

## Food safety knowledge, attitudes and practices (KAP) of the nutrition staff in three Sudanese hospitals

Hiba Abdelhamid Mohammed<sup>1</sup>, Saif Eldein Basheir Ahmed<sup>2</sup>, Fatima Abdelmaged Ahmed<sup>1</sup>

<sup>1</sup>School of Health Sciences, Ahfad University for Women, Omdurman, Sudan. <sup>2</sup> Food and Nutrition Department, King Saud University, Riyadh, Saudi Arabia.

Corresponding author: E-mail address, [saifbahmed21@gmail.com](mailto:saifbahmed21@gmail.com)

---

### Abstract

The scope of this study was assess the food safety knowledge, attitudes practices (KAP) of the nutrition staff in three hospitals in Khartoum State, Sudan. These hospitals were military and private hospital. A cross-sectional study had been carried out using structured questionnaire to collect the needed data from a sample of 86 participants. The results showed that nutrition staff knowledge level was adequate in terms of the cleaning and sanitization of the equipment (84%), hands-washing (81%), protection role of wearing gloves for patients/food service staff (84%). While the level of knowledge, was poor regarding the concept of the danger zone of temperature and time limits as well as the Hazard Analysis and Critical Control Point (HACCP) (40%), Standard Operating Procedures (SOPs ) (17%), standardized recipe (15%) and good manufacturing practices (GMP) (22%). The attitude of the nutrition staff is considered good when the food manager awareness about the food safety regulations is 84%, using (caps, masks, gloves and adequate clothing), minimizing the risk of food contamination around 97% and in the medical examination of food handlers is 93%. Most of the practices of the participants of food safety were good. The findings showed that the overall mean of KAP reached  $62.27\% \pm 12.228$ . However, there is a need to increase the food safety knowledge and education among the nutrition staff which may improve the work quality related to food safety. In addition, there is a need for further studies related to food safety applications in Sudanese hospitals.

**Keywords:** Food Safety, Sudan, Hospitals, Staff.

---

### 1. Introduction

Food safety has become a critical area of concern worldwide, leading healthcare institutions and governments of several countries are concerned to find ways to monitor production chains (De Oliveira et al., 2016). In theory, food poisoning is 100% preventable; however, this cannot be achieved due to a number of reasons involved in the supply chain, as well as in the fact that pathogens can be introduced into foods no matter how many precautions are taken (Fontannaz-Aujoulat et al., 2019). There are a number of protocols that should be followed to avoid potential health hazards. In developed countries there are intricate standards for food preparation, whereas in lesser developed countries there are less standards and enforcement (Shiklomanov, 2000). In recent years food crises, have been recorded both at a local and at the international level regarding the safety of hospital meals that have significant impact on patients' confidence (Tsakali et al., 2016).

Knowledge of food safety provides basis for the development of intervention strategies at all stages between production and consumption, so that to prevent food/borne diseases. These strategies include inspection by government agencies and educational campaigns directed at food handlers from process to consumption (Crowther et al., 1999). Despite the significant progress in food science and technology, and in consumer awareness around food safety aspects, foodborne diseases are considered to be a huge challenge. This challenge has harmful health and economic consequences in both developed and developing countries (Byrd-Bredbenner et al., 2015). Food safety in hospitals is important and faces many problems due to the presence of patients who could be more vulnerable than healthy subjects with respect to microbiological and nutritional risks (Buccheri et al., 2007).

## **Knowledge, Attitudes and Practices (KAP)**

The increasing food safety problems in Sudan emphasize the need for rapid and effective solutions. Food safety knowledge and application in Sudan still far away from what it should be and that definitely will contribute too many foodborne diseases, especially in the governmental health institutions. This study may be considered as a modest effort to assess food safety knowledge, attitudes and practices of nutritionists / dietetics staff in three Sudanese hospitals selected in this study.

## **2. Methodology**

### **2.1. Hospitals**

The study was carried out in three Khartoum state hospitals. These multidisciplinary hospitals were selected according to administrative basis; Military Hospital (MMH): located in Omdurman; Governmental Hospital (ISH): located in North Khartoum (Alamarat area); and Private Hospital (RCIH): located in Khartoum (Burri area).

Subjects: The (86) respondents were nutrition staff and selected according to certain inclusion and exclusion criteria. The inclusion criteria were determined by interviewing nutrition staff to participate in the study, while the exclusion criteria included nutrition staff working at the night shift or working as trainees. In addition to those doing their national civil service for less than one month were included in the exclusion together with those who took sick leaves, vacations or out of the service during the period of data collection. Moreover, those who did not agree to participate in the study.

The nutrition staff includes dietitians, nutritionists, nutrition educators, cooks, waiters, kitchen managers/storekeepers and quality control officers. The ethical considerations involved official ethical approvals for the study were obtained from Ahfad University for Women (AUW), ministry of Health committees, and also the consents of the respondents.

### **2.2. Data collection**

This study is a cross sectional hospital-based study, designed to evaluate Knowledge, Attitudes and Practices (KAP) of the nutrition staff towards food safety practices and procedures in different hospitals in Khartoum state using both primary and secondary data collection methods. The primary data was collected via structured questionnaire in the form of interviews. The study was conducted between September and December 2018.

The questionnaire was developed for this study with 57 multiple choice questions with “yes” and “no” or “Always”, “Sometimes” and “Never” scale of answers. The questions were designed and structured in four groups. The first group includes nine personal questions (type of hospital, sex, age, occupation, specialization, occupation status, working experience, level of education, and if attended any courses related to food safety and hygiene). The second group of questions involves “Food safety knowledge” (20 questions). The third group was focused on “Food Safety Attitudes” (18 questions). The last group was developed to determine “food safety practices”, (10 questions). Therefore, the questionnaire was designed to assess knowledge, attitudes and practices of the staff members of the nutrition department. The assessment included knowledge focused on microbiologic food hazards, temperature control, food storage, cross contamination, health requirements, utensils cleaning, and the staff opinion on training programs needed. All questions aimed at identify; employee relation to food safety assurance, hygiene violations and to what extent the employee is far from the knowledge of food safety. This could be attained by linking the first part of the questionnaire, as the demographic data or personal information, with the other parts (knowledge, attitudes and practices).

### **2.3. Statistical analysis**

Data were analyzed by using Statistical Package for social Science (SPSS version 20.0 SPSS INS) descriptive statistics were used. Non-parametric variables were analysis for differences by Chi-Square to determine the P-value and Fisher Exact Test was done where it required MS office Excel 2016 was also used to calculate the scores of knowledge, attitudes and practices of the nutrition staff. The scores were given as follows; yes and Always = 10, Sometimes = 0.5 and Never =0. According to the previous ranking method reported by Norhaslinda et al. (2016), the scores were considered as poor (less than and equal to 50%) fair (51-79%) and good (80% and above).

## Knowledge, Attitudes and Practices (KAP)

### 3. Results and discussion

#### 3.1. Frequency and percentage of sex and age groups of the nutrition staffs participated in the study among the three hospitals (MMH, ISH and RCIH).

Table (1) reveals that, with respect to sex, most of the respondents were females (73%) and this may be due to the cultural preference of females to enroll in the field of nutrition more than males in Sudan. The Commission on Dietetic Registration (CDR) reported that (90.6%) of the dietetics professional were females (2019), while Mohieldin et al. (2015) reported (83%) females. Furthermore, regarding age, as shown in table (1), the dominant age group in MMH and ISH was 20-30 years (50% for both hospitals), and at RCIH it was 30-40 years (58%). Food handlers study by Lestantyo et al. (2017) reported that; younger food handlers and / or those who lack formal knowledge in nutrition are more likely to have risky behavior concerning food hygiene than others.

**Table (1). Sex and age groups of the study participants among the three hospitals (MMH, ISH and RCIH) Military Hospital (MMH): located in Omdurman; Governmental Hospital (ISH): located in North Khartoum (Alamarat area); and Private Hospital (RCH) located in Khartoum (Burri area).**

Sex	Frequency (Percentage)			Total
	MMH	ISH	RCIH	
Male	4(9%)	8(40%)	115(8%)	23 (27%)
Female	43 (91%)	12 (60%)	8 (42%)	63 (73%)
Total	47 (100%)	20 (100)	19 (100%)	86 (100%)
Age				
< 20	1 (2%)	0 (0%)	0 (0%)	1(1%)
20-30	23 (49%)	10 (50%)	6 (32%)	39 (45%)
31-40	12 (26%)	5 (25%)	11 (58%)	28 (33%)
> 40	11 (23%)	5 (25%)	2 (10%)	18 (21%)
Total	47 (100%)	20 (100%)	19 (100%)	86(100%)

#### 3.2. Occupations of the participants

Table (2) shows that 50% of the nutrition staff of the three hospitals are nutritionists/ dietitians. This data indicate the hospital awareness of the role of nutritionists in promoting health, where Hospitals should be encouraged to further increase the number of nutritionists.

**Table (2). Distribution of the study participants according to occupation in the Sudanese three Hospitals.**

Occupation	Frequency (%)			TOTAL
	MMH	ISH	RCIH	
Nutritionist/dietetics	26 (55%)	10(50%)	7(37%)	43 (50%)
Nutrition educator	5(11%)	1(5%)	0(0%)	6(7%)
Cookers	4(9%)	2(10%)	4(21%)	10(12%)
Waiters	9(19%)	5(25%)	6(32%)	20(23%)
Kitchen managers and storekeepers	1(2%)	1(5%)	2(10%)	4(5%)
Quality control officers	2(4%)	1(5%)	0(0%)	3(3%)
Total	47(100%)	20(100%)	19(100%)	86(100%)

#### 3.3. Participants' knowledge

According to table (3), the respondents had good knowledge of the importance of cleaning and sanitizing equipment (84%), washing hands (81%), and wearing gloves while serving food (84%), cholera transmission by food (95%), and insects may transmit food borne pathogens (90%). But their knowledge were mainly critically low in questions related to temperature such as; reheating contribution to food contamination (49%), the danger zone and its temperature and time limits (12% and 11% respectively), the refrigerator temperature (20%), the hot holding and

## Knowledge, Attitudes and Practices (KAP)

cold holding temperatures (12% and 14% respectively). In addition, their knowledge was found to be poor regarding any program related to food safety such as in; HACCP (39%), SOPs (17%), standardized recipe (15%) and GMPs (22%). The above mentioned results agree with the Malaysian study reported by Sani and Siow (2014), where the level knowledge, attitudes and practices among food handlers was found to be good in personal hygiene or defining food borne diseases (94%), but it was poor regarding food storage and preparation temperature (28%). Also, a Chinese study by Zhang et al. (2015) concluded that, most food handlers did not know the maximum storage time at room temperature of food.

### 3.4. Attitudes

Table (4) reveals that, the respondents' attitude may be considered good when: the importance of food safety is considered by food manager is 79%, food manager awareness about food safety regulations is about 84%, food-service staff with cuts on hands should not touch un-rapped food 85%, (cap, masks, gloves and adequate clothing) reduce the risk of food contamination 97%. The nutrition staff attitude regarding food safety training programs was good (93%). Previous studies reported that, despite the fact that training rarely improves the behavior, but it can results in increasing both knowledge and attitude of the staff (Pilling et al., 2008). Nee and Sani (2011) reported that food hygiene training increased participants' knowledge regarding food borne diseases issues. Another study by Zhang et al. (2015) reveals that food handlers have positive attitudes about food safety and training.

**Table (3): Knowledge of food safety of the nutrition staffs among the three hospitals: (F: frequency, %: percentage).**

	Items	Yes		No	
		F	%	F	%
1	Preparation of food in advance is likely to contribute to food poisoning.	68	79	18	21
2	Reheating of food is likely to contribute to food contamination.	42	49	44	51
3	Incorrect application of cleaning and sanitization procedures for equipment (refrigerator, slicing machine, mincer, mixers, and blenders) increases the risk of foodborne disease to patients.	72	84	14	16
4	Washing hands before handling food reduce the risk of contamination.	70	81	16	19
5	Do you know what the Danger Zone is?	10	12	76	88
6	Do you know the temperature of the danger zone?	9	11	77	89
7	Do you know the danger zone time limit?	3	4	83	96
8	Wearing gloves while handling food reduce the risk of transmitting infection between patients.	72	84	14	16
9	Wearing gloves while handling food reduce the risk of transmitting infection between food-service staff.	78	91	8	9
10	Do you know the refrigeration temperature?	17	20	69	80
11	Do you know at what temperature the hot ready to eat foods should be maintained?	10	12	76	88
12	Do you know at what temperature the cold ready to eat foods should be maintained?	12	14	74	86
13	Do you know what types of Hepatitis can be transmitted by food?	30	35	56	65
14	Cholera can be transmitted by food.	82	95	4	5
15	Eating cooked leftovers stored for more than 6 hours is likely to cause food poisoning.	62	72	24	28
16	Insect such as cockroaches and flies might transmit foodborne pathogens.	77	90	9	10
17	Do you know what are Hazard Analysis and Critical Control Point (HACCP)?	34	39	52	61
18	Do you know what Standard Operating Procedures (SOPs) are?	15	17	71	83
19	Do you know what a standardized recipe is?	13	15	73	85
20	Do you know Good Management Practices (GMPs)?	19	22	67	78

The nutrition staff's attitude toward beards or moustache was medium (51%) and good about female nails (87%), and this needs more critical awareness because lack of personal hygiene in food handlers could result in food poisoning incidents (Seaman, 2010). They also had good attitude toward the medical examination of food handlers

## Knowledge, Attitudes and Practices (KAP)

(93%). In addition, the attitude of participants was fair regarding the improper storage of foods may lead to health hazard (50%) and was low in defrosted food should not be refrozen (44%), food safety responsibility (42%), wiping vegetables or fruits make them safe to be used (43%), and very low (12%) for workers with HIV/AIDS whom should be eliminated from food preparation area.

**Table (4): Attitudes scores of food safety of the nutrition staffs among the three hospitals:( F: frequency, %: percentage).**

	Items	Yes		No	
		F	%	F	%
1	Food safety is an important item should be considered by food manger.	79	9	7	8
2	The food manager should be aware of the local and the international food safety regulations.	72	84	14	16
3	Food safety responsibility should be specified for one person:	36	42	50	58
4	The application of food safety rules must be the responsibility of every person in the food service unit.	68	79	18	21
5	Food safety includes food and non-food items.	62	72	24	28
6	Raw foods should be stored above cooked foods in the refrigerator.	35	41	51	59
7	Defrosted food should not be refrozen:	38	44	48	56
8	Food-service staff with abrasions or cuts on hands should not touch unwrapped Food:	73	85	13	15
9	Using caps, masks, protective gloves and adequate clothing reduce the risk of food contamination:	83	97	3	3
10	It is important to know the temperature of the refrigerator/freezer to reduce the risk of food spoilage:	72	84	14	16
11	Is it necessary to check at regular intervals of time the thermometer setting of refrigerators and freezers:	67	78	19	22
12	Improper storage of foods may not lead to health hazard:	43	50	43	50
13	Food Safety training programs should be conducted regularly in the hospital	80	93	6	7
14	Wiping vegetables or fruits make them safe to be used:	37	43	49	57
15	Male Food handlers should not have beards or moustache:	44	51	42	49
16	Female food handlers should not have long nails:	75	87	11	13
17	Food handlers should be medically examined every six months (periodically).	80	93	6	7
18	Workers with HIV/AIDS should be eliminated from food preparation area	76	88	10	12

### 3.5. Practices

All food safety items shown in table 5 are related to practice may be considered good, but more attention is needed for the concept of thawing frozen foods, since about 30% of the respondents may not follow the right thawing procedures. Previous studies found that, acquiring good knowledge and attitude will lead to good practices. However, some studies findings contradict with this result. Good knowledge in food hygiene did not lead to good food handling practices (Sharif et al., 2013; Hassan and Dimassi, 2014).

### 3.6. Knowledge, attitude and practices (KAP) among the selected hospitals

The overall mean of KAP score was found to be low (62.27%), and the mean of the knowledge 44.77% score considered poor (Table 6). The mean of the attitude score is considered fair (69.87%), while the mean of the practice score was found to be good (85.76%). In comparison to a previous study on food handlers by (Sharif et al., 2013), these results of the present study were low in overall KAP mean when compared to (87.88%) and compared to (84.80%) for knowledge, and 88.8% for attitude, but it resembles the mean of practice (89.4%) as reported by Sharif et al. (2013).

## Knowledge, Attitudes and Practices (KAP)

**Table (5): Practices scores related to food safety of the nutrition staffs among the three hospitals :( F: frequency, %: percentage).**

	Items	Always		Sometimes		Never	
		F	%	F	%	F	%
1	Do you wash your hands before touching unwrapped raw food?	78	91	8	9	0	0
2	Do you wash your hands after touching unwrapped raw food?	76	88	10	12	0	0
3	Do you wash your hands before touching unwrapped cooked food?	76	88	10	12	0	0
4	Do you wash your hands after touching unwrapped cooked food?	68	79	15	17	3	4
5	Do you use separate utensils to prepare cooked and raw foods?	63	73	22	26	1	1
6	Do you thaw frozen food at room temperature?	60	70	24	28	2	2
7	Do you check shelf life of food products before using them?	70	81	13	15	3	4
8	Do you check integrity of food packages while using food products?	64	75	20	23	2	2
9	Food handlers can work when they have diarrhea symptoms:	17	20	17	20	52	60
10	Food handlers can work when they have common colds:	17	20	16	19	53	61

**Table (6): Means (%) of knowledge, attitude and practices (KAP) for all the nutrition staffs in the three hospitals.**

	KAP	Knowledge	Attitude	Practice
Mean (%)	62.27	44.77	69.87	85.76
S.D	12.228	18.716	14.659	11.993
Minimum	38	14	28	45
Maximum	90	95	100	100
Out of	100	100	100	100

## 4. Conclusions

Development of food inspection and food safety strategies and standards are activities required to reduce food problems in the Sudan. Sudanese national agencies in charge of food and Nutrition should implement policies related to food safety and hygiene, and manage economical and managerial barriers facing food safety application.

## Acknowledgements

The authors greatly appreciate the valuable collaboration of the administrative bodies of the three Hospitals while executing this research. Thanks also extended to the nutrition staff affiliated with the three Hospitals for their patience and remarkable collaboration during data collection.

## References

- Buccheri C, Casuccio A, Giammanco S, et al. (2007) Food safety in hospital: knowledge, attitudes and practices of nursing staff of two hospitals in Sicily, Italy. *BMC health services research* 7: 45.
- Byrd-Bredbenner C, Cohn MN, Farber JM, et al. (2015) Food safety considerations for innovative nutrition solutions. *Annals of the New York Academy of Sciences* 1347: 29-44.
- Crowther J, Cox L, Gross R, et al. (1999) Food safety training for nutritionists. *Bulletin of the World Health Organization* 77: 172.
- De Oliveira C, Da Cruz A, Tavolaro P, et al. (2016) Food Safety: Good Manufacturing Practices (GMP), Sanitation Standard Operating Procedures (SSOP), Hazard Analysis and Critical Control Point (HACCP). *Antimicrobial food packaging*. Elsevier, 129-139.
- Fontannaz-Aujoulat F, Frost M and Schlundt J. (2019) WHO Five Keys to Safer Food communication campaign- Evidence-based simple messages with a global impact. *Food Control* 101: 53-57.

## Knowledge, Attitudes and Practices (KAP)

- Hassan HF and Dimassi H. (2014) Food safety and handling knowledge and practices of Lebanese university students. *Food Control* 40: 127-133.
- Lestantyo D, Husodo AH, Irvati S, et al. (2017) Safe Food Handling Knowledge, Attitude and Practice of Food Handlers in Hospital Kitchen. *Int. J. Public Health Sci* 6: 324-330.
- Nee SO and Sani NA (2011) .Assessment of knowledge, attitudes and practices (KAP) among food handlers at residential colleges and canteen regarding food safety. *Sains Malaysiana* 40: 403-410.
- Norhaslinda R, Norhayati A and Mohd Adzim Khalili R. (2016) Knowledge, attitudes and practices (KAP) on good manufacturing practices (GMP) among food handlers in Terengganu hospitals. *International Journal of Pharmacy and Pharmaceutical Sciences* 8: 53-59.
- Pilling VK, Brannon LA, Shanklin CW, et al. (2008) Identifying specific beliefs to target to improve restaurant employees' intentions for performing three important food safety behaviors. *Journal of the American Dietetic Association* 108: 991-997.
- Sani NA and Siow ON. (2014) Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. *Food Control* 37: 210-217.
- Seaman P. (2010) Food hygiene training: Introducing the food hygiene training model. *Food Control* 21: 381-387.
- Sharif L, Obaidat MM and Al-Dalalah M-R. (2013) Food hygiene knowledge, attitudes and practices of the food handlers in the military hospitals. *Food and Nutrition Sciences* 4: 245.
- Shiklomanov IA. (2000) Appraisal and assessment of world water resources. *Water international* 25: 11-32.
- Tsakali E, Gortzi O ,Timpis D, et al. (2016) Food Safety and Quality Control in the Public Catering Sector-Intervention Programs. *Nutr Food Technol* 2.
- Zhang H, Lu L, Liang J, et al. (2015) Knowledge, attitude and practices of food safety amongst food handlers in the coastal resort of Guangdong, China. *Food Control* 47: 457-461.