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Evaluating knowledge levels of food handlers in Alexandria school canteens and their self- reported behavior towards food safety

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Abstract

The aim of this study was to evaluate food handlers 'knowledge and behavior regarding the safe handling of food in school canteens in Alexandria City. The study was conducted on 30 school canteens and included 150 participants. The level of knowledge was influenced by age, motivation and training. Our assessment of prevailing knowledge levels indicates that food professionals need to be more aware of the importance of their actions to children's health.

Key words: school canteens, food handlers, food safety

Introduction

The major function of the food safety programmes all over the world is to ensure the wholesomeness of food, and to protect consumers especially students from adulteration, misdescription and misleading advertising. So, food safety in school services is an important concern since an incident can affect a high number of students, and pupils. Thus, meal served at school canteens should be not only nutritionally balanced but also avoid placing students at risk of food borne illness. A lack of knowledge or incorrect applications of sound hygiene practices by food handlers are potential causes of serious outbreaks of food borne diseases [1].

Most if not all ready to eat foods school canteens are operated by food handlers, who might have come from lower socio economic levels, have limited education and read poorly or not at all. So it is not easy to maintain control over them in spite of persistent efforts by the concerned local health authorities, and hence, they could be dangerous source of food borne infections. In many food poisoning outbreaks, the number of the cases may be hundreds and particularly at schools.

Factors governing the outbreaks of food borne diseases

The principal factors associated with outbreaks stemming from foods prepared at food service establishments are improper cooling, lapse of 12 hours or more, between preparing and eating, inadequate reheating and improper hot holding [2]. Many malpractices take place in food preparation and permits contamination, survival and growth of food poisoning bacteria. Most outbreaks of food poisoning are of bacterial origin and 58% of incidents were found to occur in situations where food is prepared in quantities for a large number of people. [3]

Food handlers

Persons who carry staphylococcus aureus in their noses or skins are the main source of most outbreaks of staphylococcal food poisoning. [2] To avoid any contamination from food handlers food hygiene legislations try to ensure that any infected person who might transmit infection to food must be excluded from handling food. Such a person must undergo periodical medical examination to prove that he is healthy and free from infections. [4] Also Food handlers as carriers of B. Cereus, can transmit this pathogen to food by hand if do not wash their hands thoroughly after defection. [5]

Raw food

Raw foods are often contaminated before they reach the kitchen. Contamination of raw salad vegetables with E. coli was found to be particularly likely to occur during the preparation of ready to eat foods (meals) and at preparation kitchens. [6] A large outbreak of Shigella Sanni infections occurred in Great Britain, Norway and Sweden in 1994 due to contaminated lettuce imported from Southern Europe. [7]

Storage of food at room temperature

Storage of food at room temperature for a long duration is an extremely hazardous practice and this has been known to raise the risk of food borne diseases. [2] An outbreak of acute gastrointestinal illness followed a buffet served to 855 people at New Mexico Country club was reported in 1986. Three food items (Turkey, Poultry dressing and gravy) were significantly associated with illness, where staphylococcus aureus was the responsible microorganism. Investigation of food handling practices indicated that the cooked turkey had been cooled for 3 hours at room temp. [8]

Cross contamination

Using the same surfaces, the same equipment for raw and cooked preparation, or stronge of these foods in close proximity will lead to spreading of microorganisms from raw food to cooked food. In 1994, there was an outbreak of salmonellosis in the U.S.A, due to consumption of contaminated pasteurized ice cream with salmonella enteretridis which was transported in lorries that had previously carried non pasteurized liquid egg. [8]

Inadequate cooking

To reduce the number of food poisoning bacteria to the safe level temperature must reach 70°C at least for a minimum of 2 minutes in the center of the food. [9] Many organisms may survive cooking; salmonella and other organisms survive cooking with too short time and too low temperatures [3]. Heat resistant microorganisms such as Clostridium botilinum frequently survive due to insufficient heating [10]. Keeping food hot at elevated temperatures above that, which encourage bacteria to multiply, frequently decreases the percentage of food borne diseases. Preparing food for a large number of people is difficult; the risks in catering arise from inadequate cooking, cooling and storage and also from cross contamination when the preparation area are restricted [2].

Improper cleaning of equipment

Equipment and utensils used in a food service establishment must be designed and constructed to be easily and thoroughly cleaned. Otherwise, they will be an important source of contamination Inadequate cleaning of cutting boards after handling of raw meat and poultry, play a big role in transmitting food borne pathogens such as Campylobacter jejune and salmonella sp.

Food handling

Food handling practices

Food processes are never safe, but there must always be a continual effort to reach the zero defects. Handling and storing of raw and cooked food should be separated completely from each other, in order to avoid any direct or indirect transfer of microorganisms from raw to cooked foods [19]. Faults in production of food can lead to wide spread of food poisoning out breaks [2]. Food from animal sources, such as meat, fish and chicken were found to be the most susceptible to the transmission of various food borne illnesses [11].

Sanitary measures in food handling

To establish and maintain an adequate sanitary handling of food, operators' of food premises should put in their minds the following facts.

Employee selection

In most communities, local health legislation exclude any person having infectious diseases or even carriers of diseases as a result of handling foods unless he or she provides a medical report proving that they are healthy and free from infections and / or open sores, skin infections, pimples or acne [5].

Adequate facilities

When selecting food equipment, it is very important to consider how well these equipment perform the desired function (cut, chop, cook), the size needed for the products, type of operation and maintenance. Such equipment must be easily cleanable, and protect food from contamination

Personal hygiene

To avoid food contamination from food handling personnel the following directions should be considered:

a. Hand washing

Thorough and frequent hand washing should be practiced by food handlers, particularly after raw food handling, using the lavatory, sneezing or coughing, and after touch pimples or sores. However, addition of a disinfectant such as hexachlorophene to a dispenser of a liquid soap is more hygienic than using a piece of soap. Minimizing touching of food by hands is preferable due to the possible presence of S. aureus on food handlers, even though these might be very clean [13].

b. Hair covers

Staphylococcus aureus or other microorganisms can be transmitted to food via hands while handling, combing and brushing of hair. Therefore; hair must be covered with hats or hair nets to minimize such contamination.

c. Clothing

Periodic changing and washing of light colored clothing and aprons used by food handlers reduces the risks of food contamination that may result due to the accumulation of microorganisms or food materials.

d. Smoking, eating and chewing

Smoking, eating or chewing always enhance spitting, so these habits must be prohibited in areas where there is uncovered food.

Sanitary facilities

To enhance personal hygiene of food handlers, toilets should be located far away from food preparation area, i.e. to the end of the building with trap doors not opening directly to the preparation area. Wash basins with hot and cold running water soap, paper towels, nails brush should be supplied.

Education and training on food safety

Food handlers should be trained primarily to understand factors leading to outbreaks of food borne diseases and how the microorganisms can contaminate, survive and multiply in or on food. Also they should be educated and trained frequently on the preventive measures of food borne illnesses. Training programmes are probably the most effective means needed to change poor personal health and bad habits. Such programmes will be more accepted if they are supplemented with posters, information sheets, contents and other means of propaganda [13].

2.2.5. Supervision of employee

To find free exchange of information between food safety authorities and food producers, each food premises should have at least a hygiene officer. Most if not all food handlers have no knowledge about food poisoning. Food handlers should be observed daily by a qualified supervisor to detect any complication or any other evidence of infection and to regulates the work according to the local health authorities requirements [5].

With the above in view the aim of this study was to evaluate food handlers' knowledge and self-reported behavior towards the safe handling of food in school canteens in Alexandria city.

Materials and method

A descriptive study was conducted on 30 canteens belonging Alexandria City, and involved all 150 food handlers working at these premises. Face – to – face interviews were conducted between September and December 2014 using a structured questionnaire. This method was preferred over a self – administrated questionnaire due to the expected low literacy levels of the target participants.

Questionnaire design

The questionnaire included four sections:

1- socio-demographic characteristics of the population, specific training on working with food stuffs and health status.

2- Knowledge of food hygiene and safety.

3- Self –reported behavior towards safe food handling.

4- Self-reported behavior towards personal health and hygiene.

The first section described socio-demographic characteristics (gender, age, education level, professional category, length of employment, previous occupation; and one question about what motivated them to work at the canteen), specific training (whether or not received, how many courses completed, date of most recent training and duration of training period) and health status (whether they had undergone a medical examination before beginning work at the canteen) The second section was designed to obtain information about food hygiene and safety knowledge with regard to the following:

Vehicles of transmission of food-borne pathogens (10 questions); personal hygiene (eight questions); cross-contamination. (four questions); heat treatment (five questions) and chilling techniques (four questions); cold storage (four questions). These 35 questions on handlers, knowledge hand two possible answers: correct, incorrect (included reducing the response bias). One point was given to the correct answer, zero for the wrong one.

The third section included eight questions concerning food handlers' self-reported behavior towards safe handling. Eight phrases were designed with a multiple-choice. Answers were scored with one point if the self-reported behavior was considered correct and zero if it was incorrect. Finally, the fourth section concerned the self-reported behavior towards personal health and hygiene. This variable resulted from merging together those questions of health and hygiene. For the questions regarding health the following were considered correct: stay off work when ill and inform the person in charge when becoming ill at work; not use tissue handkerchiefs when suffering from cold, and have all the appropriate and up-to-date vaccinations. For the questions relating to hygiene the following were considered correct: having clean uniforms, washing uniforms at least three times a week, having appropriate and clean footwear, not going outside while wearing work footwear, using appropriate hair protection, having short and clean nails, not wearing Jewels and exhibiting a good remarkable level of hygiene. The answers were scored with one point if the behavior was correct and zero if not.

Scores of the three dependent variables obtained, namely knowledge (between zero and 79), self-reported: behavior towards safe food handling (between zero and 8) and self-reported behavior towards personal health and hygiene (between zero and 12) were subsequently changed. So that a possible score of 100 point was available for each variable, thus making the interpretation easier.

Statistical analysis of the data

Data were analyzed using IBM SPSS version 20. Qualitative data were described using number and percent. Quantitative data were described using mean and standard deviation for normally distributed data. For normally distributed data, comparison between two independent population were done using independent t-test while more than two population were analyzed F-test (ANOVA) to be used. Significance of the obtained results was judged at the 5% level.

Results

The results of the study are tabulated in tables (1-6), followed by their discussion

Table (1): Distribution of the food handlers according to socio-demographic data

	No (%)
Age group, years	
31 - 40	54 (36.0)
41 - 50	43 (28.7)
51 - 60	21 (14.0)
>60	32 (21.3)
Education level	
Illiterate	22 (14.7)
Read and write	54 (36.0)
Primary	21 (14.0)
Preparatory	23 (15.3)
Secondary	30 (20.0)
Professional cook	
cafeterias	100 (66.7)
Cook	28 (18.7)
Head cook	22 (14.6)
Length of employment, years	
5 – 9	70 (46.7)
10 - 14	31 (20.7)
15 - 19	29 (19.3)
>20	20 (13.3)
Previous occupation	
No	34 (22.7)
School caretaker	17 (11.3)
Canteens and similar	35 (23.3)
Domestic services/ agriculture	35 (23.3)

Con.Table1

Restaurant/hotel services	29 (19.3)
Motivational factors	
Like the job	59 (39.3)
Contractual stability	32 (21.3)
Lack of alternative	59 (39.4)
Received training	64 (42.7)
Number of training courses (n = 64)	
Once	11 (17.2)
Twice	32 (50.0)
Thrice	21 (32.8)
Date of last training course (n = 64)	
1 month ago	9 (14.1)
2 - 5 month	32 (50.0)
≥6 month	23 (35.9)
Hours of training (n = 64)	
40 hr	24 (37.5)
41 - 100 hr	19 (29.7)
>100 hr	21 (32.8)
Health status (a medical examination)	
yes	118(78.6)
no	32(21.3)

Table (2): Distribution of the food handlers according to food hygiene and safety knowledge

	Incorrect No. (%)	Correct No. (%)
Vehicles of the transmission of food-borne pathogens		
1- Fresh eggs can have salmonella	86 (57.3)	64 (42.7)
2- Meat always has microbes on the surface	25 (16.7)	125 (83.3)
3- Canned foods might have microbes	33 (22.0)	117 (78.0)
4- Microbes might be in the skin, nose and mouth of healthy people and contaminate foods	12 (8.0)	138 (92.0)
5- chicken usually have salmonella	46 (30.7)	104 (69.3)
6- Chicken might be more hazardous than beef due to high probability of having salmonella	42 (28.0)	108 (72.0)
7- Lettuce and other raw vegetables might have hazardous microbes	54 (36.0)	96 (64.0)
8- Foods served cold (salads) do not have to be disinfected	54 (36.0)	96 (64.0)
9- Cooked foods do not have microbes	34 (22.7)	116 (77.3)
Personal hygiene		
1- Properly bandage and glove cuts and burns on hands before handing foods	26 (17.3)	124 (82.7)
2- Always wash hands with soap and warm running water after handing raw meat	21 (14.0)	129 (86.0)
3- After washing, hands should be dried with a multi-use kitchen towels	104 (69.3)	46 (30.7)
4- It is necessary to wash hands with soap and warm running water before handing cooked foods	16 (10.7)	134 (89.3)
5- Always wash hands with soap and warm running water after using the toilet	3 (2.0)	147 (98.0)
6- When wearing gloves one might handle cooked foods after handling raw meat	125 (83.3)	25 (16.7)
7- After sneezing hands should be properly washed	10 (6.7)	140 (93.3)
8- When you go outside you should change you footwear	73 (48.7)	77 (51.3)
Cross-contamination		
1- Food-borne diseases can result from contamination of ready-to eat food stored close to raw meat	28 (18.7)	122 (81.3)

2- Multiple step preparation of food increases handling and thereby the risk of contamination	22 (14.7)	128 (85.3)
3- Food can be contaminated with microbes by contact with other higher contaminated foods	16 (10.7)	134 (89.3)
4- Preparation surfaces might be responsible for the food contamination	20 (13.3)	130 (86.7)

Table (3): Distribution of the food handlers according to knowledge

	Incorrect No. (%)	Correct No. (%)
Heat treatments		
1- Ground meat needs to be cooked to a higher temperature than non-ground	111 (74.0)	39 (26.0)
2- Cooked foods might be kept above 658C for a few (2) hours	91 (60.7)	59 (39.3)
3- Most part of foods should be heated to 758C during cooking	78 (52.0)	72 (48.0)
4- Foods prepared in advance (or leftovers) should be reheated to 758C	55 (36.7)	95 (63.3)
5- Microbes might grow because the food was kept at room temperature for a long period	46 (30.7)	104 (69.3)
Chilling techniques		
1- Leftovers should be stored in the container they are cooked in	108 (72.0)	42 (28.0)
2- Leftovers should be stored in shallow containers 5-10 cm deep to allow proper cooling	35 (23.3)	115 (76.7)
3- Cooked foods might be safely stored refrigerated below 5C	91 (60.7)	59 (39.3)
4- Foods should be slowly cooled at room temperature before storage in refrigerator	116 (77.3)	34 (22.7)
Cold storage		
1- Freezing inhibits all the bacteria that might cause food-borne illness	26 (17.3)	124 (82.7)
2- Microbes responsible for food-borne diseases grow well at room temperature	29 (19.3)	121 (80.7)
3- Frozen food should be thawed at room temperature	128 (85.3)	22 (14.7)
4- After thawing, meat might be 5 hours at room temperature	88 (58.7)	62 (41.3)

Table (4): Distribution of the food handlers according to food hygiene and safety behavior (practices)

	Incorrect No. (%)	Correct No. (%)
Self-reported behavior towards safe food handling		
1- Think about time you handled raw meat, poultry, seafood, or egg. Which of the following did you do immediately after handling raw food?	68 (45.3)	82 (54.7)
2- Think about last time you handled raw meat, poultry, seafood, or egg using a cutting board or countertop. Which of the following did you do before preparing the next food product?	78 (52.0)	72 (48.0)
3- Think about last time you handled raw meat, poultry, seafood, or egg using dishes or utensils (for example, knives). Which of the following did you do before preparing the next food product?	94 (62.7)	56 (37.3)
4- The last time you hand leftovers (including soups and stews meat, poultry, seafood, or egg), how were the leftovers at room temperature before you refrigerated them or ate them later in the day without refrigeration?	90 (60.0)	60 (40.0)
5- Last time you prepared food and had a large amount (more than four servings of leftovers such as soups or stews containing meat, poultry, seafood, or eggs). What did you do with the leftovers?	85 (56.7)	65 (43.3)
6- Think about last time you prepared a meal with fresh or vegetables using a cutting boards or countertop. Which of the following did you do when switching from vegetables to a different food product like meat or bread?	61 (40.7)	89 (59.3)
7- Think about last time you prepared a meal with fresh fruits or vegetables using dishes or utensils (for example knives). Which of the following did you do when switching from vegetables to a different food product, like meat or bread?	83 (55.3)	67 (44.7)
8- Do you use a food thermometer?	132(88.0)	18(12.0)
Health-related behaviors		
1- Stay off work when ill	113(75.3)	37(24.7)
2- Inform the person in charge if one becomes ill at work	131(87.3)	19(12.7)
3- Not use tissue handkerchiefs when suffering from cold	18 (12.0)	132 (88.0)
4- Have all the appropriate and up-to-date vaccinations	33 (22.0)	117 (78.0)
Hygiene-related behaviors		
1-Having clean uniforms	23 (15.3)	127(84.7)
2- Washing uniform at least three times a week	48 (32.0)	102 (68.0)

3-Having appropriate and clean footwear	65(43.3)	85(56.7)
4- Not going outside while wearing work footwear	66 (44.0)	84 (56.0)
5- Use an appropriate hair protection cover	27 (18.0)	123 (82.0)
6- Having short and clean nails	10 (6.7)	140 (93.3)
7- Not wearing Jewels	56 (37.3)	94 (62.7)
8- Exhibiting a good remarkable level of hygiene	10 (6.7)	140 (93.3)

Table (5): The relation between demographic data with food hygiene and safety knowledge

	No.	Mean ± SD	Test of sig.	p
Age group, years				
31 - 40	54	21.61 ± 3.98		
41 – 50	43	21.40 ± 2.95	F = 0.386	0.763
51 – 60	21	22.43 ± 3.70		
>60	32	21.56 ± 4.10		
Education level				
Illiterate	22	19.27 ± 4.34		
Read and write	54	20.93 ± 3.33		
Primary	21	22.38 ± 2.52	F = 10.966*	<0.001*
Preparatory	23	20.91 ± 2.61		
Secondary	30	24.77 ± 3.14		
Professional cook				
Cafeteria	99	20.11 ± 3.26		
Cook	28	24.29 ± 2.31	F = 39.212*	<0.001*
Head cook	23	25.09 ± 2.41		
Length of employment, years				
5 – 9	70	22.14 ± 3.64	F = 1.877	0.136
10 – 14	31	21.94 ± 2.87		

15 – 19	29	21.28 ± 4.02		
>20	20	20.05 ± 4.14		
Previous occupation				
No	34	20.59 ± 4.24		
School cooker	17	19.53 ± 1.74		
Canteens and similar	35	21.51 ± 3.05	F = 5.518*	<0.001*
Domestic services/agriculture	35	22.0 ± 4.10		
Restaurant/ hotel services	29	23.90 ± 2.79		
Motivational factors				
Like the job	59	21.58 ± 4.29		
Contractual stability	32	20.94 ± 4.01	F = 1.093	0.338
Lack of alternative	59	22.12 ± 2.69		
Received training				
No	84	20.38 ± 3.55	t = 5.180*	<0.001*
Yes	66	23.27 ± 3.19		
Number of training courses				
Once	11	20.82 ± 2.36		
Twice	32	23.19 ± 3.41	F = 9.380*	<0.001*
Three times	21	25.19 ± 1.50		
Date of last training course				
1 month ago	9	25.22 ± 1.48		
2 – 5 month	32	24.0 ± 3.34	F = 5.290*	0.008*
≥6 month	23	21.96 ± 2.62		
Hours of training				
40 hr	24	20.96 ± 2.14		
41 – 100 hr	19	24.11 ± 2.13	F = 23.121*	<0.001*
> 100 hr	21	25.67 ± 2.80		

F: F test (ANOVA) t: Student t-test *: Statistically significant at $p \leq 0.05$

Table (6): The relation between demographic data with food hygiene and safety behavior (practices)

	No.	Mean ± SD	Test of sig.	p
Age group, years				
31 – 40	54	13.72 ± 3.16		
41 – 50	43	13.23 ± 2.72	F = 1.495	0.218
51 – 60	21	12.0 ± 3.29		
>60	32	13.09 ± 3.69		
Education level				
Illiterate	22	11.64 ± 3.44		
Read and write	54	10.78 ± 2.63		
Primary	21	10.90 ± 0.70	F = 5.074*	0.001*
Preparatory	23	11.0 ± 1.45		
Secondary	30	12.97 ± 1.63		
Professional cook				
Cafeteria	99	10.74 ± 2.41		
Cook	28	12.14 ± 1.48	F = 14.744*	<0.001*
Head cook	23	13.30 ± 1.89		
Length of employment, years				
5 – 9	70	13.86 ± 3.26		
10 – 14	31	13.23 ± 1.80	F = 9.535*	<0.001*
15 – 19	29	10.69 ± 2.97		
>20	20	14.55 3.20		
Previous occupation				
No	34	13.88 ± 3.76		
School cooker	17	10.88 ± 3.30	F = 7.421*	<0.001*
Canteens and similar	35	13.46 ± 2.84		
Domestic services/agriculture	35	11.94 ± 3.02		

Restaurant/ hotel services	29	15.0 ± 1.20		
Motivational factors				
Like the job	59	13.49 ± 3.65		
Contractual stability	32	12.97 ± 2.16	F = 0.390	0.678
Lack of alternative	59	13.05 ± 3.20		
Received training				
No	84	10.95 ± 2.42	t = 2.597*	0.010*
Yes	66	11.95 ± 2.24		
Number of training courses				
Once	11	11.09 ± 2.95		
Twice	32	11.50 ± 1.37	F = 9.995*	<0.001*
Three times	21	13.57 ± 1.78		
Date of last training course				
1 month ago	9	12.67 ± 0.87		
2 – 5 month	32	12.13 ± 0.87	F = 0.462	0.632
≥6 month	23	11.87 ± 2.38		
Hours of training				
40 hr	24	11.0 ± 1.91		
41 – 100 hr	19	11.68 ± 1.77	F = 14.817*	<0.001*
> 100 hr	21	13.76 ± 1.51		

F: F test (ANOVA) t: Student t-test *: Statistically significant at $p \leq 0.05$

Discussion

. The results of the present study showed that, the majority of sample size laid between 31-40 years old (36%); the educational level was generally low, the highest percentage of the participants (36%) reads and writes. The longest experience period of the participants (46.7 %) was 5-9 years; the food handlers' previous occupations matched their general level of education; they included no school caretaker, canteens, domestic services / agriculture and restaurant/hotel services (22.7%, 11.3%, and 23.3%, 23.3% and 19.3% respectively). The highest percentage of motivational factors was 39.4% in the canteen because of the lack of an alternative. The food handlers had undergone a varied degree of training; of the 150 participants, 86 had not received any specific training on working with food.

Regarding the vehicles of transmission of food borne pathogens it was observed that food handlers gave a high percentage of correct answers to the questions: microbes might on the skin, nose and mouth of healthy people and contaminate foods, meat always has microbes on the surface and canned food might be have microbes (92%, 83% and 78% respectively). In other words almost all participants had a high level of awareness regarding these questions. However only less than a half of food handlers (42.7%) recognized eggs and poultry as potential vehicles for salmonella, which requires particular attention during manipulation. Almost the same was observed by other researches. [15] In contrast to the prevailing ignorance of the risks that raw poultry products represent, the participants showed high awareness of that meat always has microbes on the surface (83.3 %) and considered washing hands with soap and warm running water after handing raw meat (86%) to be very important. In a similar study a panel of food safety experts. [16] Considered washing hands before handling foods to be the single most important way of preventing food-borne diseases. In the current study, The majority of food handlers knew the basic food hygiene principles, as the importance of washing hands after toilet (98%), after sneezing (93.3%) and before handing cooked foods (89.3%) while the lowest percent of incorrect answer, after washing hands should be dried with a multiuse kitchen towels was 30.7 %. Towels, like dish – cloths, rapidly become contaminated, and should never be used.

All studies showed that food handlers should be aware that personal hygiene is of utmost importance to food contamination. It should be realized that even in health, the human body has its own microbial flora on the skin, face, nose and hair, which often include pathogens such as staph aureus [17]. Smoking and shaking hands, can result in cross contamination. It is not surprising; therefore, that poor personal hygiene is the most responsible for food poisoning outbreaks. [18] The results of the present study showed also that the answers relating to cross – contaminations were highly scored.

A similar study [18] showed that some food handlers did not clearly recognize that cooked foods may be contaminated by raw foods. This behavior being potentially responsible for cross – contamination is recognized as one of the most important to food safety.

In the present study, regarding heat treatments most answers were in the middle range of correct values, while the highest percentage of correct answer to the question:" microbes might grow because the food was kept at room temperature for a long period" so it is concluded that food handlers need more training courses especially on how to use temperatures (heat or cold). Training food handlers to correctly use temperature is a measure recommended in the codex Alimentarius. Again, the questions regarding chilling techniques showed the lowest percent of correct answers, foods should be slowly cooled at room temperature before storage in refrigerators (22.7%). As regards the correct use of cold storage, most problems were related to improper thawing at room temperature; the correct answers were only 14.7% without recognizing any of the risks in that procedure.

Moderate levels of correctness were observed for food handler's self – reported behavior, except the use of food thermometer the correctness being only 18%, due to the lack of knowledge and lack of temperature control instruments; cooking was controlled by means of preparation time, individual cooking experience and sensory evaluation.

Table (4) shows self – reported behavior towards personal and hygiene, this variable resulted from combining together those questions regarding aspects of health and hygiene as being directly dependent on food handler behavior; the majority of the questions could be confirmed by the observation on the researchers part, which prevented participants from giving what they thought was the correct answer.

Worse still, was the wide spread failure (12.7) to notify the person in charge of any illness, 43% of food handlers use appropriate footwear. Its level of cleanlines was self – reported to be adequate, 56.7% of cases, 44% were faulty for leaving the facility without changing their footwear or performing cleaning/disinfection procedure on re – entering.

Table (5) shows the relation among socio – demographic factors, educational level, professional cooks, previous occupation, number of training courses and date of last training course. It was observed that the level of education has an important impact on the knowledge levels regarding the safe handling of foods; and when the specific effects of training were evaluated, it was possible to demonstrate the importance of

receiving or not receiving specific training, and the effect the date of the most recent training courses had on the level of knowledge. Food handlers with previous occupation in restaurant or hotel services had a high mean knowledge score (23.90 ± 2.79), and a statistically significant effect on the knowledge score.

Table (6) shows that the socio- demographic factors, professional cook, length of employment, previous occupation, received training and the number of training courses had a significant effect on the self – reported behavior. As the questionnaire was carried out via face – to- face interview, we accept that participants could have indicated behaviors that they knew to be correct, even if they do not follow these behaviors in their day – to –day work, in order to give the researcher an expected correct answer, this helps us understand handlers high scores of their self – reported behavior towards safe food handling.

Recommendations

1- Basic food safety courses should be involved in the educational system especially in school canteens.

2- Training courses and workshops must be organized to promote and develop food handler's awareness. Management and supervisors of food service establishments must be committed to and supportive of such courses.

3- Sound production operational methods and procedures including pest control and a good maintenance programme should be provided.

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