

ASSESSMENT OF THE KNOWLEDGE, ATTITUDE AND PRACTICE TOWARDS FOOD POISONING OF FOOD HANDLERS IN SOME EGYPTIAN WORKSITES

By

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Abstract

Introduction: Food handlers represent an occupational group which plays a major role in the spread of food borne diseases. The risk of food getting contaminated depends largely on the knowledge and practice of proper food hygiene measures among food handlers. **Aim of work:** To assess the knowledge and practice of food handlers towards food hygiene in addition to identifying the frequency of workers with positive nail culture. **Materials and Methods:** A cross sectional study including 140 subjects such that 54 worked in the kitchens of Ain Shams University Hospitals and 86 from 16 fast food restaurants were included in the study. Questionnaire and nail swabs for culture were done after obtaining their consent. **Results:** The study showed that the mean knowledge score was 76.6 ± 19.6 and the mean practice score was 68.1 ± 22.4 . Knowledge questions related to the correct method of thawing food and the right place for vegetables and meat in the refrigerator showed less than 50% correct answers. Practice questions related to not keeping food at room temperature for more than 4 hours and not to continue working if having flu or hand lesions should total correct answers less than 50%. (40.7%) of those who agreed to give nail swabs showed positive culture with CoNS being the most frequently discovered pathogen. **Conclusion:** food handlers are an occupational group who need careful supervision and training courses on food hygiene and how to carry on their tasks safely without harming themselves or others.

Keywords: Food handlers, Knowledge, Safe practice, Nail swabs, Food poisoning

Introduction

Food handlers who are any person who handles food regardless whether he actually prepares or serves it play an important role in the transmission and ultimately prevention of food borne diseases (Isara and Isah, 2009).

Food handlers play a major role in transmitting pathogens from contaminated sources such as transmitting pathogens from raw meat to ready to eat food. Food handlers may also carry some human specific food borne pathogens as hepatitis A, noroviruses, typhoidal salmonella, staphylococcus aureus and shigella species in their hands, cuts or sores, mouth, skin and hair. Food handlers may also shed food borne pathogens as *E.coli* and non typhoidal salmonella during the infectiousness period or during the recovery period of a gastrointestinal sickness (Adams and Moss, 2008).

Todd et al (2007) formed a workgroup and analyzed 816 food borne outbreaks where food workers have been implicated in the spread of food borne diseases. In their last publication, they found that the most frequently reported food worker errors were handling of food by a person either actively infected by or carrying a pathogen bare-hand contact with

food, failure to properly wash hands when necessary, insufficient cleaning of processing or preparation equipment or kitchen tools. Such unhygienic practice would cause contamination of ready to eat food. A study conducted in Malaysia, 2002 which showed that approximately (10-20%) of food borne disease outbreaks are due to contamination by food handlers (Zain and Naing, 2002)

Food borne diseases are increasing in both developed and developing countries. Diarrheal diseases, mostly caused by food borne microbial pathogens are leading causes of illness and deaths in the developing countries, killing an estimated 1.9 million people annually at the global level (Schlundt et al 2004).

The risk of food getting contaminated depends largely on the health status of the food handlers, their personal hygiene, knowledge and practice of food hygiene (Mead et al, 1999).

Aim of Work

Therefore, this study aims at evaluating the knowledge and practices of food handlers and its relation with the type of work and work duration. Moreover, it aims at identifying the frequency of workers with positive nail culture from all who agreed to have a nail culture and the types of organisms in these cultures.

Materials and Methods

A cross-sectional study was carried out among food handlers. A food handler or food employee is defined by FDA (2013a) as an individual working with unpackaged food, food equipment or utensils or food-contact surfaces. In the current work it included: cooks, cook helpers and waiters.

The study included 140 subjects divided as follows: 54 food handlers working in four departments of Ain Shams University tertiary care hospital in Cairo (pediatrics, surgery, internal medicine and gynecology and obstetrics departments) after obtaining administrative approval from the hospital manager and Institutional Ethics Committee. The rest of subjects (86 workers) were included from 16 fast food restaurants in Cairo. The purpose of the study was explained to the food handlers and their informed consent was taken.

Sample size was calculated using epi info program population survey as 128 based on overall prevalence of intestinal parasite infestation to be 14% (Mohan, 2001) and the worst acceptable level as 8% with 95% confidence interval and 80% power of the test.

The study was carried out between March to November 2013. The study participants were interviewed using a structured questionnaire. It consisted of demographic details of the food handlers, information related to personal hygiene and personal habits.

The questionnaire also assessed the individual's knowledge, attitude and practices about hygienic food measures.

Ordinary sterile swabs (moistened with sterile saline) had been used to obtain a single finger swab from each food handler, the collected swabs were transferred immediately to microbiology lab and were cultured on Blood agar, and MacConkey's agar plates and then incubated at 37°C for 24 hours, Isolates were identified by growth characteristics on respective culture media and by doing biochemical tests following standard procedures according to Colle et al (2007).

Statistical analysis

Data entry and analysis were performed using SPSS version 17. The data collected was analyzed by descriptive (frequency distribution tables, mean and standard deviation) as well as inferential analysis (chi square and t test).

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Results

Table (1): Demographic characteristics of the study sample:

variables	
Age (mean±SD)	38.98 ± 8.69
Work duration (mean±SD)	12 ± 7.76
Gender	
Male	105 (75%)
Female	35 (25%)
Residence	
Rural	14 (10%)
Urban	126 (90%)
Education	
Illiterate	7 (5%)
Read and write	9 (6.4%)
School	32 (22.9%)
Technical education	43 (30.7%)
University	49 (35%)
Work type	
Cook	40 (28.6%)
Helper	79 (56.4%)
Waiter	21 (15%)
Current smoker	
yes	95 (67.9%)
Mean knowledge score	76.63 ± 19.6
Mean practice score	68.1 ± 22.4

The current study included 140 workers with mean age 38 ± 8.6 and mean work duration of $12 \text{ years} \pm 7.7$, 75% were males, 90% from urban areas, 16% illiterate/read and write, 32% with school education, 65.7% technical and university education so majority were educated. Most of them were cook helpers and smokers. Mean knowledge and practice scores were high. (Table 1)

Table (2): Relationship between type of work and knowledge questions

Questions	Cook No (%)	Helper No (%)	Waiter No (%)	Total correct answers No (%)	P value
1-Food poisoning is caused by pathogenic microbes	37(92.5)	74(93.7)	21(100)	132(94.3)	>0.05
2-Risk of food poisoning increases if food is half cooked	32(80)	73(92.4)	14(66.7)	119 (85)	≤0.05*
3-Eating unwashed vegetables increases the risk of food poisoning	38(95)	79(100)	18(85.7)	135 (96.4)	≤0.05*
4-Unhygienic practice of food handlers could be the source of food contamination	37(92.5)	79(100)	15(71.4)	131 (93.6)	≤0.05*
5-Eating covered food after six hours left at room temperature is a risk for food poisoning	26(65)	69(87.3)	16(76.2)	111 (79.3)	≤0.05*
6-Keeping food at refrigerator temperature reduces the risk of food poisoning	34(85)	65(82.3)	19(90.5)	118 (84.3)	>0.05
7-Touching ready to eat food with bare hands could be the source of its contamination	34(85)	69(87.3)	15(71.4)	118 (84.3)	>0.05
8-The correct method for thawing frozen food is to keep it overnight at room temperature	22(55)	25(31.6)	12(57.1)	59 (42.1)	≤0.05*
9-Food poisoning could cause severe diseases that end in hospitalization or death	32(80)	65(82.3)	16(76.2)	113 (80.7)	>0.05
10-Apparently healthy food handlers could be carriers of food borne pathogens	30(75)	66(83.5)	15(71.4)	111 (79.3)	>0.05
11-Insects such as cockroaches and flies could transmit food borne pathogens	31(77.5)	71(89.9)	18(85.7)	120 (85.7)	>0.05
12-Harmful bacteria multiply rapidly at room temperature	38(95)	65(82.3)	13(61.9)	116 (82.9)	≤0.05*
13-Food borne pathogens could be seen by naked eye	16(40)	50(63.3)	7(33.3)	73 (52.1)	≤0.05*
14-Vegetables should be placed at a higher shelf in refrigerator than meat and poultry	22(55)	12(15.2)	12(57.1)	46 (32.9)	≤0.05*

*: Statistically significant

Less than 50% of participants gave correct answers to questions related to correct method of thawing food and right places for vegetables and meat in the refrigerator. Significant difference between types of food handlers was found in answering some knowledge questions (Table 2)

Table (3): Relationship between type of work and response to practice questions:

Questions	Cook No (%)	Helper No (%)	Waiter No (%)	Hygienic practice No (%)	P value
1- Do you wear gloves when you handle ready to eat food or prepare food?	30(75)	50(63.3)	14(66.7)	94 (67.1)	>0.05
2-Do you wash your hands with soap and water before preparing food?	33(82.5)	69(87.3)	16(76.2)	118 (84.3)	>0.05
3-Do you wash your hands with soap and water after using the bathroom?	34(85)	67(84.8)	13(61.9)	114 (81.4)	≤0.05*
4-Do you wash vegetables and fruits before slicing them?	33(82.5)	64(81)	18(85.7)	115 (82.1)	>0.05
5-Do you not keep cooked food at room temperature for more than four hours?	19(47.5)	28(35.4)	6(28.6)	53 (37.9)	>0.05
6-Do you clean food contacting surfaces before using them?	35(87.5)	70(88.6)	19(90.5)	124 (88.6)	>0.05
7-Do you clean food contacting surfaces after using them?	40(100)	77(97.5)	20(95.2)	137 (97.9)	>0.05
8-Do you separate raw food from ready to eat food?	36(90)	74(93.7)	19(90.5)	129 (92.1)	>0.05
9-Do you regularly check the temperature of the refrigerator?	33(82.5)	56(70.9)	18(85.7)	107 (76.4)	>0.05
10-Do you boil raw unpasteurized milk before use?	23(57.5)	58(73.4)	7(33.3)	88 (62.9)	≤0.05*
11-Do you check the expiry date of ingredients you use in cooking before using them?	22(55)	58(73.4)	14(66.7)	94 (67.1)	>0.05
12-Do you not continue work if you have a flu?	13(32.5)	30(38)	11(52.4)	54 (38.6)	>0.05
13-Do you not continue work if you have diarrhea?	10(25)	34(43)	8(38.1)	52 (37.1)	>0.05
14- Do you not continue work if you have lesions on your hands?	7(17.5)	29(36.7)	4(19)	40 (28.6)	≤0.05*
15-Did you have a pre employment examination?	29(72.5)	71(89.9)	11(52.4)	111 (79.3)	≤0.05*
16-Do you have periodic medical examination?	23(57.5)	65(82.3)	9(42.9)	97 (69.3)	≤0.05*

*: Statistically significant

Less than 50% of participants gave correct answers to questions related to keeping food at room temperature for more than 4 hours, continuing work while having flu or hand lesions. Significant difference between types of food handlers was found in answering some practice questions (Table 3)

Table (4): Response of food handlers to attitude questions on food poisoning:

	Agree No (%)	Disagree No (%)
1- Safe food handling is an important part of my job responsibilities	131 (93.6)	9 (6.4)
2- It is important to wear gloves during work	100 (71.4)	40 (28.6)
3- Learning more about food safety through training courses is important to me.	119 (85)	21 (15)
4- I prefer cutting my nails regularly because long nails could contaminate food	125 (89.3)	15 (10.7)
5- I think that periodic medical for food handlers every six months is essential	116 (82.9)	24 (17.1)

Most of food handlers showed a good attitude. They believed that safe food handling was an important part of their job responsibility, it was important to wear gloves, most of them agreed on the need for training courses, prefer regular nail cutting and believed periodic medical examination was essential every 6 months (Table 4)

Table (5): Description of the participants who have positive culture:

Skin swab test	No (%)
Positive	22 (40.7)
Negative	32 (59.3)
Type of organism	
Staphylococcus aureus	6 (27.2)
Coagulase negative staphylococci	9 (41)
Diphtheroids	6 (27.2)
Candida albicans	1 (4.6)
Job nature:	
Cook	7 (31.8)
Helper	14 (63.6)
Waiter	1 (4.5)
Gender	
Male	17 (77.3)
Female	5 (22.7)
Current smoker	16 (72.7)
Nail cutting	
Twice weekly	4 (18.2)
Once weekly	12 (54.5)
Once biweekly	6 (27.3)
Age (mean ± SD)	40.32 ± 8.54
Work duration (mean ± SD)	13.14 ± 6.70
Education	
Illiterate	3 (13.6)
Read and write	2 (9.1)
School	8 (36.4)
University	9 (40.9)

The majority (40.7%) of those who agreed to have nail swabs showed positive culture mainly to Coagulase negative staphylococci. Most of them were cook helpers, males, educated, current smokers, cut nails once weekly with mean age 40.3 ± 8.5 and mean work duration of 13.14 ± 6.7 (Table 5)

Table (6): Relationship between work duration and mean knowledge and practice scores:

	Work duration	Number	Mean \pm SD	P value
Mean knowledge score	12 years	80	10.45 \pm 1.81	$\leq 0.05^*$
	≥ 12 years	59	11.10 \pm 1.36	
Mean practice score	12 years	80	9.88 \pm 2.31	$\leq 0.05^*$
	≥ 12 years	59	12.20 \pm 2.10	

*: Statistically significant

Mean knowledge and practice scores of the study participants were significantly higher among those with longer work duration (≥ 12 years) than among those with work duration less than 12 years (Table 6)

Discussion

The current study included 140 workers with mean age 38 ± 8.6 and mean work duration of $12 \text{ years} \pm 7.7$, 75% were males, 90% from urban areas, 16% illiterate/read and write, 32% with school education, 65.7% technical and university education so majority were educated (Table 1). Most of them were cook helpers and smokers. Mean knowledge and practice scores were high. In a study by Rekha and Masali (2007), they found that 73.2% of respondents were below 30 years of age and only 2.7% were above 50 years of age. They stated that the majority of respondents with good personal hygiene belonged to the age of 30-39 years which is the mean age of the current study population who also showed a

high mean practice score. In their study also, it was observed that good personal hygiene was often practiced among the highly educated workers than among illiterates. This may explain also the high mean practice score in the current study where most of participants were educated.

Food handler's knowledge:

Food handlers demonstrated satisfactory knowledge in the categories of

- Questions of high risk foods as: half cooked foods, unwashed vegetables, covered foods left for more than 6 hours at room temperature.
- Questions on food borne diseases as: food poisoning is caused by pathogens, food poisoning could

lead to hospitalization, apparently healthy workers could be carriers, insects and flies could transmit pathogens.

- Questions food storage temperatures as: food is best kept in the refrigerator; harmful bacteria could multiply at room temperature.
- Questions about the sources of food contamination as unhygienic practice of food handlers, touching ready to eat food with bare hands.

More than half of the food handlers (58%) chose that the correct method for thawing frozen food is to keep it overnight at room temperature. Similar results were obtained by other studies (Annor and Baiden, 2011, Sharif et al, 2013). Keeping meat and poultry cold while it is defrosting is essential. Bacterial growth is expected to increase if food is thawed at room temperature, and consequently the probability of food poisoning. Hence the best way to safely thaw frozen food is in the refrigerator or applying defrost program in the microwave (United States Department of Agriculture, 2006).

Some basic knowledge is defective where about half of the participants mentioned that food borne pathogens

could be seen by naked eye. Similarly, other studies showed that between 52.5% and 64.4% wrongly believed that they can detect food contamination with bacteria by visual, olfactory or taste checks (Gomes-Neves et al, 2007, Jevnik et al, 2008, Martins et al, 2012 and Walker et al, 2003). Unlikely, another study carried out among food handlers in military hospitals in Jordan (Sharif et al, 2013) showed that food handlers correctly answered the same question.

Also, regarding the question of placing vegetables on a higher shelf in the refrigerator than meat and poultry, 54% of the participants gave an incorrect answer. Sharif et al (2013) had different results where 85% of their study participants had correctly chosen the answer. Improper storage of ready to eat food facilitates the growth of *Listeria monocytogenes* to an infectious level. Specifically, improper holding temperature and slow cooling of hot foods promote growth of *B. cereus* and *Cl. Perfringes* to levels causing diseases (McCabe-Sellers and Beatti, 2004).

In general, the food handlers had good knowledge on hygiene measures with a mean percentage score of 76.6% \pm 19.6%. These results were similar to

another study carried out in military hospitals in Jordan (Sharif et al, 2013). On the other hand, in South Africa (Marais et al, 2007) and in Turkey (Bas et al, 2006) the mean scores were much lower (46% and 43% respectively).

Regarding their practice:

Seventy eight percent of the study participants regularly checked the temperature of the refrigerator, while 38% only avoid keeping cooked food at room temperature for more than four hours. This discrepancy between knowledge and practice was also agreed by other researchers (Nee and Norrakiah 2011) who found that the majority of the respondents have an average practices in all parts of the questions, despite their good knowledge. In their study, they found that the participants had good knowledge on personal hygiene and definition of food borne diseases (94% and 74%, respectively). On the contrary, their knowledge on temperature control was poor with only 28%. In Jordan, a study showed that the food handlers have a good knowledge of temperature control and they practiced such knowledge (Sharif et al, 2013). Other studies carried out in Turkey, Portugal, United Kingdom, Slovenia and Italy demonstrated

that food handlers are defective in knowledge concerning the importance of temperature control in practicing food handling hygienic measures (Bas et al, 2006, Buccheri et al, 2007, Marais et al, 2007, Gomes-Neves et al, 2007, Jevčič et al, 2008, Walker E et al, 2003). Improper temperature control of fresh or cooked food promotes growth of food borne pathogens (McCabe-Sellers and Beatti, 2004).

In this study, washing hands with soap and water before preparing food and after using the bathroom was 84% and 81% respectively. Similar findings were obtained by Buccheri et al (2007) where about 80% of food handlers in their study always washed their hands before and after food handling. Some studies showed very low frequency of hand washing (Okojie et al, 2012). Other studies showed significant increase in knowledge about hand hygiene measures, namely, washing hands before handling food (23.5% to 65.4%) after carrying out a health education session (Malhotra et al, 2008).

The majority of the study participants reported working while having flu, diarrhea or skin lesions (61%, 63% and 71% respectively). In other studies, 40% of food handlers continued

working while having diarrhea, while 80% of them would handle food during an attack of fever (Annor and Baiden 2011). Lower rate was reported by Black (1999) where 5% of food handlers in his study continued working while sick with vomiting or diarrhea. In another study Buccheri et al (2007), 15% only worked while having skin lesions. Food and drug administration (FDA, 2013 b) mentioned that any food handler should stop working while having diarrhea until 24 hours after diarrhea resolution.

In general, the food handlers practiced good hygiene level with a mean percentage score of 68.1 % \pm 22.4%. Nearby result (72%) was mentioned by Cuprasitrut et al (2011). Much higher result (89%) was reached in another study (Sharif et al, 2013).

In the current study, 22 participants (41%) had positive nail swabs. Those are distributed as follows; 9 (17%) were infected with CoNS, 6 (11%) with *Staphylococcus aureus*, 6 (11%) with Diphtheroids and only 1 case of *Candida albicans* (Table 5). A study in Egypt had a similar infection rate with *Staphylococcus aureus* (38%) (El-Shenawy et al, 2014)

It was mentioned that *S. aureus* colonization rates in the general

population were estimated to be approximately 20% - 32%. (Wertheim et al, 2005). Regarding studies specific for food handlers, prevalence rates vary among countries. It ranged from 2% of food handlers in a study done in Italy (Talarico et al, 1997), 12% in Finland (Hatakka, 2000), 16.5% in Ethiopia (Andargie et al, 2008), 19% in Chile (Figueroa et al, 2002), 57.5% in Botswana (Loeto et al, 2007) and 62% in India (Simon and Sanjeev, 2007).

It was found that food handlers who were more experienced had better mean knowledge and practice scores. This was also agreed by other researchers (Sharif et al, 2013) and (Tang and Fong, 2004). Another study done by Buccheri et al, 2007 reported a relation between work duration and some items of knowledge and practice with a significant difference.

Regarding a comparison between workers as regards the type of work they do and their correct answers to knowledge questions, it was found that the percentage of helpers giving correct answers to queries about "Unhygienic practice of food handlers could be the source of food contamination", "Eating covered food after six hours left at room temperature is a risk for food poisoning"

and “food borne pathogens could be seen by naked eye” were significantly higher than that of other work types. The percentages of waiters answering correctly queries about “the correct method for thawing frozen food is to keep it overnight at room temperature” and “vegetables should be placed at a higher shelf in refrigerator than meat and poultry” was significantly higher than that among other categories and the percentage of cooks answering correctly the query about “harmful bacteria multiply rapidly at room temperature” was significantly higher than that among helpers and waiters.

Regarding the comparison in practice questions, the cooks who correctly washed their hands with soap and water after using the bathroom and the helpers who discontinued work if they had lesions on their hands showed a significantly higher percentage than other work types.

This discrepancy according to work types agrees with the findings of other work which showed variability in answers according to work types (Sharif et al, 2013)

Regarding their attitude, they have general positive attitude towards safe

food handling measures. The majority are willing to attend food safety training courses. The benefits of such training was confirmed also by some researchers after a meta-analysis study where they concluded that food safety training increased knowledge and improved attitudes about hand hygiene practices. Refresher training and long-term reinforcement of good food handling behaviors may also be beneficial for sustaining good hand washing practices (Soon et al, 2012.)

Limitations

Limitations of this study include inability to perform nail swabs to all study participants.

Recommendations

It is recommended that food premises should imply training programs to food handlers concerning proper food hygiene practices. This will have an important role in improving their knowledge, attitude and practice about food sanitation, especially if this is associated with concurrent supervision to ensure the effectiveness of such programs.

Regarding academic research, further wider studies are recommended to be carried out both hospital

and community based to measure knowledge of food handlers with the required bacteriological examination.

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