

# Effectiveness of Food Safety Training on Food Safety Knowledge and Practices of Hospital Food Handlers in Selected Hospitals in Kenya

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Epidemiological research has indicated that foodborne nosocomial diseases continue to be critical in the hospital environments. Additionally, research on foodborne disease risk factors has indicated that most outbreaks are associated with food service establishments can be attributed to food handlers' improper food handling practices and observation studies have revealed that food handlers frequently engage in unsafe food hygiene practices. Food safety training has been identified as a way to assure public health, yet evidence supporting the effectiveness of training has been remains inconclusive. The objective of this study was to assess food safety knowledge and practices of food handlers working in selected hospitals in Kenya before and after food safety training. This study employed a quasi experimental study design. A systematic random sample of 42 hospitals in Kenya was selected to assess the effect of training on food safety knowledge and practices. A total of 140 food handlers employees (68 control and 73 interventional) participated in this study. Pre and post-training assessments were conducted on knowledge and practices on food safety practices. Overall knowledge ( $P < 0.05$ ) improved significantly between pre- and post-training ( $56.5 \pm 16.5 - 87.8 \pm 15.5$ ) while practices did not improve significantly ( $101.3 \pm 11.6 - 105.3 \pm 12.2$ ), however some improvements were observed in some individual practices that were examined independently. Results indicated that training can improve knowledge but might not always improve practices. The results of this study support the assumption that the development and delivery of a food safety education training for food handlers would increase food safety knowledge and practices. Yet, increasing knowledge is not a guarantee that practices will change as demonstrated by high scores in knowledge and low scores in practices. Future studies investigating on ways in which acquired food safety knowledge can be translated into practice are warranted.

**Keywords:** *Foodborne Diseases, Food Safety Education Training, Food Safety Knowledge, Food Safety Practices*

## INTRODUCTION

Foodborne diseases (FBDs) remain responsible for high levels of mortality, morbidity and economic losses in the general population, but particularly for high-risk populations, such as infants and young children, elderly and immuno-compromised. Cases of FBDs occur daily throughout the world, from the most to the least developed countries. Foodborne diseases are attributed to consumption of contaminated food with a wide variety of pathogenic microorganisms, toxins produced by microorganisms, parasites and viruses. It is difficult to obtain accurate estimates of the incidence of microbiological FBDs disease. However, in developed countries, the percentage of people suffering from microbiological FBDs each year has been reported to be up to 30%, while the problem is likely to be even more widespread in developing countries (WHO, 2007).

According to the World Health Organization (WHO), the global incidence of food-borne diseases is difficult to estimate, but it has been reported that in 2005 alone 1.8 million people died from diarrheal diseases attributed to food and water contamination. Other studies also show that food and waterborne diarrhea diseases are considered as the leading causes of illness and death in less developed countries (Schlundt *et al.* 2004).

Food borne diseases are common in developing countries including Kenya because of the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipments, and lack of education for food-handlers (WHO, 2006). Ministry of Health (2003), reported that high burden of FBDs in Kenya was related to poor hygiene and sanitation. Unsafe sources, contaminated raw food items, improper food storage, poor personal hygiene during food preparation, inadequate cooling and reheating of food items and a prolonged time lapse

between preparing and consuming food items were mentioned as contributing factors for outbreak of food borne diseases. Studies conducted in different parts of the country show poor sanitary conditions of catering establishments and presence of pathogenic organisms like campylobacter, *Salmonella*, *Staphylococcus aureus*, and *Escherichia coli*. Across these settings, food handlers displayed serious gaps in safe food handling practices (Githiri, *et al.*, 2009, Muinde & Kuria, 2005; Oloo, 2010).

The issue of food safety and foodborne disease has also proved to be critical in some foodborne nosocomial outbreaks in the hospital environments (Guallar *et al.*, 2004), where it is a matter of high concern for immune-suppressed patients for whom food-borne infections can be life threatening (Hayes, Elliot, Krales, & Drowner, 2003). In nosocomial outbreaks of infectious intestinal disease, the mortality risk has been proved to be significantly higher than the community outbreaks and highest for foodborne outbreaks (Meakins, Adak, Lopman, & O'Brien, 2003). Food hygiene in the hospital can acquire peculiar features: many patients could be more vulnerable than healthy subjects to microbiological and nutritional risks; large numbers of persons can be exposed to infections and possible complications; gastroenteritis can impair digestion and absorption of nutrients and the perception or fear about poor food hygiene practices might result in patients rejecting the meals supplied by the hospital catering (Barrie, 1996).

The importance of safe food for hospitalized patients and the detrimental effect that contaminated food could have on their recovery has been emphasized (Kandela, 2004). Patients receiving foods from a single kitchen with poor food handling practices could suffer a foodborne infection which could result in an outbreak involving the whole hospital (Ayliffe, 1992). Outbreaks of foodborne infection in hospitals are associated with high attack rates and disruption of services as reported by various studies (Maguire, 2000; Van Duynhoven, 2005; Pzybylysk, 2001; Custovic & Ibrahimagic, 2005; Dalton, 2004).

Recent studies (Githiri, Okemo, & Kiminywe, 2009) in Kenya indicate possible contamination of food served to patients by food handlers. The studies also raise peculiar concern from the common involvement in the role of food handlers, nurses or domestic staff, who are not specifically trained about food hygiene standards and Hazard Analysis Critical Control Points (HACCP), but can be engaged in receipt, distribution and serving of readymade foods and supervision of these services. Hence there is a great need for research, education and increased awareness among food services staff in hospitals regarding safe food handling practices.

Regulatory authorities invariably have called for increased training to improve practices and reduce the risk for food-borne illness. Prevention and control of

FBDs was declared to be a public health priority by the World Health Assembly in 2000 (WHO, 2007). Current interventions to increase safe food handling concerns with safe food handling practices has become widespread. Training and enforcement are the primary interventions used to promote food safety in the food service environments. Training typically focuses on the presentation of science-based facts regarding the causes of food-borne illness, or in some cases, competency based training around specific, prescribed behaviors. The implied theoretical framework behind most training programs is that increased knowledge about sources of contamination and appropriate worker responses will result in improved food handling behavior.

Nonetheless, the literature is mixed regarding the effect of food safety training on employee knowledge, and even less persuasive regarding the impact of knowledge-oriented training on behavior. Despite increased regulatory pressure for safe food handling training, the number of well controlled studies examining the effects of such programs on employee knowledge is surprisingly small in Kenya.

The purpose of this study was to determine the effect of HACCP based food safety educational on the knowledge and practices regarding food safety and hygiene amongst food handlers working in hospital kitchens in selected hospitals in Kenya.

It was hypothesized that: the intervention group with HACCP based food safety training will show higher levels of food safety knowledge and practices, and there will be a positive relationship between sanitation knowledge and practices after the HACCP based training.

## MATERIALS AND METHODS

This study used a quasi experimental design which dictates performing a pre-test and a post test for both the control and treatment/intervention groups. The interventional study design used the equivalent pretest and posttest control group method. A control group and an intervention group of hospitals were used for the test of internal validity for the training effect. One group of hospitals was invited to participate voluntarily as the intervention group which received food safety training and other group was also invited to participate as the control group which was not given the training, this was meant to control the effects of both internal and external variables.

### *Training*

Food safety training material was made by a team of experts based on previous works that focus on personal and food hygiene such as "A Training Guide for Managers of Food Establishments" (Jacob, 1989). For effective training, a group of not more than twelve food

handlers were trained at a time. The training methods involved lectures, demonstration, group discussions, and practical experiences. This was achieved by use of flip charts, posters, actual food handling and preparation for educating food handlers as advocated by the WHO (Jacob, 1989). The training materials were constructed in accordance with WHO and MOH food handling protocols (WHO, 1994; WHO, 2001; MOH 2006). Largely, the training was formulated around the HACCP guidelines with inbuilt relevant and critical modifications where necessary.

### Study Participants

The participants of this study were food handlers in twenty two (22) public, mission and private hospitals that had a bed capacity of more than 120 in Kenya. Participants were not randomly selected but were conveniently chosen so that they could be available for as long as three consecutive months. Two types of questionnaires for measuring the food handlers' food safety knowledge and practices were administered to the control and the intervention group before and after food safety training.

Food safety performances of the hospitals were also evaluated by trained panelists through the on-site inspection (observation) with the food safety monitoring tool. The food handlers in the interventional group were provided with a window within which to apply the knowledge and skills provided. After a period of three months, data collection using the initial protocol and tools were implemented to evaluate the impact of the intervention on the level of adherence to food safety

standards operating procedures among the hospital food handlers.

### Data Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS). The average and the standard deviation were calculated as the food general hygiene management performance. For the evaluation of food handlers' pre/post food safety knowledge attitudes and practices, the average and the standard deviation was be calculated, and t-tests were carried out for testing levels of significance. Pearson correlation tests was done to identify the correlation among food handlers' food safety knowledge, behavior and on-visit inspection scores was used to determine the relationship between variables, whereas, multivariate analysis as well as chi-square tests was performed to examine if there are any significant relationships between demographics, training, knowledge, food safety and microbial knowledge, cooking practices and food safety practices.

## RESULTS

### Characteristics of Participants

Table 1 below presents the general characteristics of the control and interventional groups. There were no significant differences observed in terms of profiles of the control and intervention groups except the hospital type (mission, private and public), educational background and work experience. This partially supported that the intervention and control group had similar characteristics.

Category		Intervention Group N(%)	Control Group N(%)	X <sup>2</sup>
Gender	Male	39(38)	32(32)	0.133
	Female	63(61)	41(41)	
Age	>25	10	3	1.800
	25 - 30	16	7	
	30 - 35	26	22	
	35 -40	11	9	
	40 - 45	13	8	
	45 - 50	15	8	
	<50	11	16	
Education Level	Lower primary	18	7	2.901
	Upper Primary	23	12	
	Secondary	47	33	
	College	10	19	
Position	University	4	2	4.001
	Cook	35	22	
	Assistant cooks	31	27	
	Domestic workers	29	18	
	Nutritionist	8	6	

Hospital Type	Public	6	5	12.922
	Private	5	3	
	Mission	2	2	
Working Experience	1 year or less	11	9	4.662
	1 - 2yrs	18	16	
	2 - 3yrs	15	15	
	3 -4yrs	22	12	
	More than 4	36	21	
Employment Status	Full-time	92	41	1.822
	Part time	10	32	

Table 1. Demographic Characteristic of Respondents

Participants aged 32 showed the highest proportion of the study group, showing 21 persons (20%) of the intervention group and 17 persons (23%) of the control group. In the case of education levels, 61 persons (60%) of the intervention group and 54 persons (73%) of the control group had secondary education and above. Majority of the respondents listed their working experiences as either one year or less or more than 4 years, amongst them, 57 were cooks, and 58 were assistants who had the chef certification and the remainders did not have qualifications, they only supported the cook or conducted less skillful tasks, such as serving and washing dishes.

In the intervention group, 92 (90.2%) belonged to regular full time job employees, and only 10 workers were part time employees. This was continually done in order to avoid the missing follow ups due to observed turnovers

### Food Safety Knowledge

Table 2 below shows the scores from food safety knowledge testing before and after the training. When comparing the pre-test scores between the intervention and the control group, the t-test analysis showed no significant difference in the level of food safety knowledge between the two groups.

Table 2: Effects of Food Safety Training on Food Safety Knowledge Scores

Category		Before Training	After Training	t-value
Personal Hygiene	Intervention Group (N= 68)	12.6 ±4.0	18.6 ±5.0	-2.821
	Control Group (N=73)	12.2 ±4.3	11.9 ±4.0	1.144
	t-value	0.571		
Food Handling	Intervention Group	20.2 ±7.2	42.1 ± 6.2	-6.603
	Control Group	20.8 ±9.4	19.7 ±7.4	1.762
	t-value	0.903		
Food Storage	Intervention Group	8.3 ±2.5	8.0 ± 3.0	0.318
	Control Group	8.5 ±2.7	9.8 ± 4	1.002
	t-value	0.611		
Kitchen Sanitation	Intervention Group	6.0 ±4.1	8.3 ± 3.5	-0.612
	Control Group	5.6 ±4	6.1 ±3.5	2.624
	t-value	0.052		
Working Environment	Intervention Group	9.4 ± 4.8	10.8 ±4.2	-0.425
	Control Group	9.3 ±4.0	9.2 ±4.1	0.216
	t-value	0.730		
Total	Intervention Group	56.5 ±16.5	87.8 ±15.5	-5.165
	Control Group	56.4 ±15.1	56.7 ±17.8	1.816
	t-value	0.533		

In the total score, the intervention group showed the greater increase with the score of 56.5 and 87.8 in the pre / post training respectively.

Table 3: Comparison of Food Handlers' Hygiene Knowledge Scores before and after Food Safety

Category		Before	Total After	t-value
PH	Q1. When washing your hands, you should rub your hands together with soap for at least	78.0±42.9	78.0 ±41.9	0.000
	Q2. Which of the following the most common cause food borne illness?	12.2 ±33.6	68.3 ±47.1	-6.237
	Q3. Good personal hygiene practices include all of the following EXCEPT	61.0 ±48.5	63.4± 48.8	-0.225
	Q4. What will you avoid to do when you develop a fever and severe cough before going to work?	78.0±37.3	97.6 ±15.6	-2.794
	Sub - total (20 points)	11.5 ±5.0	15.4 ±5.0	-3.506
FS	Q5. In the refrigerator, where should cooked foods be stored?	56.1 ±50.1	78.0 ±41.9	-2.148
	Q6. Which of the following is not a food labeling requirement?	43.9 ±50.3	22.0 ±41.9	2.148
	Sub - total (10 points)	5.0 ±3.5	5.0 ±3.3	0.000
FH	Q7. Which of the following is necessarily needed for wearing disposable gloves?	26.8 ±44.9	75.6 ±43.5	-5.000
	Q8. Which of the following is the temperature affecting the most rapid growth of bacteria	22.0 ±42.9	78.0± 41.9	-6.061
	Q9. Which of the following is the proper internal temperature in cooking?	46.3± 50.4	70.7 ±46.1	-2.285
	Q10. Which of the following is the proper holding temperature in cooked foods?	58.5 ±49.8	58.5 ±49.9	0.000
	Q11. The safest way to thaw (defrost) foods is:	58.5 ±48.5	75.6 ±43.4	-1.652
	Q12. Potentially hazardous foods (time/temperature control for safety foods) are:	68.3 ±45.8	80.5 ±40.1	-5.709
	Q13. What is cross-contamination?	26.8 ±46.6	80.5 ±40.1	-0.943
	Q14. What is usually the riskiest step in food preparation?	63.4 ±48.5	73.2 ±44.9	-2.615
	Q15. Which of the following is not a proper cleaning method of vegetables and fruits?	22.0 ±42.9	48.8± 50.6	-5.709
	Sub - total 45points	19.6±10.3	32.1± 9.2	-5.753
CS	Q16. Which is the correct way to wash dishes, utensils and equipment?	56.1± 49.0	56.1± 50.2	0.000
	Q17. What are some of the food contact surfaces that must always be washed and sanitized?	58.5 ±42.9	70.7 ±46.1	-1.150
	Sub – total 10points	5.7 ±3.8	6.3± 3.5	-0.752
EH	Q.18. Which of the following is best way to control insect vectors and rodents in the kitchen?	61.0 ±49.0	58.5 ±49.9	0.222
	Q.19. Where must you store chemicals such as cleaners and sanitizers?	39.0 ±49.4	26.8 ±44.9	1.170
	Q. 20. What must be at hand washing sinks at all times?	48.8 ±50.4	70.7 ±46.1	-2.054
Sub - total 15 points		7.4 ±5.4	7.8 ±4.5	-4.345
Total (100points)		56.5	87.8	-4.438

### Food Safety Practices

The scores of food handler's food safety practices before and after treatment are presented in table 4. In the case of the food safety practices evaluation, the first time showed similar levels of practices on food safety between the intervention group and control group before training. Food safety practices of the control group in the post-test did not significantly improve, compared to that of the pretest ( $P>0.05$ ). The intervention group showed some positive changes in the practices after training. Safety practices showed minor positive changes, but non-significant: which were

indicated as 'health checking before work (4.7,  $t=0.801$ ), washing hands before work (5.1,  $t=0.352$ ), separate handling of raw materials and cooked foods (4.5,  $t=1.391$ ), handling methods of cooked foods (5.4,  $t=1.952$ ), proper storage of sanitizer and cleaner (4.3,  $t=1.376$ ), and cleaning and maintaining toilet facilities (4.4,  $t=0.4733$ ). In total it appeared that there was not any significant increase in the intervention group, showing 101 points in the pre-test and 105 in the post-test (see table 5)

Table 4: Effects of Food Safety Training on Food Safety Practices

Category	Food Safety Practice Score			t value	
	Before Training	After Training			
Personal Hygiene	Intervention Group	14.1± 2.5	14.3± 2.3	0.032	
	Control Group	14.2± 2.0	13.8 ±3.0	2.044	
	t value	0.785			
Food hygiene	Food Supply & Storage	Intervention Group	22.2 ±5.0	24.4± 5.4	0.827
		Control Group	22.1 ±7.8	21.6 ±5.9	-0.601
		t value	0.250		
	Food Handling & Serving	Intervention Group	27.6 ±5.5	29.9 ±5.3	0.307
		Control Group	28.3 ±4.5	26.6 ±5.8	0.482
		t value	0.703		
Env hygiene	Cleaning & sanitation	Intervention Group	17.7 ±2.7	19.0 ±4.3	0.197
		Control Group	22.1 ±2.5	21.4 ±3.8	1.938
		t value	0.185		
	Working environment	Intervention Group	19.6 ±4.4	20.7 ±4.1	-0.555
		Control Group	21.3 ±4.0	19.3± 3.5	1.364
		t value	0.129		
Total	Intervention Group	101.3±11.6	105.3±12.2	0.021	
	Control Group	110.7	102.7	0.407	
	t value	0.319			

Table 5: Comparison of Hospital Food Handlers' Hygiene Practices Before and After Food Safety Training

Category	Total		t-value
	Before	After	
Q1. Which of the following is needed for hand washing?	78.0± 42.9	78.0 ±41.9	0.000
Q2. Which of the following is the most outbreak of food-borne illness?	12.2 ±33.6	68.3 ±47.1	-6.237
Q3. Which of the following is not proper activity of employee before works?	61.0 ±48.5	63.4± 48.8	-0.225
Q4. What do you need to do when workers have a fever and cough severely?	78.0±37.3	97.6 ±15.6	-2.794
Sub - total (20 points)	11.5 ±5.0	15.4 ±5.0	-3.506
Q5. Which of the following is proper method of refrigerator?	56.1 ±50.1	78.0 ±41.9	-2.148
Q6. Which of the following is the item needed for proper labeling?	43.9 ±50.3	22.0 ±41.9	2.148
Sub - total (10 points)	5.0 ±3.5	5.0 ±3.3	0.000
Q7. Which of the following is necessarily needed for wearing disposable gloves?	26.8 ±44.9	75.6 ±43.5	-5.000
Q8. Which of the following is the temperature affecting the rapid growth of bacteria?	22.0 ±42.9	78.0± 41.9	-6.061
Q9. Which of the following is the proper internal temperature in cooking?	46.3± 50.4	70.7 ±46.1	-2.285
Q10. Which of the following is the proper holding temperature of cooked foods?	58.5 ±49.8	58.5 ±49.9	0.000
Q11. Which of the following is the proper thawing method for frozen foods?	58.5 ±48.5	75.6 ±43.4	-1.652
Q12. Which of the following is not a potentially hazardous food?	68.3 ±45.8	80.5 ±40.1	-5.709
Q13. What is that germ transmitted from uncooked food to cooked food through employees hand and food contact surfaces?	26.8 ±46.6	80.5 ±40.1	-0.943
Q14. Which of the following is improper practices of employees in preparation process?	63.4 ±48.5	73.2 ±44.9	-2.615
Q15. Which of the following is a proper cleaning method of vegetables and fruits?	22.0 ±42.9	48.8± 50.6	-5.709
Sub - total 45points	19.6±10.3	32.1± 9.2	-5.753
Q16. Which is not a proper practice in cleaning and sterilizing of equipments and utensils?	56.1± 49.0	56.1± 50.2	0.000
Q17. Which of the following is an improper in methods of sterilization?	58.5 ±42.9	70.7 ±46.1	-1.150
Sub – total 10points	5.7 ±3.8	6.3± 3.5	-0.752

Q18. Which of the following is the improper activity for controlling pests in restraint?	61.0 ±49.0	58.5 ±49.9	0.222
Q19. Which of the following is not the proper method for equipment and facility Management about hygiene supervision of equipment/utensils?	39.0 ±49.4	26.8 ±44.9	1.170
Q20. Which statement below describes the improper method for equipment management?	48.8 ±50.4	70.7 ±46.1	-2.054
Sub - total 15 points	7.4 ±5.4	7.8 ±4.5	-4.345
Total (100points)	56.5	87.8	-4.438

### Sanitation Rated by the On-site Inspection

The result of observational inspection on sanitation management is presented in table 6. According to the result of observational inspection by trained inspectors, the score of the sanitation performance of the intervention group before training was 48.8 out of 100

points. The scores were, in particular, low in the items of "food handlers hygiene education (2.1)" and "proper hand washing/hand washing facilities supplied (3.5)" in personal hygiene.

Dimensions	Practices	Possible Score	Score		t-value
			Before	After	
<b>Personal Hygiene</b>					
1	Food handlers wash their hands after contaminating them	5	4.2 ±0.9	4.7±0.9	-1.000
2	Hand-wash facilities are operable, accessible and supplies with soap and utensils	5	3.5 ±0.8	3.5 ±0.8	0.000
3	Food handlers dress code and personal hygiene	5	4.7±0.7	5.0±0.0	-0.987
4	Food handlers wear clean clothes	5	4.1±0.8	4.8±0.6	-1.628
5	Health examination of food handlers	5	4.0± 0.2	4.1±0.4	0.000
6	Food handlers hygiene education	5	2.1±0.9	2.2±0.6	0.005
	Sub – total score	30	23.1±4.3	24.3±4.0	-1.722
<b>Food Storage</b>					
1	Raw meats and poultry are stored below ready to eat foods in refrigeration units	5	3.2±0.8	3.4±0.7	-1.058
2	Food is covered to protect from overhead contamination	5	4.3±1.1	4.7±0.0	-1.054
3	Food and beverages are stored at least 6" of the floor	5	3.3±1.0	4.2±0.0	-1.352
4	Food is properly labeled and stored	5	2.0±0.0	2.0±0.0	0.000
5	Storage facilities are kept clean and in good order	5	3.4±0.9	4.3±0.7	-0.043
6	Chemicals/toxic materials stored in an area separate from food, utensils and food contact surfaces	5	2.2±0.8	3.1±0.0	-1.724
	Sub-total score	30	18.4±5.6	21.7±6.1	-1.623
<b>Food preparation service</b>					
1	Appropriate utensils are used to minimize bare hand contact with food	5	2.1±0.8	3.3±0.0	-1.832
2	Gloves are changed after soiling	5	1.7±0.8	2.0±0.7	-1.510
3	Separate cutting boards are used for ready to eat foods and food being prepared	5	2.6±1.1	2.3±0.7	-1.414
4	Sneeze guards are used in food preparation areas	5	0.9±0.0	1.0±0.0	0.000
	Sub-total score	20	7.3±2.3	8.6±2.5	-0.522
<b>Time/Temperature Control</b>					
1	Food handlers take temps of reheated foods	5	0.0±0.0	0.0±0.0	0.0±0.0
2	Employees take internal temps of hot & cold food items	5	0.0±0.0	0.0±0.0	0.0±0.0
3	Employees temperatures were observed being taken during preparation	5	0.0±0.0	0.0±0.0	0.0±0.0
4	Employee maintain food temperature logs	5	0.0±0.0	0.0±0.0	0.0±0.0
	Sub-total score	20	0.00	0.00	0.00
	Total Score	100	48.8±6.5	54.6±6.8	-1.438

Table 6: Effects of Training Sanitation Performance

In the dimension of food storage, “food properly labeled and stored (3.3)”, checking and recording temperatures of food (0.0)” and preventing contamination by holding foods off the floor (3.3)” were needed to improve the practices. Lastly, on food preparation service: of most importance, the items “Appropriate utensils are used to minimize bare hand contact with food (2.1)” “gloves changed after soiling (1.7)”, “Separate cutting boards are used for ready to eat foods and food being prepared (2.6)” were needed to improve. As for the result for examining. pre/post score change after training the score was increase as 54.6 points, but no significant differences indicated.

## DISCUSSION

While the contribution of food mishandling and faulty practices in the epidemiology of food-borne diseases underscores the rationale for hygiene training of food handlers, there is uncertainty concerning the beneficial effects of such training to food safety, and there is a need to evaluate current practice. In an effort to elucidate this issue, an evaluation of food hygiene training was undertaken in this study. The objective was to examine the effectiveness of food hygiene training in terms of its impact on food hygiene knowledge and practices. There are many studies on healthcare training and the training of food handlers. This study is different in that it was on staff working in a healthcare institutions (hospitals).

### Knowledge

Results from the evaluation of the effectiveness (food safety knowledge Pre- and posttest) of food safety training demonstrated that the curriculum was used successfully to improve food safety knowledge for the participants overall ( $56.5 \pm 16.5$  vs.  $87.8 \pm 15.5$ ). Food safety training resulted in significant differences in the mean score percentages of all the different knowledge parameters after training ( $P < 0.05$ ) and in an improvement in their overall food safety knowledge. The highest knowledge improvement was in food handling (71%). The lowest improvement was in food storage (50%).

The positive impact of the food safety education on knowledge of the food handlers in this study is similar to results from several previous studies (Singh, 2004; Camples et al, 1998, Soneff et al, 1994, Viedma et al 2000, Mathias, Sizto and Hazewood, 1995). However, some studies have reported no significant impact of food safety education on the knowledge of food handlers (Danhaivijitr et al, 2005). This could be partly due to variation in the methodology of health education. At the same time, the demographic and professional profile of food handlers could also influence the outcome of the health education interventions. Other studies (Finch and Daniel, 2005: Hertzman, Stefanelli,

and Farrish, 2008; Meer and Misner, 2000; Lin and Sneed, 2005; Raval-Nelson and Smith, 1999) have also found that food safety training and/or certification have a positive impact on food handlers' knowledge on food safety. However, the results are mixed when analyzing whether increased knowledge leads to better food safety attitudes, practices, and behaviors. Jenkins-McLean, Skilton, & Sellers (2004) and Lin and Sneed (2005) found that enhancing knowledge can change behaviors and practices.

It may be contended that improvement in knowledge in this study could be due to the influence of personal and food hygiene messages communicated to the food handlers through other sources such as mass media. It should be noted that there were neither other educational campaigns nor an increased focus in the mass media, other than routine, on personal and food hygiene during this study. Though this reduces the possibility of extraneous sources of learning in influencing knowledge and practices of the food handlers, the role of such sources cannot be ruled out completely. In addition, a 2004 study by Dharod, Pérez-Escamilla, Bermúdez-Millán, Segura-Pérez, and Damio found that food safety knowledge, attitudes, and behaviors could be positively affected by culturally relevant media.

### Practices

Lack of significant change positive change amongst the food handlers practices after the food safety education was observed in this study ( $101 \pm 11.6$  vs.  $105.3 \pm 12.2$ ). This could be attributed to self-report other than actual observation. The reported harmful practices have the potential to transfer pathogenic organisms to food and merit attention. In spite of the food handlers being aware and have a positive attitude towards food safety practices, the reported lack of safe practices highlights a gap between knowledge and attitude and actual food safety practice. Other studies have shown similar findings; Azanza, Gatchalian, and Ortega (2000) found a significant discrepancy between reported food safety knowledge and actual food safety practice. Meer and Misner's (2000) research showed that although participants in a US Food and Nutrition Education program with previous food safety education scored higher than those without it on 11 food safety knowledge questions, there were no significant differences in their practices.

### On-site Sanitation Inspection

Without actually going into the facility and observing the workers' food handling behaviours, it is hard to determine if, as a result of the food safety training, the participants will adopt safe food handling behaviours. This study employed an onsite inspection program to assess whether the knowledge showed by food handlers was put into practice; little improvement was observed ( $48.8 \pm 6.5$  vs  $54.6 \pm 6.8$ ). These findings are in



concurrence with previous studies (Meers & Misner, 2000) which showed that food safety knowledge scores had a small positive effect on food safety practices. In a review of food safety studies, Redmond & Griffith (2003) showed that food safety knowledge, attitudes, intentions, and self reported practices did not correspond to observed behaviours, suggesting that observational studies provide a more accurate indication of the food safety practices actually used in food preparation.

Another study by Clayton and associates (2002) reported that food safety training does not necessarily guarantee that the workers carry out the safe food handling behaviours. The study suggested that barriers preventing the workers from always practicing safe food handling included lack of time, lack of staff and lack of resources. These results were based on the food handlers' self reported practices, like the food safety practices survey in this study. Additionally, similar relevant reports such as USDA (2002) also showed that consumers were knowledgeable about food safety, but this knowledge was not always reflected in their food handling behavior when they were observed. Another study by McIntosh and his colleagues found out that knowledge on specific food borne pathogens and food safety practices had no effect on the food handlers' willingness to change their behavior (McIntosh, Christensen & Acuff, 1994). In another study conducted in school food service employees' food handling and practices and food safety knowledge and attitudes, it was established that the food safety knowledge was high, but when handling behaviours were observed, the safe food handling was not practiced (Henroid & Sneed, 2004).

In contrast, some studies demonstrate increased food safety practices as a result of food safety education when food handlers are observed. Studies have reported that food safety education helped to increase sanitary conditions in restaurants (Cotterchio et al, 1998; Soneff et al, 1994; Mathias et al, 1995). These studies suggest that food safety did lead to increased adoption of safe food handling practices as evidenced in an adult in a care facility audit (Soneff et al, 1994) and restraint inspection scores (Cotterchio et al, 1998; Mathias et al, 1995).

Even though the actual foods served to patients in the hospitals studied were not sampled for microbial analysis in this study to more definitively determine their safety, reported lack of food sufficient food hygiene practices can theoretically put the patients in the hospital environment at risk of developing food borne illnesses.

## **CONCLUSIONS**

Food-related epidemics are important health problems for all countries. The most efficient method to stop this problem or at the very least to decrease it is by to

training those working in the food industry and repeating this training periodically. The results of this study support the assumption that the development and delivery of a food safety education program for participating food recovery agency personnel and volunteers will increase food safety knowledge and an indication of adoption of safe food handling behaviors. This will presumably decrease the risk and incidence of food-borne illness in patients in the hospital environment.

The study findings showed that food safety knowledge and handling practices in the 22 hospitals studied were unsatisfactory before training. However, the training programme improved most of the aspects of food safety issues assessed in all the hospitals, although practice still lagged behind knowledge.

It is also concluded from this study, that due to the limitation on the training time and frequency of training, an education effect could affect the improvement of hygiene knowledge, but the food safety practice and hygiene management performances were not improved. However, considering the fact that there were some significant increases in knowledge, it is concluded that practicing continual and repetitive hygiene education could be effective even in improving the sanitation management level as well as the hygiene knowledge and sanitation practices. To do this, the frequency of food safety training reinforced through specific goal setting, and more concrete training programs suitable for the employees' educational background should be designed. In addition, designing the program to motivate employees to maintain and self-regulate proper practices should be required.

## **RECOMMENDATIONS**

It may be contended that the improvement in knowledge and some practices observed in the present study is reflective of a temporal trend rather than the health education intervention. This is contested as this study is limited by having only 2 measures of knowledge and practices 3 months apart, and not repeated measures. But the magnitude of the change observed is unlikely to be due to a temporal trend. The validity of the results can be improved by inclusion of repeated measures in future studies. Furthermore, the results of the present study are limited to only the hospital environment, the nature and extent of the impact of a similar health education intervention among food handlers having different demographic and professional profile and in different settings could be different. Further studies looking at varied groups of food handlers working in varied and larger settings are warranted. Without microbial analyses and time/temperature checks of the food, etc., it is impossible to determine if the food safety curriculum and delivery of the program made the food served by food handlers to patients. Perhaps further exploration and testing the safety of the food is needed.

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