple yet very important tools that if their hygiene is not ensured, it will continuously contaminate the meat products causing the transfer of the pathogens to other food materials. Regarding work tables and food preparation surfaces (for meat and vegetables), Seyedoshohada Hospital was in a moderate level, Imam Musa Kazem and Beheshti Hospitals were in a totally acceptable condition and the rest of the hospitals were considered acceptable. Each table was assigned to a particular food material. In Modares and Imam Musa Kazem Hospitals the tables were made of metal while the rest of the studied hospitals used fiberglass tables. In Tofighi's study, the tables were made of condensed fiberglass in hospital C and wood in the two others (Kazemi *et al.*, 2010). Rafati *et al.* (2010) study the material used for meat chopping boards was implant and stone while it was fiberglass Farhadfar (2007) study.

Alzahra and Imam Musa Kazem Hospitals have special separated parts for preparation of salads while the rest of the hospitals lack such facility. Salads were prepared at the same day of consumption. Modares

Hospital didn't have food carts. Chamran and Amin Hospitals were in unacceptable conditions. Feiz, Alzahra and Seyedoshohada Hospitals were moderate regarding this equipment and in the rest of the hospitals the condition was evaluated acceptable. In Alzahra, Feiz, Seyedoshohada and Chamran Hospitals the food carts of the nutrition departments are in poor condition applying tension on lumbar and thigh areas. One of the other considerations to prevent unnecessary traffic of non-personnel to the kitchen is applying monitored entrances. In Seyedoshohada, Amin, Farabi, Imam Musa Kazem the kitchen entrance opened by pressing the intercom button. This system was not seen in the other hospitals. Such facility was not recorded in any of the hospitals in study Kazemi *et al.* (2010). In Farhadfar's study only one of the three hospitals and in Rafati's study only the public medical center had a door opener system installed on their kitchen entrances.

Hand washing facilities (washing and drying hands) in food processing locations in Feiz, Imam Musa Kazem, Amin, Beheshti and Farabi Hospitals were in a very unacceptable condition. These facilities were defective in the rest of the hospitals.

Regarding lighting of the environment, Alzahra Hospital was in a poor condition, Modares and Seyedoshohada were in a moderate condition and Noor, Ali-Asghar and Farabi Hospitals were found to be in a totally acceptable condition. Lighting in other hospitals was assessed acceptable.

Ventilation systems were rated really unacceptable in Azahra and Seyedoshohada Hospitals and unacceptable in Amin Hospital. Kashani and Imam Musa Kazem Hospitals were in moderate condition. The rest of the hospitals were in an acceptable condition.

Utensils are air-dried in all the studied hospitals which is a totally unacceptable method. Using foot pedal valves or electronic sensor faucets conveniently allow hands-free access to water thus reducing the possibility of contamination. Such facilities were not available in any of the studied hospitals.

Taylor (2008) in a study titled "A new method of HACCP for the catering and food service" showed that applying HACCP principles in equipment and facilities, correct and modern methods of cooking and close inspection in nutrition departments of the hospitals have been significantly effective in assessment of the therapeutic centers by food standard agencies in United Kingdom.

4.3. Third Domain (Observance of the Health Measures)

The ceilings are not at all sanitized in Alzahra, Feiz, Modares, Seyedoshohada, Farabi and Imam Musa Kazem Hospitals and occasionally in the rest of them. Doors are generally washed regularly. Azahra, Noor and Ali-Asghar Hospitals lack windows. In Chamran, Eisabnmaryam, Imam Musa Kazem and Farabi Hospitals the windows are washed completely and regularly while in the other hospitals they are washed occasionally. Supervision on sanitization and disinfection processes using appropriate methods such as periodic inspections and samplings was not performed at all in Feiz, Seyedoshohada, Modares, Beheshti, Noor and Ali-Asghar Hospitals. Goal-oriented periodic inspections are done in Imam Musa Kazem and Eisabnmaryam Hospitals. Only occasional non-continuous surveys were performed in the rest of the hospitals. Waste disposal is done regularly from the food production and preservation places. Cleaning tools have a particular location in Alzahra, Imam Musa Kazem, Beheshti and Eisabnmaryam Hospitals while no particular place was considered for them in the rest of the hospitals. Sanitation of the trash cans was appropriate in all hospitals, with no cases of temporary storage of the wastes. All hospitals followed insect eradication programs using preventive measures. Alzahra and Imam Musa Kazem Hospitals lack the required facilities for controlling and prevention of harmful rodents in the storage, while this issue was mostly regarded in the rest of the hospitals.

4.4. Forth Domain (Staff)

Staff's dressing room is located after the entrance of food preparation and processing salon in Azahra, Feiz and Seyedoshohada Hospitals while in Modares and Kashani Hospitals it is located at the same place as food processing. In Amin, Noor, Ali-Asghar, Chamran, Eisabnmaryam and Farabi Hospitals the dressing rooms are outside the kitchen area while in Beheshti and Imam Musa Kazem Hospitals they are connected to the kitchen although the number of the rooms is insufficient.

A lack of disinfection pool at the entrance of the kitchens was observed in all hospitals. There is a platform for changing the shoes in all hospitals. In Rafati's study, lack of disinfection pools as well as occasional entrance of people with particular shoes are mentioned as common problems with kitchens of non-military health-treatment centers (Rafati *et al.*, 2010). It seems that establishment of shoe changing platforms at kitchen entrances and using special footwear for the area can't resolve this issue and further proceedings such as determining a red line at the entrance, wearing a gown, passing disinfection pools, continuous education and tight implementation of the principles are necessary. In Alzahra, Chamran and Beheshti Hospitals working

cloths during processing the raw ingredients was different from the finished products, a caution which was not considered in the other hospitals.

Human resources are of the basic components of health and medical services and obviously every subsection of them. On the other hand, staff play the most important and effective role in both following the requirements and implementing the HACCP system. Therefore training the efficient staff is a valuable goal. Accordingly, holding educational courses for staff will improve their performance. Staff education and encouragement as well as flexibility of the product are the two most important factors in implementation of the HACCP system (Semos and Kontogeorgos, 2007).

Bucheri *et al.* (2007) did in a survey on 401 nurses involved in food processing in two general and pediatric hospitals and concluded that lack of knowledge on etiologic agents, carriers of food-borne pathogens and proper temperature of hot and cold food storages is the most common issue among them.

Mentioned studies all confirm the importance of the staff factor and even more importantly educated and qualified staff (Bucheri *et al.*, 2007).

4.5. Fifth Domain (Education and Supervision on Food Production and Distribution)

Transportation is in very poor condition in Modares Hospital. Amin and Farabi Hospitals weren't in acceptable conditions either. It was moderate in Feiz, Seyedoshohada and Imam Musa Kazem Hospital and the rest were acceptable. None of the studied hospitals applied supervision and control on transportation process. Regular inspection of the transportation process is not done in any of the hospitals. Modares and Imam Musa Kazem Hospitals don't have food carts. Only Beheshti and Kashani Hospitals had special elevators for food distribution. In Tofighi's study, using a separate elevator for food transportation was applied most of the time in hospital B, occasionally in hospital A and never in hospital C (Kazemi *et al.*, 2010). In Feiz, Modares, Kashani, Eisabnemyam and Beheshti Hospitals in each shift there was always one staff that was trained with first aids. In all hospitals, the staff working with chemicals had taken the necessary instructions and the directors of the nutrition departments were qualified with the proper education and skills. Patchell *et al.* (1998) pointed out that improvement of health related behaviors and education about mandated prerequisites of HACCP system before and during the implementation of this system are important parameters in reducing food contamination.

Moreover, Reglier (2005) in a research in France (2005) evaluated the microbial contamination of food in medical centers and showed that not paying attention to time and temperature are two main reasons for food contaminations with pathogens. They suggested that controlling temperature and time between food preparation and distribution is essential to ensure food quality and safety (Reglier, 2005). In a review in Italy on 171 nutrition departments of hospitals, it was found that 76 (43%) of them had HACCP system, 67 (38%) had a planning for implementation of the system in the next year, 12 stated applying the system as an important requirement and only 16 reported that they didn't plan on implementing this system (Osborn *et al.*, 1997). According to Surak (2007) report, using HACCP standards have had a very significant role in food safety and hygiene in United States.

5. CONCLUSION

One of the main observed problems with the First domain (engineering and construction condition) was non-separation of contaminated and non-contaminated sections. Second domain (equipment and facilities condition) was lacked the accurate and validated monitoring and measurement equipment using appropriate mechanisms such as comparison controls and supervised calibration which are performed annually in Hospitals. Third domain (observance of the health measures) the ceilings are not at all sanitized in many hospitals. Supervision on sanitization and disinfection processes using appropriate methods such as periodic inspections and samplings was not performed at all in hospitals. Sanitation of the trash cans was appropriate in all hospitals, with no cases of temporary storage of the wastes. All hospitals followed insect eradication programs using preventive measures. Forth domain (staff) a lack of disinfection pool at the entrance of the kitchens was observed in all hospitals. There is a platform for changing the shoes in all hospitals. Lack of disinfection pools as well as occasional entrance of people with particular shoes are mentioned as common problems with kitchens of non-military health-treatment centers. Fifth domain (education and supervision on food production and distribution) in all hospitals, the staff working with chemicals had taken the necessary instructions and the directors of the nutrition departments were qualified with the proper education and skills. Special principles must be applied in nutrition departments of health-medical centers in order to prevent the transmission of pathogens to the kitchen. Using HACCP

system as a food safety management system in nutrition department of the hospitals will result in production of healthy and safe food, as well as improved patients' satisfaction, decreased complaint rates, preventing food poisoning episodes and avoiding unnecessary costs. Nutrition departments in the hospitals must work harder to establish HACCP standards. Educational courses for staff and enforcement of the prerequisites are recommended to move towards the establishment of this system and ensure the food safety of the hospitals.

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