

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Association between sociodemographic factors and knowledge level of food safety and hygiene among hospital food services staff.

Mohammad Abd Elmoneim Elmadbouly*

Department of Clinical Nutrition, Faculty of Applied Medical Sciences, Umm Al-Qura University, P.O. Box 7067, (21955) Makkah, Saudi Arabia.

ABSTRACT

Contamination of food due to limited knowledge of food safety practices primarily increases the risk of food borne illnesses. Therefore, food handlers should improve their knowledge and skills on food safety and hygiene. The aim of this study was to evaluate the effects of selected sociodemographic factors on the knowledge of food safety and hygiene among food service staff in hospitals. A cross-sectional study was conducted for hospital food service staff in the Makkah area. Information on sociodemographic characteristics and existing knowledge regarding food safety and hygiene was gathered by using a pretested questionnaire. In our study, the level of knowledge was influenced by age and gender. Females were significantly more knowledgeable than males regarding many aspects of food hygiene and safety. Additionally, the present study revealed that dietitians scored the highest number of correct responses for all parameters of food safety and hygiene. In conclusion, the findings of this study indicate that age, gender, education level and job title were associated with the level of knowledge among the participants. Increased effort must be made to enroll food handlers in an effective food safety training program to help them increase their food safety knowledge before they begin working at a hospital.

Keywords: sociodemographic factors, food safety, food hygiene, hospital staff

**Corresponding author*

INTRODUCTION

Food safety concerns have existed for a long time, as millions of people across the globe suffer from foodborne illness every year. Contamination of food due to limited knowledge of food safety practices primarily increases the risk of foodborne illnesses [1]. Food handlers, as the most important influence in food service, must play a role in providing safe food for their customers. Hence, currently it is compulsory for them to undergo food training courses to gain knowledge of food and personal hygiene. However, in addition to training, work experience and sociodemographic characteristics can affect their level of knowledge [2]. Food service staff in hospitals represent a potential source of food contamination in hospital-related foodborne outbreaks, since they may possibly transmit pathogens into foods during every step of the food handling process, from buying to distribution [3]. Food safety education is most effective when the messages are geared toward changing the behaviors that are the most likely causes of the foodborne illness [4]. The objective of this study was to assess the food safety and hygiene knowledge of hospital food service staff as well as study the association between this knowledge and the sociodemographic factors to enhance the level of staff knowledge.

SUBJECTS AND METHODS

Study Design

A cross-sectional study was conducted for hospital food service staff including workers, chefs, supervisors and dieticians in the Makkah area. The objectives and protocol of the study were presented to the interested hospital and food service staff. The study protocol was approved by the research ethics committees in the Makkah Health Affairs Directorate Committee. All participants were enrolled in the study voluntarily and anonymously.

Questionnaire

The questionnaire was written in two languages (English and Arabic) and consisted of 45 questions, including demographic characteristics, food hygiene and safety knowledge, foodborne disease agents and prevention of foodborne diseases.

Statistical analysis

Descriptive statistics were used to present the data on demographic characteristics and knowledge of food hygiene and safety. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 21. A chi-square test was applied to examine the association between demographic characteristics and food hygiene and safety knowledge.

RESULTS

Factors associated with knowledge:

Age

As shown in the table (1) participants aged below 40 years were significantly ($p < 0.05$) more knowledgeable than those aged over 40 years regarding the following: impossibility of receiving food with external blemishes before expiration (52.1% versus 11.1%); finding that a kitchen is free from insects does not mean that its 100% clean (53.1% versus 11.1%); washing their hands with soap and water and then using sanitizer (77.1% versus 33.1%); wearing a head cover when touching or distributing food to patients (78.1% versus 44.4%); and preferring to wash fresh fruit and vegetables using warm water with soap (41.7% versus 23.4%). On the other hand, older participants (> 40 years) were significantly ($p < 0.05$) more knowledgeable regarding the fact that cooked food should be placed at a temperature of no less than 60°C (55.5% versus 19.8%) and non-significantly more knowledgeable ($p > 0.05$) regarding the transmission of microorganisms through food, including the hepatitis virus, clostridium botulinum, salmonella, and cholera (55.6% versus 32.3%, 55.6% versus 31.3%, 66.7% versus 58.3%, and 66.7% versus 41.7%, respectively).

Table 1: Association between sociodemographic factors and knowledge level of food hygiene and safety

Knowledge	Sociodemographic factors							
	Gender		Age(year)		Education		Job	
	Male (n=60)	Female (n=47)	<40 (n=96)	≥40 (n=9)	Low (n=52)	High (n=50)	Dietician (n=14)	Others (n=88)
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
	P value		P value		P value		P value	
There is no negative consequence of the small gaps on grounds if cleaned on daily basis	26 (43.3)	28 (59.6)	49 (51.0)	4 (44.4)	27 (51.9)	25 (50.0)	12 (85.7)	40 (45.5)
	0.095		0.488		0.846`		0.005	
Not necessarily if used air conditioner or basic ventilation as long as it gives the purpose	29 (48.3)	23 (48.9)	49 (51.0)	2 (22.2)	28 (53.8)	21 (42.0)	7 (50.0)	43 (48.9)
	0.951		0.095		0.231		0.937	
Toilets must be far from the areas of food preparation	44 (73.3)	41 (87.2)	76 (79.2)	7 (77.8)	38 (73.1)	42 (84.0)	14 (100)	69 (78.4)
	0.077		0.602		0.180		0.044	
Toilets must be supplied with running water and there is no problem if toilets do not have soap and detergents	35 (58.3)	28 (59.6)	58 (60.4)	4 (44.4)	30 (57.7)	31 (62.0)	9 (64.3)	49 (55.7)
	0.897		0.279		0.657		0.546	
Should the food handlers check the food to make sure that it is not spoiled as well as that it is within validity dates	39 (65.0)	43 (91.5)	73 (76.0)	7 (77.8)	35 (67.3)	44 (88.0)	13 (92.9)	66 (75.0)
	0.001		0.635		0.012		0.123	
Transport vehicles should be equipped with a refrigerator and freezer	40 (66.7)	41 (87.2)	73 (76.0)	6 (66.7)	35 (67.3)	42 (84.0)	13 (92.9)	64 (72.7)
	0.014		0.392		0.050		0.091	
It is possible to receive food with external defects when not expired	24 (40.0)	28 (59.6)	50 (52.1)	1 (11.1)	22 (42.3)	29 (58.0)	11 (78.4)	38 (43.2)
	0.044		0.019		0.113		0.014	
When should tools and kitchen equipment be washed, rinsed and cleaned after each use?	26 (43.3)	20 (42.6)	41 (42.7)	3 (33.3)	25 (48.1)	21 (42.0)	8 (57.1)	36 (40.9)
	0.936		0.431		0.538		0.255	
There is no need to disinfect tools after cleaned because the cleaning process will ensure they are free of microbes	26 (43.3)	32 (68.1)	53 (55.2)	3 (33.3)	20 (38.5)	37 (74.0)	13 (92.9)	42 (47.7)
	0.011		0.182		<0.001		0.001	
Correct application of equipment cleaning procedures do not reduce the risk of transmission of infection to patients	21 (35.0)	14 (29.8)	31 (32.3)	3 (33.3)	19 (36.5)	15 (30.0)	5 (35.7)	27 (30.7)
	0.568		0.607		0.484		0.706	
Drying should be done by using tissues	35 (58.3)	34 (72.3)	62 (64.6)	5 (55.6)	29 (55.8)	37 (74.0)	12 (85.7)	54 (61.4)
	0.133		0.420		0.054		0.066	
It is not necessary to cover the containers of disposable waste as long as it is disposed of regularl	35 (58.3)	33 (70.2)	62 (64.6)	4 (44.1)	30 (57.7)	36 (72.0)	14 (100)	49 (55.7)
	0.205		0.200		0.131		0.001	
Pesticides can be stored in food handling places if they are closed	29 (48.3)	28 (59.6)	53 (55.2)	2 (22.2)	22 (42.3)	32 (64.0)	14 (100)	40 (45.5)

	0.247		0.060		0.028		<0.001	
When looking around in kitchen and finding that it is free from insects, does that mean it is 100% clean?	27 (45.0)	27 (57.4)	51 (53.1)	1 (11.1)	25 (48.1)	26 (52.0)	11 (78.6)	41 (46.6)
	0.201		0.017		0.692		0.025	
The degree of cooling and freezing temperatures can be ascertained by the temperature index that is fixed in cooling and freezing rooms	24 (40.0)	30 (63.8)	46 (47.9)	6 (66.7)	24 (46.2)	27 (54.0)	9 (64.3)	43 (48.9)
	0.014		0.235		0.428		0.284	
Which of the following is the correct temperature of the refrigerator? (1°C, 1-4°C, 5-9-8°C, 12°C & 13-16°C)	22 (36.7)	23 (48.9)	42 (43.8)	2 (22.2)	17 (32.7)	27 (54.0)	11 (78.6)	33 (37.5)
	0.202		0.186		0.030		0.005	
Are raw foods kept separate from cooked foods?	44 (73.3)	39 (83.0)	76 (79.2)	6 (66.7)	35 (67.3)	44 (88.0)	14 (100)	65 (73.9)
	0.235		0.310		0.012		0.021	
Is it important to know the refrigerator temperature to prevent or reduce the risk of food contamination?	42 (70.0)	40 (85.1)	75 (78.1)	5 (55.6)	35 (67.3)	45 (90.0)	14 (100)	64 (72.7)
	0.067		0.135		0.005		0.017	
There is no problem with defrosting frozen food and re-freezing it	26 (43.3)	26 (55.3)	47 (49.0)	5 (55.6)	24 (46.2)	26 (52.0)	13 (92.9)	34 (38.6)
	0.218		0.488		0.555		<0.001	
Cutting boards for meat are different from those for fish and different from those for vegetables	45 (75.0)	40 (85.1)	71 (77.1)	9 (100)	37 (71.2)	45 (90.0)	13 (92.9)	67 (76.1)
	0.199		0.109		0.017		0.142	
Food must be cooked until the internal temperature reaches at least (70°C for 2 minutes, 5°C for 5 minutes or 35°C for 30 minutes)	13 (21.7)	15 (31.9)	27 (28.1)	0 (0.0)	14 (26.9)	14 (28.0)	5 (35.7)	22 (25.0)
	0.231		0.061		0.903		0.399	
The best way to prevent food poisoning from fresh fruits and vegetables is to wash them with warm water with soap for at least 20 seconds	25 (41.7)	11 (23.4)	31 (32.3)	4 (44.4)	24 (46.2)	10 (20.0)	2 (14.3)	30 (34.1)
	0.047		0.345		0.005		0.118	
Hepatitis virus may be transmitted through food	21 (35.0)	16 (34.0)	31 (32.3)	5 (55.6)	16 (30.8)	18 (36.0)	5 (35.7)	30 (34.1)
	0.918		0.150		0.575		0.905	
Clostridium botulinum may be transmitted through food	22 (36.7)	14 (29.8)	30 (31.3)	5 (55.6)	13 (25.0)	20 (40.0)	5 (35.7)	29 (33.0)
	0.455		0.135		0.105		0.530	
Salmonella may be transmitted through food	35 (58.3)	29 (61.7)	56 (58.3)	6 (66.7)	22 (42.3)	39 (78.0)	14 (100)	46 (52.3)
	0.724		0.455		<0.001		<0.001	
Cholera may be transmitted through food	28 (46.7)	19 (40.4)	40 (41.7)	6 (66.7)	21 (40.4)	22 (44.0)	7 (50.0)	38 (43.2)
	0.519		0.137		0.712		0.633	
Staphylococcus aureus may be transmitted through food	25 (41.7)	14 (29.8)	32 (33.3)	6 (66.7)	16 (30.8)	19 (38.0)	6 (42.9)	31 (35.2)
	0.205		0.054		0.442		0.581	
Do you wash your hands with soap and water, then use sanitizer?	39 (65.0)	40 (85.1)	74 (77.1)	3 (33.3)	39 (75.0)	37 (74.0)	13 (92.9)	63 (71.6)
	0.019		0.010		0.908		0.078	
Do you wash your hands before handling raw foods?	54 (90.0)	45 (95.7)	88 (91.7)	9 (100)	48 (92.3)	46 (92.0)	14 (100)	81 (92.0)
	0.262		0.476		0.954		0.344	



Do you wash your hands after handling raw foods?	56 (93.3)	42 (89.4)	88 (91.7)	9 (100)	47 (90.4)	46 (92.0)	14 (100)	80 (90.9)
	0.463		0.476		0.774		0.293	
Do you wash your hands before handling cooked foods?	52 (86.7)	39 (83.0)	81 (84.4)	9 (100)	42 (80.8)	44 (88.0)	13 (92.9)	73 (83.0)
	0.595		0.235		0.315		0.311	
Do you use gloves when touching food or during food distribution to patients?	54 (90.0)	42 (89.4)	86 (89.6)	9 (100)	46 (88.5)	45 (90.0)	14 (100)	77 (87.5)
	0.914		0.391		0.802		0.180	
Should the following be avoided during food preparation: smoking, sneezing, coughing, tasting food with fingers, and touching nose, hair, and the food?	16 (26.7)	22 (46.8)	36 (37.5)	1 (11.1)	20 (38.5)	17 (34.0)	10 (71.4)	27 (30.7)
	0.031		0.107		0.639		0.005	
Do you wear a head cover when you touch food or during food distribution to patients?	43 (71.7)	38 (80.9)	75 (78.1)	4 (44.4)	36 (69.2)	42 (84.0)	14 (100)	64 (72.7)
	0.272		0.040		0.079		0.017	
Do you use a mask in the areas of food preparation and processing or distribution to patients?	43 (71.7)	38 (80.9)	72 (75.0)	6 (66.7)	37 (71.2)	40 (80.0)	14 (100)	62 (70.5)
	0.404		0.420		0.299		0.012	
You must separate cooked from raw food during food presentation.	40 (66.7)	39 (83.0)	71 (74.0)	6 (66.7)	35 (67.3)	41 (82.0)	13 (92.9)	63 (71.6)
	0.057		0.448		0.089		0.078	
Cooked food that will be stored for the next day should be allowed to cool then be placed in the refrigerator, left at room temperature (kitchen), or placed in the refrigerator while still hot	28 (46.7)	20 (42.6)	44 (45.8)	3 (33.3)	26 (50.0)	21 (42.0)	8 (57.1)	38 (43.2)
	0.671		0.360		0.418		0.330	
When reheating cooked food, it should be heated or warmed properly	29 (48.3)	26 (55.3)	51 (53.1)	4 (44.4)	29 (55.8)	24 (48.0)	9 (64.3)	44 (50.0)
	0.473		0.439		0.432		0.320	
To keep, cooked food should be placed at a temperature of not less than (40°C, 50°C or 60°C)	16 (26.7)	8 (17.0)	19 (19.8)	5 (55.6)	8 (15.4)	13 (26.0)	1 (7.1)	21 (23.9)
	0.235		0.028		0.185		0.142	
You must keep salad at a refrigerated temperature of less than 5°C or room temperature until served	31 (51.7)	33 (70.2)	56 (58.3)	6 (66.7)	26 (50.0)	35 (70.0)	12 (85.7)	50 (56.8)
	0.052		0.455		0.039		0.034	
Microbes multiply more quickly at room temperature than refrigerated temperature	39 (65.0)	38 (80.9)	68 (70.8)	8 (88.9)	36 (69.2)	37 (74.0)	13 (92.9)	61 (69.3)
	0.070		0.229		0.593		0.057	
In the proper conditions, bacteria multiply at interval of 10-15, seconds, 10-30 minutes, or 1-2 hours	20 (33.3)	20 (42.6)	37 (38.5)	1 (11.1)	22 (42.3)	17 (34.0)	7 (50.0)	32 (36.4)
	0.328		0.097		0.388		0.329	

Gender

Females were significantly ($p < 0.05$) more knowledgeable than males regarding the following: food should be fully tested and checked to make sure that it is not spoiled as well as validity dates (91.5% versus 65.0%); imported food (especially that of animal origin) must be transported by special cold and clean carts (87.2% versus 66.7%); it is impossible to receive food with external defects before expiration (59.6% versus 40.0%); the need to disinfect tools after cleaning because the cleaning process alone will not ensure that they are free of microbes (68.1% versus 43.3%); the degree of cooling and freezing temperatures can be ascertained by the temperature index that is fixed in cooling and freezing rooms (63.8% versus 40.0%); they should wash their hands with soap and water and then use sanitizer (85.1% versus 65.0%); and they should

avoid smoking, sneezing, coughing, and tasting food with their fingers as well as touching their nose and hair during food preparation (46.8% versus 26.7%). On the other hand, males were significantly ($p < 0.05$) more knowledgeable of the fact that avoiding food poisoning from fresh fruits and vegetables is achieved by washing them with hot water and soap (41.7% versus 23.4%).

Job Title

Dieticians were significantly ($p < 0.05$) more knowledgeable than supervisors and workers regarding the following: there is negative consequence of the small gaps on the ground if cleaned on daily basis (85.7% versus 45.5%); toilets must be far from food (100% versus 78.4%); it is impossible to receive food with external defects before expiration yet (78.4% versus 43.2%); there is need to disinfect tools after cleaning because the cleaning process alone will not ensure that they are free of microbes (92.9% versus 47.7%); it is necessary to cover the containers of disposable waste even when it is disposed of regularly (100% versus 55.7%); pesticides can be stored in food handling places if they are closed (100% versus 45.5%); finding that a kitchen is free from insects does not mean it is 100% clean (78.6% versus 46.6%); the correct temperature of the refrigerator is 1-4°C (78.6% versus 37.5%); raw foods should be kept separate from cooked foods (100% versus 73.9%); the importance of knowing the refrigerator temperature to prevent or reduce the risk of food contamination (100% versus 72.7%); the problem with defrosting frozen food and re-freezing it again (92.9% versus 38.6%); salmonella may be transmitted through food (100% versus 52.3%); smoking, sneezing/coughing, tasting food with fingers, and touching the nose and hair should be avoided during food preparation (71.4% versus 30.7%); head covers should be worn when touching food or distributing it to patients (100% versus 72.7%); masks should be used in the preparation and processing area or when distributing food to patients (100% versus 70.5%); and salad must be kept at a refrigerated temperature less than 5°C until served (85.7% versus 56.8%).

Education

Higher-educated participants were significantly ($p < 0.05$) more knowledgeable than those with less education regarding the following: the food should be fully tested and checked to make sure that it is not spoiled as well as that it has not expired (88% versus 67.3%); the need to disinfect tools after cleaning because the cleaning process alone will not ensure that they are free of microbes (74% versus 38.5%); pesticides can be stored in food handling places if they are closed (64% versus 42.3%); the correct temperature of the refrigerator is 1-4°C (54% versus 32.7%); raw foods should be kept separate from cooked foods (88% versus 67.3%); the importance of knowing the refrigerator temperature to reduce the risk of food contamination (90% versus 67.3%); cutting boards for meat should be different from those for fish and different from those for vegetables (90% versus 71.2%); salmonella may be transmitted through food (78% versus 42.3%); salad must be at a refrigerated temperature of less than 5°C until served (70% versus 50%). On the other hand, less educated participants were significantly ($p < 0.05$) more knowledgeable than those of higher education regarding the fact that avoiding food poisoning from fresh fruits and vegetables is achieved by washing them with hot water and soap (46.2% versus 20%).

DISCUSSION

The level of knowledge of food safety practices varies between the participants based upon their gender, age, job status, education level, and marital status [1, 5]. The age of the respondent significantly influences their knowledge of food handling. A Tukey post hoc test revealed that the level of knowledge depended on the age groups [4]. As in our study, the level of knowledge was influenced by age; it was found that younger participants were significantly ($p \leq 0.05$) more knowledgeable than those aged over 40 years regarding items concerning food hygiene and personal hygiene. On other hand, older participants (>40 years) were more knowledgeable regarding other items related to personnel hygiene practices. The influence of age on knowledge was confirmed in another study (Sharif *et al.*, 2013). In contrast, it was reported that the level of food safety knowledge and food safety handling among young food handlers is low [4, 6].

Generally, females were significantly more knowledgeable than males regarding many aspects of food hygiene and safety. These finding corresponds to findings of others [7, 8]. One possible reason for this may be the fact that females spent more time obtaining health information from different sources, such as television and health centers.

Another study found that a significant association exists between sanitation and hygiene knowledge and socio-economic status, including income of the family, education and occupation, while no significant association was found between age and gender [9].

In the present study, more highly educated participants had higher scores and were more knowledgeable than those of lesser education regarding the importance of knowing the refrigerator temperature to prevent or reduce the risk of food contamination (90% versus 67.3%), cutting boards for meat should be different from those for fish and different from those for vegetables (90% versus 71.2%), and washing hands after handling raw food and before handling cooked food (92% & 88% versus 90% & 88%, respectively). This result supported other studies that showed that there is a limited level of knowledge on food hygiene among hospital food handlers, especially those of secondary and primary levels of education [10]. Additionally, food-service staff with higher educational levels had greater knowledge of safe temperatures for food storage [11]. On the other hand, another study revealed that the knowledge of food handlers is reversely affected by the level of education, as food handlers with a lower level of education showed a higher knowledge of food safety issues (73%) than those with a higher level of education (64%). This lack of knowledge regarding hygiene issues among food handlers is one of the most commonly reported practices contributing to foodborne illness [12].

The present study revealed that dieticians scored the highest number of correct responses for all parameters and were more significantly knowledgeable than supervisors and food handlers regarding many aspects related to food hygiene, safety and prevention of foodborne diseases. Similar results have been reported in other studies [13, 14]. This is because food handlers had low education levels and may not be trained adequately before beginning to work at the hospital. The plurality of food workers had low education levels, which may lead to poor understanding towards the prevention of foodborne diseases and the importance of implementing food safety systems.

CONCLUSION

In conclusion, this study evaluated the level of knowledge of food hygiene and safety of food handlers in hospitals. Our findings may help in planning food safety and hygiene education intervention programs for food handlers in hospitals. The findings indicate that age, gender, education level and job title were associated with the level of knowledge of the participants. More effort must be made to enroll food handlers in an effective food safety education and training program before the beginning to work at a hospital to help them increase their food safety knowledge.

REFERENCES

- [1] Moreb, Nora A.; Priyadarshini, Anushree; Jaiswal, Amit K. Knowledge of food safety and food handling practices amongst food handlers in the Republic of Ireland. *Food Control*, 2017, 80: 341-349.
- [2] Shalinawati R, Mohamed NA, Jamaluddin TZMT and Shahlan. Association between Sociodemographic Factors, Working Experience and Training Status with Knowledge Level towards Food and Personal Hygiene among Food Handlers in Kuala Lumpur, Malaysia. *Journal of Nursing and Health Science*. 2016; 5(1): 17-22
- [3] Osaili, T. M., Obeidat, B. A., Hajeer, W. A., and Al-Nabulsi, A. A. Food safety knowledge among food service staff in hospitals in Jordan. *Food Control*, 2017; 78, 279-285.
- [4] Mohd, F. S., Son, R., Mohhiddin, O., Toh, P. S., and Chai, L. C. Food court hygiene assessment and food safety knowledge, attitudes and practices of food handlers in Putrajaya. *International Food Research Journal*, 2015; 22(5): 1843-1854.
- [5] Zain, M. M., and Naing, N. N. Sociodemographic characteristics of food handlers and their knowledge, attitude and practice towards food sanitation: a preliminary report. *Southeast Asian J Trop Med Public Health*, 2002; 33(2):410-417
- [6] Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., and Blalock, L. Food safety self-reported behaviors and cognitions of young adults: results of a national study. *Journal of Food Protection*, 2007; 70(8): 1917-1926.
- [7] Cheraghi, Z., Okhovat, B., Doostilrani, A., Talaei, M., Ahmadnezhad, E., Gooya, M. M., and Holakouie-Naieni, K. Knowledge, Attitude, and Practice regarding Food, and Waterborne Outbreak after Massive Diarrhea Outbreak in Yazd Province, Iran, Summer 2013. *International scholarly research notices*, 2014

- [8] Kibret, M., and Abera, B. The sanitary conditions of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar town. *Ethiopian journal of health sciences*, 2012; 22(1): 27-35.
- [9] Mohd, R., and Malik, T. Sanitation and Hygiene Knowledge, Attitude and Practices in Urban Setting of Bangalore: A Cross-Sectional Study. *Journal of Community Medicine and Health Education*, 2017; 7(4): 1-5. doi: 10.4172/2161-0711.1000540
- [10] Githiri, M., Kimiywe, J., and Okemo, P. Knowledge in food hygiene and hygienic practices differ-in food handlers at a hospital in Nairobi, Kenya. *African Journal of Food Science and Technology*, 2013; 4(1): 19-24.
- [11] Abdelhafez A. K. Knowledge, attitudes, and practices of food service staff about food hygiene in hospitals in Makkah area, Saudi Arabia. *Life Science Journal*, 2013; 10(3): 1079-1085.
- [12] Hamadan, H.E., &Almhaifer, A. N. Knowledge Attitudes and Practices of Food Handlers in Hail Hospitals. *Current Research in Microbiology and Biotechnology*. 2015; 3(1): 573-577
- [13] Ramírez, E., Linerio, J., Chombo, P., Jasso, R., Bravo, S., and Ashraf, H. L. Level of Knowledge and Compliance of Mexican Food Code among Hospital Foodservice Employees in Guadalajara, México. *Food and Nutrition Sciences*, 2011; 2: 1027-1035.
- [14] Sharif, L., Obaidat, M. M., & Al-Dalalah, M. R. Food hygiene knowledge, attitudes and practices of the food handlers in the military hospitals. *Food and Nutrition Sciences*, 2013; 4: 245 -251.