

Investigating the Level of Meeting HACCP Standard Requirements in the Nutrition Department of the Selected Hospitals Affiliated to Tehran University of Medical Sciences

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Citation: Mehdi Raadabadi, Jamil Sadeghifar, Hossein Dargahi, Mohammadkarim Bahadori, and Mehran Nejadi. Investigating the Level of Meeting HACCP Standard Requirements in the Nutrition Department of the Selected Hospitals Affiliated to Tehran University of Medical Sciences Archives of Pharmacy Practice. 2012; 3(2) pp 159- 165.

Abstract

Objectives: Undoubtedly the nutrition department is one of the most important departments in hospital; because the performance of this department has a dramatic effect on patients' satisfaction and improves the therapeutic process.

Method: In this cross-sectional study, nutrition department of the eight hospitals affiliated to Tehran University of Medical Sciences were examined. The required data was collected using questionnaire, as well as interviews and observations. Collected data then was analyzed using SPSS version 16.0 by running Kruskal-Wallis test.

Results: Out of the eight hospitals which were assessed based on HACCP standards, the condition of one hospital was moderate, while others were appropriate. The average score of all hospitals were 3.77 ± 1.54 . This indicates that according to HACCP principles, the level for hygiene food status in the evaluated hospitals was sufficient. Minimum and maximum scores were 3.11 and 4.04, respectively. Besides, statistically significant differences were observed among the average scores of hospitals ($H = 46.83, p = 0.000$).

Key words:

Nutrition Department, Hospital, HACCP

Manuscript History:

Article Received on: 10th Nov, 2011

Revised on: 30th Jan, 2012

Approved for Publication: 2nd Mar. 2012

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Conclusion: For establishing HACCP, the nutrition department of these hospitals should put more efforts in the engineering and construction issues, staffs and their training, and supervision on preparation and distribution of food. They can assure food safety and quality in their respective hospital by establishing necessary educational courses and strengthening HACCP prerequisites.

Introduction

In recent decades, the epidemiology of foodborne diseases is changing with new or unexpected pathogens often emerging on a countrywide or worldwide scale, with new foods expanding the range of potential vehicles of pathogens, wider social contexts being involved and new classes of individual being at higher risk(1-2). These changes may be attributable to several socio-economic and demographic factors, including dramatic qualitative-quantitative changes in primary production, processing, distribution and handling of food and the increasing exposure of individuals, such as elderly patients with impaired immunity and many hospitalized subjects (3-5) The frail elderly and the ill individuals often have lower immunity and the infectious dose to precipitate an infection is lower in them, as compared to healthy adults. Therefore, therefore the application of an effective food safety management system is crucial in hospitals (6). It has been argued that outbreaks of foodborne disease in hospitals constitute avoidable causes of illness and death in a vulnerable population (7). In the UK, since 1968, on average the number of reported salmonella outbreaks in hospitals has fallen from 53 per year to 6 per year (8). The reason for this fall is likely to be multi-factorial and probably a reflection of better control of cross-infection on the one hand, coupled with improvements in food hygiene on the other.

The HACCP concept was introduced in the United States in 1971 at the Conference of Food Protection where it was "recommended for widespread use" (9). HACCP is a

logical, structured approach to the analysis and control of potential hazard points in a food operation (10). Hospital management's support and commitment in HACCP application is vital to its successful implementation. Efforts to implement HACCP only at junior management levels are usually doomed to failure. In fact, a poorly developed or supported HACCP program may give the organization a false sense of security and may lead to many problems (11).

Regardless of the size of organizations, the same preventable faults contribute to outbreaks of foodborne diseases and often several occur simultaneously. The risk factors associated with food preparation procedures and employee behavior in hospitals are: a. improper holding/time and temperature (40.3%), b. contaminated equipment/protection from contamination (18.9%), c. poor personal hygiene (17.5%), d. chemical contamination (13.4%), e. inadequate cooking (6.3%), and f. food from unsafe sources (0.5%)(12).

All these factors could be efficiently controlled and monitored in order to eliminate or reduce the hazards to an acceptable level, in the framework for implementation of a HACCP plan in hospitals. A food safety management system based on HACCP principles in a hospital provides a method of achieving active managerial control on multiple risk factors. It contributes to consistency in food preparation, as well as employee awareness and participation in food safety.

Oliveira et al. analyzed feed samples for microbiological quality, before and after the implementation of the HACCP system and they concluded that when control measures were applied and monitored, the hazard was reduced (13). A report by Patchell et al. showed that training and improved hygienic practices, that included sections of Prerequisite Programs needed prior to and during the implementation of HACCP system, reduced the incidence of contamination of enteral feeds after the introduction of the new feeding protocol (14).

Problems of implementing prerequisite programs and HACCP system in hospitals include lack of commitment by management, lack of financial resources, inadequate equipment and space, mistranslation of HACCP principles, lack of scientifically validated risk assessment procedures, and lack of food hygiene management training. It should be mentioned that the common involvement of nurses or internal staff, in the role of food handlers, who are not specifically trained about food hygiene and HACCP, may present a further cause of concern.

Buccheri et al. conducted a survey in 2005 in an acute general hospital and a paediatric hospital, where nursing staffs were routinely involved in food service function. It was shown that respondents (nurses) had a generalized lack of knowledge about etiologic agents and food vehicle associated to foodborne diseases and proper temperatures of storage of hot and cold ready to eat foods (15).

Despite great advances in modern technology, producing safe food and keeping it safe remains a worldwide public health problem with the illness caused by the consumption of contaminated food described as the most widespread health problem in the contemporary world (16).

HACCP is essentially a system based on seven well-defined, theoretical risk management principles. However, during the first four decades of its development, many opinions were

promulgated as to how these principles should be applied in practice. Consequently, in 1993, the Codex Alimentarius Commission established definitive guidelines for the application of HACCP principles to be used in conjunction with the existing Codex guides for pre-requisites (17). In general, in developing countries, it has been suggested that both the incidence and related costs of foodborne diseases are greater than in those of high-income countries (18). HACCP is an internationally recognized system of managing food safety and its use is advocated in the hospitality industry (19). However, as previous papers in this interim demonstrate, there is an overwhelming range of practical and psychological barriers to its successful implementation in this industry (20). In many hospitals meals are prepared and cooked in the hospital kitchen and distributed directly to the wards. Increasingly, however, meals are prepared in advance, by cook chill and cook freeze systems, and catering contracts are outsourced (21).

Since the performance of nutrition department in hospitals plays a dramatic role on patients' satisfaction and improving the therapeutic process, the current study aims to examine the nutrition departments of several selected hospitals affiliated to Tehran University of Medical Sciences (Iran) and investigate their level of compatibility with HACCP.

Materials and Methods

Methods

The survey was conducted by using a semi-structured questionnaire, distributed during June to September 2011 in 3 general hospitals and 5 single-specialty hospitals affiliated to Tehran University of Medical Sciences. For the purpose of the study, we selected eight hospitals, namely *Sina* with 19 wards and 351 beds, *Rozbeh* with 10 wards and 196 beds, *Farabi* with 8 wards and 451 beds, *Imam Khomeini* with 41 wards and 1230 beds, *Shariati* with 38 wards and 530 beds, *Razi* with 4 wards and 69 beds, *Amir Alam* with 10 wards and 226 beds, and *Bahrami* with 12 wards and 113 beds. Since the survey data did not influence patient management and the issue being investigated is a matter of public record, ethical approval for the study was not required.

After obtaining necessary approval from relevant authorities for conducting the study, the questionnaire was addressed to food services unit leader which was potentially involved in food related functions in all of the hospitals. Confidentiality of the answers was also warranted.

As for the scale applied in the survey, each question was provided with 5 options ranging from 1 to 5, where option No. 1 specified minimum utility (minimum quality) and option No. 5 specified maximum utility (maximum quality), and the values between these two options specified borderline cases. The labeling of scores includes "completely inappropriate" for scores between 1 and 1.8 (20 to 36 percent), "inappropriate" for scores between 1.81 and 2.6 (36.1 to 54 percent), "moderate" for scores between 2.61 to 3.4 (54.1 to 68 percent),

“appropriate” for scores between 3.41 to 4.2 (68.1 to 84 percent), and “completely appropriate” for scores between 4.21 to 5 (84.1 to 100 percent).

Data collection was done by using a valid and reliable questionnaire, consisting of 156 items, under five main dimensions, namely engineering and construction status, equipments and facilities, compliance with health standards, staff, and finally training and the supervising of food preparation and distribution of food, which were identified through interviews and observations. The collected data was analyzed by using SPSS Software version 16.0 and conducting Kruskal-Wallis statistical test.

Findings

Results of the study show that out of the 8 investigated hospitals based on HACCP standards, one hospital had a moderate status, while others were appropriate (Figure 1). Total scores of investigated hospitals were in the range of 3.77 ± 1.54 which indicates an appropriate status of food hygiene in the hospitals according to HACCP principles. The lowest and highest scores were 3.11 and 4.04 respectively. Significant statistical differences were observed among mean scores of the hospitals ($H = 46.83, p = 0.000$). The following sections discuss the findings based on the five examined dimensions.

Engineering and Construction

The overall mean score and standard deviation of investigated hospitals under engineering and construction dimension was 3.61 ± 1.57 which was in appropriate condition. Three hospitals had a moderate status, while 5 hospitals had an appropriate status. The lowest and highest score were 3.28 and 4.18 respectively (Table 1). According to Kruskal-Wallis test, no significant difference was observed among hospitals under engineering and construction dimension ($H = 9.73, p = 0.20$).

Equipments and Facilities

Investigated hospitals had an appropriate condition under equipments and facilities dimension, with a score ranging 33.87 ± 1.51 . The lowest and highest scores were 3.20 and 4.24 respectively (Table 1). One hospital had a completely appropriate status, while 6 hospitals had an appropriate status and 1 hospital had a moderate status. Results of Kruskal-Wallis test indicated a significant difference in the mean scores of hospitals under equipments and facilities dimension ($H = 15.68, p = 0.02$).

Compliance with Health Standards

The average mean score for investigated hospitals for their compliance with health standards was 3.62 ± 1.50 , and the results of Kruskal-Wallis test indicated no significant difference among the mean scores of hospitals under this dimension ($H = 13.59, p = 0.059$). Lowest and highest scores were 3.12 and 4.18 respectively (Table 1). According to HACCP standard, 3 hospitals had a moderate status, while 5 hospitals had an appropriate status.

Staffs

The fourth investigated dimension under HACCP standard was staffs. Under this category, investigated hospitals achieved an

average score of 3.57 ± 1.54 . Two hospitals had a moderate status, 4 hospitals had an appropriate status and 2 hospitals had a completely appropriate status. Results of Kruskal-Wallis test indicated a large and significant difference among the mean scores of investigated hospitals under this dimension ($H = 20.10, p = 0.005$).

Training and the Supervising of Preparation and Distribution

The final investigated dimension under HACCP was related to training status and supervision of food preparation and distribution which achieved an average score of 3.94 ± 1.60 for investigated hospitals. Significant statistical difference was observed among the mean scores of hospitals under this dimension ($H = 19.34, p = 0.007$). The lowest and highest scores were 2.91 and 4.27 respectively. It was found that one hospital had an average status, while 4 hospitals had an appropriate status and 3 hospitals had a completely appropriate status.

Results and Discussion

None of the eight investigated hospitals had implemented HACCP system and the nutrition department in these hospitals did not have this standard implemented. In the study by Angelillo(22) in Italy, among the 36 hospitals investigated, only 54% and in the study by Grintzali and Babatsikou(23) only 4 out of 99 investigated hospitals had HACCP system. These studies indicate that in spite of the important role of food safety management systems based on HACCP standards in avoiding foodborne diseases, enough attention has not been paid to his system and its implementation. Lack of knowledge and high costs of implementation can be considered as the main barriers in implementing this system in hospitals.

In the study by Bas (24), lack of knowledge about HACCP and other food safety programs have been found to be the most important impediment in implementing food safety systems. Besides, lack of prerequisite programs and lack of sufficient space has been found as other key barriers. Grintzali and Babatsikou (23), in a study in Greece in 2003, reported the lack of commitment from the management, insufficient financial resources, insufficient equipments and space, incorrect perceptions about HACCP, lack of applying scientific and valid methods in risk assessment, and lack of training for food safety managers as the most critical problems in implementing prerequisites of HACCP system in hospitals. Although lack of adequate financial resources has been argued to be a major impediment in implementing this system, there are some organizations which implement it merely for the sake of achieving profitability and competitive advantage. The study by Li Bai(25) in China supports this argument, and found that the most important motivations for the investigated institutions to implement HACCP system were improved access to new markets, improved quality of production

and increased market share.

On average, investigated hospitals gained the score of 3.77 based on obtaining prerequisites of HACCP standard. In the study of Rafati et al. (26), military and non-military hospitals were investigated which obtained 77.8% and 70.8% of the HACCP prerequisites respectively. Besides, in the study of Farhadfar (27) on compliance with HACCP prerequisites, the nutrition unit of two of the investigated hospitals were found to be in appropriate conditions (67.4% and 66.6%), while another investigated hospital had a moderate condition by obtaining 54% of the prerequisites. The comparison of the current study with previous studies reveals that only hospital number 1 had a moderate condition, while the rest of the investigated hospitals had an appropriate condition.

In the category of engineering and construction, three hospitals had a moderate condition and 5 of them had an appropriate status. In this category, 31 items including issues related to the floor, walls, ceiling, doors, windows, lifts, etc. were investigated. The most frequent problem pertained to the lack of required arc in the connection point of floor and walls for a better washing and the inappropriate location of the office for the nutrition unit staff which was outside kitchen. Since authorities of nutrition unit are supposed to monitor the preparation, cooking and distribution process of the food, their office should be located in a better place nearby kitchen for better monitoring. Similar finding has been obtained in the study of Farhadfar (27). Besides, in the study of Rafati et al.(26) , despite the existence of monitoring office in the nutrition unit, appropriate view point on the food cooking and preparation process was not provided. Items with the least problems included issues related to windows and sinks, as well as resistant doors which could be disinfected.

In the category of equipments and facilities, under which 58 items were investigated, one hospital had a completely appropriate status, while 6 hospitals had an appropriate status and 1 hospital had a moderate condition. Among the investigated items, level of light in the unit, availability of a washing container (flush tank), and the ratio of toilets to number of staffs were the most problematic ones. Besides, the availability of separate sinks, the availability of an especial storehouse for waste and non-edible materials, and standardized kitchen tables had the best condition. Despite having proficient staffs, a quality final product cannot be achieved if required equipments and facilities are not provided. Taylor (28) asserts that using HACCP system has had a significant role in areas of equipments and facilities, modern methods of cooking and preparation of food, and efficient management of nutrition units in hospitals, in the evaluation of medical centers by food standard agencies in UK.

In the category of compliance with health standards, 25 items were investigated. Overall, 3 hospitals had a moderate status and the condition for 5 hospitals was appropriate. The most critical problems in this category included lack of a defined program for cleaning, unavailability of hot water, steam and compressed steam for cleaning and disinfection, lack of a place for defrosting, and inappropriate way of killing and eradicating insects. If these problems are not resolved, they will lead to increased microbial pollution. Thus, compliance with the prerequisites of HACCP standard can decrease prevalence of

these pollutions. Oliveira et al.(13)investigated food samples before and after implementation of HACCP system and found that the control activities involved in HACCP resulted in the decrease of pollution risks. Their findings showed that the level of bacteria in the food decreased from 10^5 cfu mL⁻¹ to 10^1 cfu mL⁻¹. Besides, the study by Tessi et al.(29) in 2004 on the microbial quality of cooked food in an academic unit in Argentine revealed that from the 101 investigated samples, the average microbial pollution was 3.63×10^4 and the average total pollution was 1.90×10^2 per gram. Issues such as the availability of a dried standard storehouse in the vicinity of the delivery point for the raw materials, appropriate cleaning of trash bins, and the separation of cleaning tools used for cleaned and dirty areas, need to be compatible with HACCP standard prerequisites.

In the category of staffs, 19 items were investigated. Overall, 2 hospitals had a moderate status, 4 hospitals had an appropriate status and 2 other hospitals had a completely appropriate status. Items with the best conditions in the category of staffs included the appropriate staffs' clothing such as hat, cover, shoes and ironed pinafore with light color, limitation of wearing work clothing and shoes only in the working area, and good relations of unit supervisors with staffs. Besides, lack of facilities such as dry-cleaning, using disposable clothing for clean clothing, and entry of miscellaneous people to the unit without any limitations were considered as the most important problems observed.

Human resource is one of the most important assets of any organization and lack of proficient human resource is considered as a liability for an organization. Human resource is also among the most critical factors in the success of a healthcare and medical center and its units. Besides, in implementation of HACCP system and compliance to its prerequisites, staffs play the most important role. Thus, holding training programs for staffs can result in their increased proficiency. In the study of Anastasios(30) , training and motivation of staffs and the flexibility of product were found to be the most important factors in the implementation and operationalization of HACCP system. In a study on two public children hospitals where over 401 nurses involved in nutrition issues, Buccheri et al.(15) concluded that they all lacked awareness about the etiologic agents, food conveyers pertaining to foodborne diseases, and appropriate temperature for storehouses of warm and cold food. This study highlights the importance of having trained and proficient staffs.

Finally, in the category of training and supervising the preparation and distribution of food 23 items were investigated. Overall, 1 hospital had a moderate status, 4 hospitals had an appropriate status and 3 hospitals had a completely moderate status. Items such as lack of the training of staffs on first aids, application of equipments applied in the initial product for process of final product, and lack of changing clothing by the staff while working with the initial and final product are among the issues with the least compatibility with HACCP prerequisites.

Furthermore, items such as removing any access point for animals to approach kitchen, availability of a food menu for patients, and good functionality and cleanness of food conveying and distribution trolleys were among the issues with the highest level of compatibility with HACCP prerequisites. Besides, in all of the investigated hospitals, managers and nurses of the unit had sufficient required knowledge, education and skills related to principles and hygiene operation of final product. Previous researchers such as Patchell et al. (14) argued the training and improved hygiene behaviors on HACCP prerequisites, before and during its implementation, as important factors in decreasing food pollution. Besides, Reglier et al. (31), in a study in 2005 in France on evaluating microbial status of consumed food in medical centers, indicated that in most cases of food microbial pollutions, it is caused by lack of precise compliance with standards of time and temperature, whereas time and temperature control are essential to ensure quality and safety of food.

The current study is not without limitations. The main limitation of this research pertains to sample size and the instrument applied. It is assumed that replicating similar study with higher sample size and applying additional qualitative measures can help to achieve more reliable and precise results.

Conclusion

Nutrition unit is among the most important units of every hospital, because its performance and operation plays a critical role in the satisfaction of patients and is also important to the health level of the patients. Besides, evaluation of a patient from the hospital and the unit is highly dependent on the performance of the nutrition unit of the hospital.

As clinical units have specific principles to avoid dissemination of microorganisms, nutrition units also require an integrated system for the hygiene management of food and avoiding risks of food pollution. Undoubtedly, implementation of HACCP system and compliance with its principles will decrease the above mentioned risks to a great extent. While there are significant barriers in implementation of this system, such as lack of experience in analyzing problematic issues, lack of epidemiologic information on evaluation of risks, and lack of technical information in developing countries, the least which can be done by hospitals in developing countries is to comply with this system to the best possible level. It is also recommended for governmental organizations to hold explanatory sessions for hospitals and provide them with updated information and increased awareness about the best practices and outcomes achieved to encourage them for implementation of HACCP system.

Hospital managers in the developing countries, including Iran, should consider implementation of HACCP system as a priority for their hospitals to ensure food safety in their organization. Holding training programs and ensuring compliance with HACCP prerequisites can be a starting point towards its implementation.

Acknowledgment

This research has been supported by Tehran University of Medical Sciences & health Services grant number 132/1167

dated 26/06/2011.

References:

1. MacKenzie A, Allard D, Perez E, Hathaway S. Food systems and the changing patterns of foodborne zoonoses. *Revue scientifique et technique (International Office of Epizootics)*. 2004;23(2):677.
2. Tauxe RV. Emerging foodborne diseases: an evolving public health challenge. *Emerging Infectious Diseases*. 1997;3(4):425.
3. Buzby JC. Older adults at risk of complications from microbial foodborne illness. *FOOD REVIEW-WASHINGTON DC*. 2002;25(2):30-5.
4. Buzby JC, Roberts T. Economic costs and trade impacts of microbial foodborne illness. *World health statistics quarterly Rapport trimestriel de statistiques sanitaires mondiales*. 1997;50(1-2):57.
5. Gerba CP, Rose JB, Haas CN. Sensitive populations: who is at the greatest risk? *International journal of food microbiology*. 1996;30(1-2):113-23.
6. Worsfold D. A guide to HACCP and function catering. *The Journal of the Royal Society for the Promotion of Health*. 2001;121(4):224.
7. Wall P, Ryan M, Ward L, Rowe B. Outbreaks of salmonellosis in hospitals in England and Wales: 1992-1994. *Journal of Hospital Infection*. 1996;33(3):181-90.
8. Dalton CB, Gregory J, Kirk MD, Stafford RJ, Givney R, Kraa E, et al. Foodborne disease outbreaks in Australia, 1995 to 2000. *Communicable diseases intelligence*. 2004;28(2):211.
9. Bauman HE. The HACCP concept and microbiological hazard categories. *Food Technology*. 1974;28(1):30-4.
10. Richards J, Parr E, Riseborough P. Hospital food hygiene: the application of Hazard Analysis Critical Control Points to conventional hospital catering. *Journal of Hospital Infection*. 1993;24(4):273-82.
11. Mortimore S, Wallace C. *Food Industry Briefing Series: HACCP*. HACCP. 2001.
12. Food U. Drug Administration. 2004. FDA report on the occurrence of foodborne illness risk factors in selected institutional foodservice, restaurant, and retail food store facility types (2004). 2006.
13. Oliveira M, Batista C, Aidoo K. Application of hazard analysis critical control points system to enteral tube feeding in hospital. *Journal of Human Nutrition and Dietetics*. 2001;14(5):397-403.
14. Patchell C, Anderton A, Holden C, MacDonald A, George R, Booth I. Reducing bacterial contamination of enteral feeds. *Archives of disease in childhood*. 1998;78(2):166.
15. Buccheri C, Casuccio A, Santo Giammanco MG, La Guardia M, Mammina C. Food safety in hospital: knowledge, attitudes and practices of nursing staff of two hospitals in Sicily, Italy. *BMC health services research*. 2007;7(1):45.
16. BenEmbarek P. HACCP and the food industry: the international experience. *Proceedings of the 3rd*

- National Conference, HACCP for Catering: Preparing for 2006; Salford2002.
17. Alimentarius C. Recommended International Code of Practice: General Principles of Food Hygiene. CAC/RCP. 2003;1-1969.
 18. Henson S. The economics of food safety in developing countries. *ESA Working Paper*. 2003;12:3-19.
 19. Alimentarius C. Hazard analysis and critical control point (HACCP) system and guidelines for its application. Annex to CAC/RCP. 1997:1-1969.
 20. Taylor E. HACCP for the hospitality industry: history in the making. *International Journal of Contemporary Hospitality Management*. 2008;20(5):480-93.
 21. Engelund EH, Lassen A, Mikkelsen BE. The modernization of hospital food service—findings from a longitudinal study of technology trends in Danish hospitals. *Nutrition & Food Science*. 2007;37(2):90-9.
 22. Angelillo IF, Viggiani NMA, Greco RM, Rito D. HACCP and food hygiene in hospital: knowledge, attitudes, and practices of food services staff in Calabria, Italy. *Infection control and hospital epidemiology*. 2001;22(6):363-9.
 23. Grintzali GP, Babatsikou F. The significance of the application of Hazard Analysis Critical Control Point System in hospital catering. *Health Science Journal*. 2010;4(2):84-93.
 24. Bas M, Yuksel M, Cavusoglu T. Difficulties and barriers for the implementing of HACCP and food safety systems in food businesses in Turkey. *Food Control*. 2007;18(2):124-30.
 25. Bai L, Ma C, Yang Y, Zhao S, Gong S. Implementation of HACCP system in China: A survey of food enterprises involved. *Food Control*. 2007;18(9):1108-12.
 26. Rafati H, Tavakoli HR, Amerion A, Hosseinpour MJ, Nasiri T. Comparison of HACCP implementation requirements in nutrition department of two military and non-military health-treatment centers. *Journal of Military Medicine*. 2010;11(4):191-6.
 27. Farhadfar AH. Nutrition sector review selected hospitals of Isfahan on HACCP prerequisite enforcement system. *Hospital*. 2007;19(2):22-9.
 28. Taylor E. A new method of HACCP for the catering and food service industry. *Food Control*. 2008;19(2):126-34.
 29. Tessi M, Aringoli E, Pirovani M, Vincenzini A, Sabbag N, Costa S, et al. Microbiological quality and safety of ready-to-eat cooked foods from a centralized school kitchen in Argentina. *Journal of Food Protection* 174;. 2002;65(4):636-42.
 30. Semos A, Kontogeorgos A. HACCP implementation in northern Greece: food companies' perception of costs and benefits. *British Food Journal*. 2007;109(1):5-19.
 31. Réglier-Poupet H, Parain C, Beauvais R, Descamps P, Gillet H, Le Peron J, et al. Evaluation of the quality of hospital food from the kitchen to the patient. *Journal of Hospital Infection*. 2005;59(2):131-7.

Table 1: Mean Score of Investigated Hospitals un

	A	B	C	D	E	TOTAL
Hospital 1	3.38±1.58	3.20±1.72	3.12 ± 1.48	2.63±1.38	2.91±1.62	3.11±1.60
Hospital 2	4.00±1.55	3.83±1.59	3.43 ± 1.44	3.57±1.77	3.95±1.71	3.78±1.59
Hospital 3	3.74±1.50	3.83±1.50	3.81 ± 1.40	3.68±1.81	4.05±1.56	3.82±1.51
Hospital 4	3.32±1.59	4.00±1.38	3.36 ± 1.57	3.36±1.73	4.21±1.51	3.68±1.55
Hospital 5	3.28±1.78	4.24±1.37	4.18 ± 1.56	3.77±1.55	4.05±1.58	3.95±1.56
Hospital 6	4.18±1.30	3.96±1.47	3.38 ± 1.59	4.17±1.28	4.05±1.60	3.95±1.46
Hospital 7	3.51±1.60	4.01±1.49	3.79 ± 1.50	4.38±1.09	4.27±1.52	3.96±1.48
Hospital 8	3.52±1.57	4.00±1.32	4.00 ± 1.37	4.55±0.78	4.25±1.48	4.04±1.35
Total	3.61±1.57	3.87±1.51	3.62 ± 1.50	3.75±1.54	3.94±1.60	3.77±1.54
H	9.73	15.68	13.59	20.10	19.34	46.83
P-Value	0.20	0.02	0.059	0.005	0.007	0.000

A: Engineering and Construction

B: Equipments and Facilities

C: Compliance with Health Standards

D: Staffs

E: Training and the Supervising of Food Preparation and Distribution

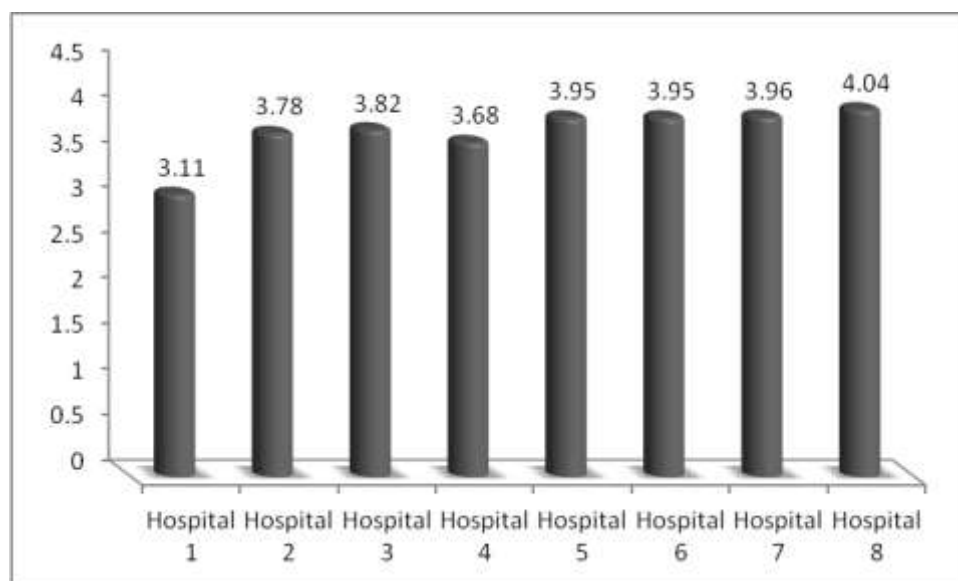


Figure 1: Average Total Scores of the Hospitals

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