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Assessment of knowledge, attitudes and practices of food handlers regarding food safety in Lahore, Pakistan

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Abstract

Background: Food Safety is an important central focusing point related to health of all communities in the entire world. Food related diseases are accountable for most of deaths and illnesses all over the world. Aim: To assess the attitudes, practices and knowledge of food managers regarding food safety in Lahore. Method: a cross sectional study was done regarding food safety in Lahore, Pakistan for 4 months (After the approval of synopsis) by using purposive sampling. A total of 97 participants were taken from different cafes and restaurants in different parts of Lahore, Pakistan. Data was collected through purposive sampling. Participants were assessed through pre-tested questionnaire. For data analysis SPSS version 25.0 was used. Results: The overall knowledge of food safety was revealed by Food managers (mean score= 62.4 ± 33.6%). The interviewees achieved high scores in construct of personal hygiene (mean score= 92.6 ± 7.0%) out of 6 constructs on food safety knowledge tested, but had less knowledge about the symptoms of food borne diseases (mean score= 54.0 ± 36.0%) and food borne pathogens (mean score= 20.0 ± 26.0%). Conclusions: The conclusion was that in different parts of Lahore, Pakistan food handlers had a better knowledge of food safety with overall moderate level of self-reported practices and attitude. However, majority of them did not know about the pathogens that cause food borne diseases.

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Introduction

Food Safety is an important central focusing point related to health of all communities in the entire world. Food related diseases are accountable for most of deaths and illnesses all over the world (Who PY *et al.*, 2016). Food servers in different food sets have a biggest role in outbreak of food related illnesses (Nik Husain *et al.*, 2016). There have been many causes of food related illnesses for example parasitic and chemical, but microbes play major role (Reboucas LT *et al.*, 2017). According to the result of one of World Health Organization studies that was held in 2015, about 60 Crore people suffer annually from food related illness due to contaminated food consumption (WHO, 2015). All over the world, with increased demand of prolong shelf life food products, the supply of food has been made more challenging now a days (Walsh C and Levamc, 2019).

In regional terms, Europeans record has been reported that about twenty three million people suffered from food related illness, including five thousands mortalities annually (De corato U, 2019). This is suggested that the attitude of a food handler is beneficial in the prevention of food related illness (Cunha DT *et al.*, 2018). European Safety Authority (EFSA) has reported that approximately 48.7 percent of food related illness cases linked with food services in food settings. In 2005, according to World Health Organization (WHO), about 1,800,000indivuals expired due to diarrhea all over the world, among these victims mostly consumed unclean water and food. It was suggested by a research that handlers of food play a central character in food contamination (Al Shabib NA *et al.*, 2016). Awareness about food safety is a major concern among developing and developed countries (Odeyemi OA and Bamidele FA, 2016). In most of the countries studies have been done regarding attitude, knowledge and practice of food safety of consumers' (Agueria DA *et al.*, 2018). Most foodborne disease outbreaks among consumers that are linked with food at home have either been failed to report or failed to diagnose (Vrbova L *et al.*, 2012). Many studies revealed that due to misinterpretation about symptoms and indications of food-borne illnesses consumers and food handlers do not seek health treatment (Lim T-P *et al.*, 2012). In Pakistan and Jordan, there is less information of food safety and food hygiene present amongst food handlers (Akhtar S, 2015). In Cameroon insufficient information and practical implementation about food safety amid consumers has been reported (Sneyd A, and Sneyd LQ, 2014).

The Present investigation was a KAP study of food handlers regarding food safety. This study will help to highlight factors leading towards food borne illnesses through food handlers towards the consumers. After identification of the risk factors awareness for prevention could be created through health education.

Materials and methods

Study Design

Cross-Sectional study.

Sampling Size

This study includes 97 food handlers.

Study Duration

4 months

Study Setting

All 97 participants were working in food restaurants, cafes located in different areas of Lahore, Pakistan.

Study Procedure

For this study we had obtained ethical approval from the University Institute of Dietetics and Nutritional Sciences (UIDNS) and written consent forms were filled by all participants.

Data Collection Tool

We had taken pretested questionnaire for a study done in Malaysia by contacting and taking permission of corresponding author of that study (Lee H *et al.*, 2017). The questionnaire was consisted on 97 questions and 4 parts (demographic information, knowledge about food safety, attitudes and practices regarding food safety). Though food safety knowledge was based on further 6 parts 1)personal hygiene , 2)cross contamination prevention and sanitation,3) food handling, 4) health problems that would affect

food safety, 5) symptoms of borne diseases and 6) food borne pathogens. Basic content regarding food safety training, food handling and personal hygiene were asked in questionnaire. Each item of food safety knowledge had 'False' or 'True' options. The score was given to right/correct answer.

Sampling Criteria

Sampling technique of this study was purposive sampling.

Inclusion

Food handlers of branded chain restaurants, local restaurants and cafes were in inclusion criteria of this study.

Exclusion

Local vendors were in the exclusion criteria of this study.

Study Analysis

By using SPSS 25.0 statistical analysis was done. The overall performance on food safety knowledge was converted into percentage by dividing the total scores over the total number of questions of this part. While the food safety attitude and self-reported practices were assessed by four and five level Likert scale questions, respectively. For the question of attitude part lowest score '1' was given to 'Disagree' and highest score '4' given to 'Agree', while in practices part lowest score '1' was given to 'Never' and highest score '5' to 'Always'.

Results

Although 97 food handlers had participated, while the total numbers of males and females were n=93(95.9%) and n=4(4.1%) respectively. A large number of the sample was constituted by the food handlers that were aged between 21-41 years old. The majority of participants was Muslim n=93(95.9%), whereas only 4 food handlers were Non-Muslims. A large number of food handlers were Punjabi n=89(91.8%), remaining were Kashmiri and Pathan. A very small number of participants was belonged to other ethnicity. 45.4% (n=44) Food handlers were married, 53.6% (n=52) were un-married whereas only 1 food handler was from separated/divorced category. A good number of the food handlers had college/university level education n=39(40.2%), 33% (n=32) had secondary level education and 20 food handlers had primary school level education. Only 3.0 food handlers had no formal education, whereas 3.1% food handlers had enrolled in food related diplomas. Over half of the participants (n=77, 79.3%) had ≥2 years' experience in the food service industry, whereas only 20% food handlers had less than 2 years' experience.39 food handlers out of total 97 participants were designated as chef in the different food service industries, while the others participants were performing their roles as vegetables' cutter (2.1%), dish washer(15.5%), food server (18%) and 23% were designated as cashier and manager. A half number (n=48, 49.5%) from the all participants (n=97) have not attended the SFHTC whereas 41 food handlers (42.3%) had taken up the SFHTC, 3 years ago.

Table 1. Participants' demographic characteristics.

Variable	Item	Number	Percentage (%)
Gender	Male	93	95.9
	Female	4	4.1
Age	<21 years old	5	5.2
	21-41 years old	83	85.6
	>41 years old	9	9.3
Religion	Muslim	93	95.9
	Non-Muslim	4	4.1
Ethnicity	Punjabi	89	98.1
	Kashmiri	3	3.1
	Pathan	3	3.1
	Others	2	2.1
Marital Status	Single	52	53.6
	Married	44	45.4
	Separated/Divorce	1	1.0

Education level	Primary School	20	20.6
	Secondary School	32	33
	College/University	39	40.2
	Illiterate	3	3.1
	Others(Diploma in food related Course)	3	3.1
Work Experience	≤ 2 years	20	20.6
	2-4 years	39	40.2
	5-6 years	8	8.2
	>6 years	30	30.9
Designation & Job Responsibility	Chef	39	40.2
	Dish washer	15	15.5
	Vegetables' cutter	2	2.1
	Food server	18	18.6
	Others(Cashier,manager,etc)	23	23.7
Did you attend the Safe Food Handling Course?	No	48	49.5
	Yes	49	50.5
When did you attend the Safe Food Handling Course.	Never attend before	48	49.5
	≤ 3 years ago	41	42.3
	>3 years ago	8	8.2
Total		97	100

As shown in Table 2 food handlers demonstrated average knowledge on food safety (mean score = 62.4 ± 33.6%). Of the six constructs on food safety knowledge, respondents scored high on personal hygiene (mean score=92.6 ± 7.0%), but poorly on construct of food-borne pathogens (mean score=20.0 ±26.0%) and dietary symptoms (mean score=54.0 ± 36.0%).

Table 2. Percentage and frequency distribution of the accurate* answer on food safety knowledge scored by 97 food handlers.

Items	Frequency	Percentage (%)	Constructs
1. Personal hygiene			
Washing hands after touching money is essential.	94	96.9	Personal Hygiene (Total score=10)
Washing hands before meal preparations is essential.	97	100	
Washing hands after using toilet is essential.	97	100	
Washing hands after touching raw meats is essential.	97	100	
Washing hands after touching the body is necessary.	94	96.9	
Washing hands after sneezing is essential.	95	97.9	Standardized score: 92.6±7.0%
Washing hands after cleaning tables is essential.	95	97.5	
Washing hands after handling the garbage is necessary.	94	96.9	
Is it important to use gloves before handling ready to eat food item.	89	91.8	
Hands should be washed for at least twenty seconds.	74	76.3	
2. Cross contamination and prevention			
The same knife is used for cutting of raw meat or vegetables.	77	79.4	Cross contamination and prevention (Total score=12)
The used knife in cutting of raw meat is washed with hot water before vegetable cutting.	89	91.8	
The used knife in cutting of raw meat is washed with soap and water before vegetable cutting.	84	86.6	
The knife is washed with soap and water then applies sanitizer before vegetable cutting.	63	64.9	
Different knives are used in cutting of raw meat and vegetables.	72	78.4	Standardized score: 66.6±26.2%
The same cutting board is used in cutting of raw meat and vegetables.	65	67	
The used cutting board in cutting of raw meat is washed with hot water before vegetable cutting.	92	94.8	
The used cutting board in cutting of raw meat is washed with soap and water before vegetable cutting.	3.0	3.1	
The cutting board is washed with soap and water then applies sanitizer before vegetable cutting.	60	61.9	
The used cutting board in raw meat cutting is wiped with a piece of cloth before vegetable cutting.	24	24.7	
Separate cutting boards are used in cutting of raw meat and	79	81.4	

Items	Frequency	Percentage (%)	Constructs
vegetables.			
The most effective way to sanitizing and cleaning food contact surfaces is washed the surface with soap and water then apply a sanitizer on it.	91	93.8	
3. Food handling			
Using open container on the counter to thaw frozen meat is a safe technique.	72	74.2	Food handling (Total score=10) Standardized score: 59.0±26.0%
Using refrigerator to thaw frozen raw meat is a safe technique.	89	91.8	
Using running tap water to thaw frozen raw meat is a safe technique.	82	84.5	
1-5°C is a safe operational temperature of refrigerator.	82	84.5	
-18°C is a safe operational temperature of freezer.	62	63.9	
It is safe to use steam table for leftover storage.	22	22.7	
It is safe to use refrigerator for leftover storage.	86	88.7	
It is safe to use kitchen shelf for leftover storage.	29	29.9	
It is a safe food for consumption, if storage temperature of raw chicken is too hot, but after it has been properly cooked on correct temperature.	42	43.3	
Consumption of Improperly stored cooked rice, which may contain microbes, can cause food borne illness.	24	24.7	
4. Knowledge of health problem that would affect food safety			
Food safety would be affected by sneezing.	97	100	Knowledge of health problem that would affect food safety (Total score=10) Standardized score:77.0±26.0%
Food safety would be affected by coughing	97	100	
Food safety would be affected by hypertension.	34	35.1	
Food safety would be affected by wounded hand but covered by wearing glove.	73	75.3	
Food safety would be affected by fever.	22	22.7	
Food safety would be affected by sore throat.	79	81.4	
Food safety would be affected by vomiting.	97	100	
Food safety would be affected by diarrhea.	90	92.8	
Food safety would be affected by smoking.	95	97.9	
You are permitted to serve ready-to-eat food (salad, sandwiches etc.) on that day when you are suffering from diarrhea or vomiting without severe symptoms.	82	84.5	
5. Knowledge of symptoms of food borne diseases			
A symptom of food borne diseases is abdominal pain.	92	94.8	Knowledge of symptoms of food borne diseases (Total score=9) Standardized score: 54.0±36.0%
A symptom of food borne diseases is diarrhea.	94	96.9	
A symptom of food borne diseases is vomiting.	94	96.9	
A symptom of food borne diseases is nausea.	91	93.8	
A symptom of food borne diseases is headache.	38	39.2	
A symptom of food borne diseases is hypertension.	18	18.6	
A symptom of food borne diseases is hypoglycemia.	24	24.7	
A symptom of food borne diseases is bone pain.	27	27.8	
A symptom of food borne diseases is sneezing or coughing.	7.0	7.2	
6. Knowledge of food borne pathogens			
Do you know about Salmonella?	15	15.5	Knowledge of food borne pathogens (Total score=9) Standardized score: 20.0±26.0%
Do you know about Listeria monocytogenes?	10	10.3	
Do you know about Staphylococcus aureus?	12	12.4	
Do you know about Bacillus cereus?	12	12.4	
Do you know about Escherichia coli?	12	12.4	
Do you know about Clostridium perfringens?	14	14.4	
Do you know about Campylobacter jujuni?	6.0	6.2	
Do you know about Shigella?	5.0	5.2	
Do you know about Hepatitis?	92	94.8	

(*Except for construct of food borne pathogens, in which the percentage column ndicate the percentage of "Yes" response.).

The table 3 shows frequency and percentage of distribution of the positive attitudes' respond on food safety scored by 97 food handlers. Poor 25% positive attitudes respond was shown by food handlers

towards attend food safety seminar to enhance their knowledge in food service. Food handlers showed a moderate 69% attitudes' respond towards the importance of knowledge of food safety. The participants showed an overall average attitude, scoring an average of 42.3 ± 16.0 out of total score 56.

Table 3. Percentage and frequency distribution of the positive attitudes' respond on food safety scored by 97 food handlers.

Items	Frequency	Percentage%
Self –improvement		
I would read different news article regarding food safety to improve and enhance my food safety knowledge.	44.0	45.4
I would enhance my knowledge regarding sanitation by attending different seminars on proper sanitation.	47.0	48.5
I think by attending different food service or cooking competitions, they would help out in improving my professional knowledge.	32.0	33.0
I would enhance my knowledge regarding food safety by attending different seminars on food safety.	39.0	40.2
I think I'm professionally expert in food service, So I don't need to attend seminars regarding food safety.	25.0	25.8
Food safety concern		
Food handlers have major role in prevention of food poisoning.	66.0	68.0
Government has major role in prevention of food poisoning.	30.0	30.9
Universities have major role in prevention of food poisoning.	27.0	27.8
Consumers have major role in prevention of food poisoning..	22.0	22.7
A major need to control food safety in a cooking area is maintenance of clean environment.	64.0	66.0
Self-checking regarding food safety measures is very important for academic institute as well as for restaurants.	63.0	64.9
For consumers, food safety matters a lot as compare to taste.	34.0	35.1
Safe food availability is not possible without proper knowledge regarding food safety.	67.0	69.1
Food poisoning has no severe impact on health.	33.0	34.0
(Total score= 56) Standardized score: 42.3±16.0%		

The results of table 4 showed that the participants had reported that they frequently practiced safe food handling during food preparation, scoring an average of 62.0±16.1 of the total score of 60 and the lowest positive respond 37.1% were shown by the food handlers towards the use of mask during touching/distribution of unwrapped foods and also only 41.2% participants were reported to use gloves while touching/distribution of unwrapped foods as mentioned in table 6.

Table 4. Percentage and frequency distribution of the correct answer on food safety practices.

Items	Frequency	Percentage%
Do you practice of washing hands before handling uncovered raw food products?	58.0	59.8
Do you practice washing hands after handling uncovered raw food products?	71.0	73.2
Do you wear gloves during handling of uncovered food products?	40.0	41.2
Do you wear defensive outfit like Apron etc. during handling or distribution of uncovered food products?	72.0	74.2
Do you wear mask during handling or distribution of uncovered food products?	36.0	7.1
Do you wear cap during handling or distribution of uncovered food products?	74.0	76.3
Do you change cutting board for raw meat or poultry, vegetable and fruit?	70.0	72.2
Do you sanitize and wash the working outfits?	65.0	67.0
Do you change a piece of cloth to dry dish wares?	78.0	80.4
Do you disinfectant the knife after cutting raw meat or poultry?	76.0	78.4
Do you practice washed and clean dish wares for ready to eat food products?	74.0	76.3
Do you perform your duty when you are suffering from cold, cough, flue or diarrhea?	31.0	32.0
(Total score= 60) Standardized score:62.0±16.1%		

The results of table 5 had shown that 37 participants whose literacy level was university/college exhibited better scores of overall knowledge, attitude and self-reported practices. Participants who were illiterate and who had any food related course diploma exhibited approximately same scores of overall knowledge, attitude and self-reported practices. Participants who had work experience of >6 years had better scores of overall attitude, self-reported practice and knowledge. Participants who had attended a course ≤3 years ago showed slightly good scores of overall knowledge, attitude and self-reported practice better than participants who had never attended a course or attended a course more than 3 years ago.

Table 5. Attribution of food safety knowledge, attitude, and self-reported scores to educational level, work experience, and safe food handling course (n=9).

Construct	Educational Level					Work Experience				Did you attend the Safe Food Handling Course?		When did you attend the Safe Food Handling Course?		
	Primary School	Secondary School	College/ University	Illiterates	Others	≤2 years	2-4 years	5-6 years	>6years	No	Yes	Never attended	≤3 years ago	>3years ago
	n =20	n =32	n =39	n =3	n =3	n =20	n =39	n =8	n =30	n =48	n =49	n =48	n =41	n =8
Knowledge%														
-Personal hygiene	19.7	29.1	37.2	2.8	2.8	7.9	19.6	2.9	37.1	45.5	47.3	7.4	45.5	39.9
-Cross contamination	14.4	21.3	29.2	2.1	2.6	6.1	13.6	22.2	29.3	32.2	38.9	5.7	32.2	33.2
Prevention and sanitation	13.4	18.9	23.0	2.3	1.8	5.0	12.0	17.8	24.6	30.3	29.1	4.3	30.3	24.8
-Food handling	16.5	25.0	31.7	2.4	2.6	6.6	16.8	23.9	30.9	37.6	40.6	6.0	37.6	34.6
-Health problems that would affect food safety	18.2	28.4	30.9	2.3	2.6	7.1	17.8	23.3	34.1	41.6	40.9	5.8	41.6	35.5
-Symptoms of food borne diseases	2.1	6.2	9.9	0.34	1.2	2.0	3.1	6.1	8.6	8.7	11.1	1.7	8.7	9.4
-Food borne pathogens -overall knowledge scores	16.9	19.9	27.3	2.1	2.3	6.0	14.0	16.3	27.7	33.0	42.0	5.2	33.0	30.0
Food safety attitude														
-Self-improvement	19.6	33.0	37.8	2.4	3.0	7.8	21.6	28.4	38.0	46.2	47.6	7.8	46.2	39.8
-Food safety concern	16.3	25.3	31.6	2.4	2.6	7.0	16.0	25.0	32.0	39.7	39.3	6.5	39.7	33.0
-Overall attitude score	17.9	29.1	34.7	2.4	2.8	7.4	18.8	26.7	35.0	43.0	43.5	7.2	43.0	36.4
Self-reported practices														
-overall practices score	13.0	20.0	25.0	2.0	2.3	5.1	13.1	19.7	25.0	28.6	34.0	4.8	29.0	28.0

Discussion

According to a study proper and certified hygiene training to Food Handlers plays a major and positive attribute in prevention and control of food contaminations in food premises (EL-Nemr I *et al.*, 2019). Food safety includes other factors like raw material selection, cooking practices, storing of food, maintaining temperature of food and mainly management of waste material (Cortese RD *et al.*, 2016). Most of the researches have revealed that training and knowledge about hygiene practices and food handling are necessary part of duty for food handlers (Martins RB *et al.*, 2012). Diseases and infections resulting from food are major concern for public. (Luo X *et al.*, 2019).

A research was directed to assess the implementation of practices regarding safety of food among workers of food service in food premises and to assess the influence of awareness program on their understanding. Hand sanitation implementation was more in male members than female. After the awareness program, it was observed that maximum applicants replied the post-test survey appropriately. Therefore, it was concluded that delivering information on food safety can lead to improve food safety practices (Joseph A, 2018).

Another research was conducted to examine knowledge, practices and training regarding safety of food among workers of Ireland. It was noticed that 1/4th from the total participants answered that they had never appeared in any training program regarding food safety, showing poor obedience to judicial requirements. In particular, 1% of the entire canteen workers were considered for the absence of training surveyed. The study paid attention towards importance of attending food safety training and illuminate possible ways in place of betterment (Gruenfeldova J *et al.*, 2019). Another similar study was conducted in Malaysia about knowledge regarding food safety among food providers.

The study proved that despite of the fact that providers of food have information about personal hygiene they still don't had knowledge about cleaning the food preparation area and maintaining of the raw and cooked foods temperature (Ismail FH *et al.*, 2016). In one more similar cross sectional study, that was done in Malaysia to assess the knowledge, behavior and practices about safety of food between abattoir workers. The facts of study concluded that most of the workers had very low level of knowledge but had good practice of compliance. It also showed that females have good knowledge about abattoir hygiene than males and males have good practice about abattoir hygiene than females. (Abdullahi A *et al.*, 2016).

A study was done In Saudi Arabia regarding knowledge of food safety among women. The facts and figures of study showed that mostly older and working women having higher practices and knowledge about safety of the food and personal hygiene than younger and non-working women respectively. (Farahat MF *et al.*, 2015). A study was performed in Bahir Dar town to see the practice and knowledge of food providers regarding food safety and to see the sanitary state of food service setting. The results revealed that food handlers had poor food hygiene practices. (Kibret *et al.*, 2012). Food borne illnesses have been increased in Pakistan especially diarrhoea among children. In Pakistan no food safety awareness programs are being started to take actions regarding foodborne illnesses. Researches have shown that in big cities of Pakistan like Islamabad, Rawalpindi, Lahore and Faisalabad the ratio of campylobacter species in street food is really high (Ahmed Z *et al.*, 2017). Analysis of current study showed that out of 97 participants, 95.9% (93) of the food handlers were males and 4.1% (4) were females. Contrarily, results of another study showed that 40.3% food handlers were male and 59.7% were females. Findings of our study reported that Majority (85.6%) of study subjects aged between 21 years – 41 years. This finding was similar to a previous study. Among 97 participants the majority of participants was muslim and belonged to Punjab, 95.9% and 98.1% respectively (Lee H *et al.*, 2017). In present study, 53.6% Participants were single. In a previous study, 73.1% participants were married (Lee H *et al.*, 2017). Lack of knowledge was seen in only 3% participants whereas the highest percentage of participants belonged to the category of college/ university that is 40.2% and remaining participants had the education up to primary and secondary school, 20.6% and 33% respectively. These results were dissimilar to a research done in Malaysia (Lee H *et al.*, in 2017). Present study revealed that the among 97 participants 40.2% were chef, 15.5% were dish washers, 2.1% were vegetable cutters, 18.6 were food servers and others (manager, cashier etc) were 23.7%. Contradictory results were shown in a study done in Kingdom of Saudi Arabia (Al-Shabib *et al.*, 2016). Findings of current study showed that 50.5% participants had attended a safe food handling course and 49.5% participants had not attended a safe food handling course (Lee H *et al.*, 2017). This study show that handlers of food who took part in this research have fine knowledge about self-hygiene (mean: 92.6+7.0%) but have no information about cross contamination (mean: 66.6+26.2%). Previous studies also showed similar findings (Zhang H *et al.*, 2015) (Gomes Neves E *et al.*, 2011). This study suggests that provision of safety regarding food handling course can improve the information of food handlers in regards to safety of food, cross contamination as well as health problems. A study that was conducted by in Malaysia on practices of hygiene revealed that 30% of handlers of food claimed that course about food safety was unsuccessful to enhance their knowledge at work (Saad *et al.*, 2013). In the current study it was observed that those with tertiary level education have shown improvement in knowledge regarding food safety than those with low level of education. These results are also supported by different studies (Pichler *et al.*, 2014) (McIntyre *et al.*, 2013) (Lynch *et al.*, 2003) (Toh and Birchenough, 2000).

In contrast to it, working experience demonstrated to have a good effect on food safety knowledge among the participants of study. Similar observation was reported two studies. (Saad *et al.*, 2013) (Lee H *et al.*, 2017).

This study showed the positive attitude of participants regarding food safety and training (mean: 45.1+18.1%). Results of a past study were analogous to the current study, reporting positive attitudes of participants about food safety and training (Zhang H *et al.*, 2015). Majority of the respondents were not using gloves only 41.2% respondents said that gloves are used by them when they distribute or touch the unwrapped foods. This shows that food handlers may not follow the food safety procedures, despite of their knowledge about food safety. Similar findings were reported by a study done in Ghana (Akbanda *et al.*, 2017). Therefore, provision of knowledge, training and motivating the food handlers may affect the attitude of food handler and as a result it may improve food safety practices. Utmost earlier studies reported that provision of knowledge and training regarding food safety may not change the attitude of food handler regarding safe food handling. (Lee H *et al.*, 2017) (Angelillo IF *et al.*, 2000) (Curtis V *et al.*, 2019) Thus the current study also suggest that food handling course may help out in improving the knowledge of food handlers regarding hygiene practices but it may not necessarily change their behavior or attitude. Therefore, more studies are needed to know the factor that opposes the provision of knowledge into safe food handling.

Conclusions

Our study concluded that food handlers in different parts of Lahore, Pakistan, have good food safety knowledge, comprehensive policy and self-reporting practices. However, the participants were unaware of the pathogens of food. Although people with high literacy level showed better knowledge and attitude but it was also observed that many of the food handlers do not use the secure food handling procedures despite of the fact that they had good knowledge about food safety. Hence, effective food training on regular basis should be conducted to lessen the reported cases of food-borne illnesses in food premises.

Research highlights

- Food servers in different food sets have a biggest role in outbreak of food related illnesses
- Provision of knowledge, training and motivating the food handlers may affect the attitude of food handler and as a result it may improve food safety practices
- Food handling course may help out in improving the knowledge of food handlers regarding hygiene practices but it may not necessarily change their behavior or attitude.

Limitations

This study was only done in Lahore, Pakistan so it's results can't show the real food safety situation in whole Pakistan. Further Studies are needed to be done on mass levels covering whole Pakistan.

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