

# FOOD SAFETY, ATTITUDE AND PRACTICES ASSESSMENT OF FOOD HANDLERS WORKING IN SELECTED CATERING ESTABLISHMENTS IN DELHI

<sup>1</sup>Veena Kumari, <sup>2</sup>Deeksha Kapur

<sup>1</sup>Research Scholar, <sup>2</sup> Professor,

School of Continuing Education, Indira Gandhi National Open University, New Delhi, India

## ABSTRACT

**Background:** Food safety is a non negotiable element and is very critical. In India food safety is currently considered to be an important issue for all the stakeholders in the area of food production. This study was conducted to assess food safety knowledge, attitude and practices among food handlers at selected catering establishment in Delhi. **Methods:** A descriptive, cross-sectional study was conducted in 24 catering establishments in all the nine districts of Delhi from March to September 2017. A self administered questionnaire was used to assess 287 food handlers working in the selected catering establishment. Convenient sampling was used while selecting food handlers. The questionnaire was reviewed by industry and academic experts and pilot tested before the final version was distributed to the food handlers. The self administered questionnaire had four parts: First part had questions related to their socio demographic profiles and the second part contained 20 knowledge questions and was set up with 5 points for correct answers and 0 points for wrong answers with the maximum total possible score of 100 points. Catering sector guidelines and foSTaC training material developed by FSSAI had been used to decide “correct” or “incorrect” answer... Third part contained 20 questions on attitude. A 5-point Likert Bipolar scale, from -2 point for strongly disagreed to +2 point for strongly agreed was used and it measures either positive or negative attitude. Fourth part of the questionnaire contained 20 Practices questions. **Data Analysis:** The SPSS version 20, statistical package was used for all analyses. Mean responses and percentages of responses in each category were calculated and presented in tabular form. Categorical data was analyzed using chi square, ANOVA (confidence interval 95%) were used to compare knowledge scores with demographic profile. **Results:** This study discovered a significant lack of knowledge in food safety, as only 29.61% and 4.8% of the food handler’s demonstrated good knowledge and practices respectively. The mean knowledge, attitude and practices scores of food handlers were 61.16±11.89, 77.10±9.0 and 44.45±13.46 respectively. ANOVA tests showed significant difference ( $p < 0.05$ ) between the relationship of food handlers knowledge with their job titles only ( $F=4.1035$ ,  $p < 0.005$ ). The study revealed statistically significant association between knowledge and attitudes ( $X^2=143.6809$ ,  $p < 0.00001$ ), attitudes and practices ( $X^2=3273.1794$ ,  $p < 0.00001$ ), and also knowledge and practices ( $X^2=61.5318$ ,  $p < 0.00001$ ). A positive correlation was also observed between knowledge and attitude scores ( $p$  value=0.000689,  $r=0.1992$ ), between attitude and practices score ( $p=0.036124$ ,  $r=0.1237$ ) and also knowledge and practices score ( $p$  value=0.00001,  $r=0.2801$ ). The strongest positive correlation is between knowledge and practices score. **Conclusions:** Food handlers play a significant role in the prevention of food borne disease and are the first line of defense to ensure food safety. Their low knowledge score and poor practices may contribute to cause food borne illness and outbreaks. The study revealed that more than half of the food handlers had never attended any training programs. The researcher suggests that they must undergo continuous training session which is needed to produce safe and hygienic food. Through training their knowledge and practices can be improved as they have shown positive attitude towards food safety issues and training programs.

**Keywords:** FSS Act, 2006, Schedule 4, Food Safety, Time and Temperature, Thawing

## INTRODUCTION

Food safety is a non negotiable element and is very critical. Now a day’s trend of eating out has increased so also the responsibility of catering establishment’s food handlers to serve safe and wholesome food to its consumers. In India food safety is currently considered to be an important issue for all the stakeholders in the area of food production. Food service staffs play a pivotal role in the prevention of food borne disease and they continue to not follow food safety practices when working in food service facilities (Kibret & Abera, 2012) either they are unaware of the norms or they neglect it or they follow faulty practices (Choung, 2010). According to Bryan (1988) and Mederios et al. (2001), the common food handling mistakes besides serving contaminated raw food also include inadequate cooking, heating, or re-heating of foods consumption of food from unsafe sources, cooling food inappropriately and allowing too much of a time lapse. Knowing how to properly cook, clean, chill, and separate foods while handling and preparing them can help avoid complications from food borne illness (Kramer, 2004). Besides knowledge, attitude is also an important factor that ensures a reduction trend of food borne diseases. Howes et al. (1996) indicates the

correlation of positive behavior, attitudes and continued education of food handlers towards the maintenance of safe food handling practices. According to Howes et al. (1996), a study in the USA showed that approximately 97.0% of foods borne outbreaks were due to improper food handling practices in food service fields. Todd *et al.* 2007, formed a work group and analyzed 816 food borne outbreaks where food workers have been implicated in the spread of food borne diseases. 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 the food and cross-contamination of ready to eat (RTE) foods (Adam, 2008, Todd et al, 2007). Therefore, it is important to have an understanding of the interaction on prevailing food safety beliefs, knowledge and practices of food handlers in order to minimize food borne outbreaks (WHO 2000).

### **Problem Statement**

The research problem addressed in this study is an attempt to assess the food safety knowledge, attitude and practices of food handlers working in the selected catering establishments as per the guidelines developed for the catering sector by the FSSAI, India's apex food regulator body. Many similar studies had been conducted across the world and India but knowledge was never assessed specific to the FSSAI guidelines.

### **Materials and Methods**

#### **Research Design and Location**

This descriptive cross sectional study was carried out from March 2017 to September 2017. The study was conducted in the 24 catering establishments and was selected from the nine districts of Delhi, Capital of India.

#### **Sample Population, Sample Size and Sampling Technique**

The study population was comprised of 287 food handlers working in the selected catering establishments involved in processing, handling, storing, serving and packing. Sample size was calculated using a table given by Krejcie (1970). The convenient sampling technique was used to maximize the number of food handlers for the knowledge assessment

#### **Study Variables**

##### **Dependent Variable**

The dependent variable used in the study was Food Safety knowledge, attitude and practices scores. The knowledge was classified as high/ medium/ low and attitude was measured as negative or positive.

##### **Independent Variables**

Demographic characteristics like educational level of food handlers, their age, gender, marital status, work experience, region they belong to, training and income status.

#### **Research Tools and Techniques**

The self administered questionnaire specific to assessing food safety knowledge, attitude and practices was designed in both Hindi and English Language. It had four parts: First part had questions related to their socio demographic profiles, jobs and responsibilities and the second part contained 20 knowledge questions and had been divided into seven sections: Basic food Safety (4), Personal hygiene (5), Cross Contamination (2), Safe time and temperature (3), Cleaning and Sanitation (2), Pest & Waste Management (2), Product Information and Training (2). The food handlers were asked to choose either the correct answer or the "Don't Know" from the multiple options ((Egan et al, 2007). The correct answer was allotted 5 points and 0 point for wrong answers with the maximum total possible score of 100 points. The food handlers knowledge

scores were also classified into three knowledge levels, High level: 80–100 scores, Medium level: 60–79 scores and Low level: 0–59 scores. Many studies emphasized a passing score at seventy percent (Waggoner, 2004; Hertzman, 2007; Liu et al., 2015) %, and are also the minimum acceptable score set by FSSAI for passing the food handlers' test. Therefore, a total of fourteen correct answers would be needed to be considered a passing score in the current study. Third part contained 20 attitude questions .A 5 point Likert Bipolar scale, from -2 point for strongly disagreed to +2 point for strongly agreed was used. It measures either positive or negative response to a statement. Few negative statements were also formulated to force food handlers to evaluate every statement in its own way. When all items are formulated in the same direction, people seem to evaluate them equally (Ratray & Jones, 2007). People do not express the same opinion when they have to evaluate a negatively phrased item instead of a positively phrased one. People tend to express their opinions more positively when a questionnaire item is phrased negatively (Kamoen et al, 2007). Questions pertaining to attitudes were aimed at determining the understanding of food handlers about food safety. Fourth part of the questionnaire contained 20 Practices questions with multiple options. A 5 point was allotted for correct practice and 0 for incorrect practice for evaluation purpose. Catering sector guidelines and foSTaC training material developed by FSSAI had been used to decide “correct” or “incorrect” answer or practice. For evaluation, a score  $\geq 70\%$  by an individual food handler was considered as having “good” practice. Before collecting data the aim and objectives of the study were fully explained to the owners of catering establishments and food handlers. The consent form was given to each food handler who agreed to take part in the study. Also, the rights were given to them to withdraw their names anytime from the study or they could refuse to answer any question. Participation in the study was purely on voluntary basis. Food handler's identification was also kept confidential.

#### **Pilot Study and Validity**

A series of pilot studies were undertaken for preparing and finalizing the questionnaire. A logical analysis survey with the help of 3 experts from foods industry and academic institutes was undertaken to rate possible topics for inclusion in the questionnaire. The prepared questionnaire was pre-tested on 30 food handlers, selected randomly from a non participating catering establishment to ensure clarity of interpretation. Pilot study findings further helped in revising and refining the instrument questions so as to enhance the reliability and validity of the final tools. The content of the knowledge questionnaire was based on the guidelines given in schedule 4, Part 5, FSS Act, 2006. The content of the attitude and practice questionnaire was gathered from the beliefs which were assessed during the focus group discussion with the food handlers (Kumari and Kapur, 2018).

#### **Reliability**

Cronbach's (1951) alpha is used as a measure for reliability in social science and it ranged between 0 and 1 (Santos,1999 ). Cronbach alpha greater than or equal to seven is deemed to be the acceptable value, but research has shown that Cronbach alpha greater than or equal to six is acceptable and can be used as a reliable indicator in research (Sim & Wright, 2000; Cortina, 1993; Field, 2005. The interpretation of Cronbach's alpha reliability coefficient score of the knowledge questionnaire was 0.732 and revealed that research instruments had acceptable level of internal consistency.

#### **Data Analysis**

The SPSS statistical software version 20 was used for all the descriptive and inferential analyses. Mean and percentages of responses in each category were calculated and presented in tabular and graphical form. Difference in means was considered statistically significant at  $p < 0.05$ . Frequencies of knowledge, attitude and practices questions were examined to determine how many of the food handlers answered the questions correctly or incorrectly. One way analysis of variance (ANOVA) was used to compare the mean scores of knowledge test categories and to assess the significant relationship between knowledge and demographic variables that could influence the study results. Categorical data was analyzed using Chi-square test. Pearson correlation test was used to see the direction and strength of correlations between mean knowledge and mean attitudes scores, mean attitude and mean practices score and lastly between mean knowledge and mean practices scores.

## RESULTS AND FINDINGS

### Socio-demographic Characteristics

A total of 287 food handlers responded to the knowledge test survey. The socio demographic data regarding age, gender, marital status, education level, work experience and region they belong to are presented in Table 1. The mean age of food handlers was  $28.29 \pm 7.58$  years with a range of 37 (20-57 years). Vast majority 89.9% (258) of the food handlers were between the age of 20 and 40 years with a very low proportion 7% (20) aged between 40-50 and 3% (9) over 50 years. It was also found that the majority of the food handlers working in the selected catering establishments were men 95.5% (274) with a very few female employees 4.5% (10). Among all the food handlers 56.1% (161) were married and rest 33.3% (126) were single. It was observed that the 73% (210) of food handlers had some form of formal educational qualifications up to 12<sup>th</sup> standard with a very few 21.6% (62) had also attended university degree but none of the food handlers had attended any technical education relevant to their job. Very little proportion of food handlers 5.6% (16) had never attended school but they could read and write which they had learnt from their colleagues. More than fifty percent of the food handlers 55.4% (187) had work experience up to 5 years, 23% (66) had 6-10 years, 18.8% (54) had 11-20 years and very few proportion 2.8% (8) had above 20 years. The food handlers had migrated to Delhi for work from diverse locations with maximum of them were from Bihar 79 (27.5%) followed by Uttar Pradesh 26.8% (77).

**Table 1: Socio Demographic Characteristics of Food Handlers (N=287)**

Variable	Frequency	Percentage	Mean $\pm$ sd	Range
<b>Age</b>				
20-30	200	69.70%	$28.29 \pm 7.58$	20-57 (37)
31-40	58	20.20%		
41-50	20	7.00%		
>50	9	3.10%		
<b>Gender</b>				
Male	274	95.50%		
Female	13	4.50%		
Any Other	0	0.00%		
<b>Marital Status</b>				
Single	126	43.90%		
Married	161	56.10%		
Divorced	0	0.00%		
Widower	0	0.00%		
Any Other	0	0.00%		
<b>Education</b>				
Up to 5 <sup>th</sup>	10	3.40%		
6 to 8 <sup>th</sup>	50	17.40%		
9 to 10 <sup>th</sup>	65	22.60%		
11 to 12 <sup>th</sup>	85	29.60%		
Graduation	62	21.60%		
PG	2	0.70%		
Diploma	0	0.00%		
Never went to school	16	5.60%		

Work Experience				
0 to 11 months (< 1 year )	38	13.20%	6.55±5.79	1-25 (24)
1To 5yrs	121	42.20%		
6 to 10yrs	66	23.00%		
11-20 yrs	54	18.80%		
>20 yrs	8	2.80%		
State				
Uttar Pradesh	77	26.80%		
Rajasthan	8	2.80%		
Bihar	79	27.50%		
Uttrakhand	27	9.41%		
Bengal	9	3.10%		
Nepal	21	7.30%		
Others ( Chhatisgarh,Jharkhand, Delhi, Haryana)	66	23.00%		

Further data revealed that only one third of the food handlers 32.8% (94) were skilled, half of the food handlers 50.2% (144) were semiskilled and rest others were unskilled as shown in figure 1.They were working as cooks (9%), assistant cooks (5.6%), helpers (3%), counter boys (49.10%) and others (13.3%) included cashiers, home delivery man, housekeeping team members and waiters as depicted in figure 2. They also performed all the daily operations in the catering establishment but only during carnivals, festivals and rush hours.

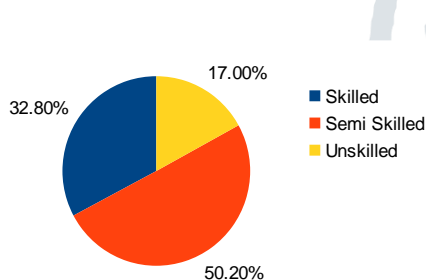


Figure 1: Skill Level of the food handlers (N=287)

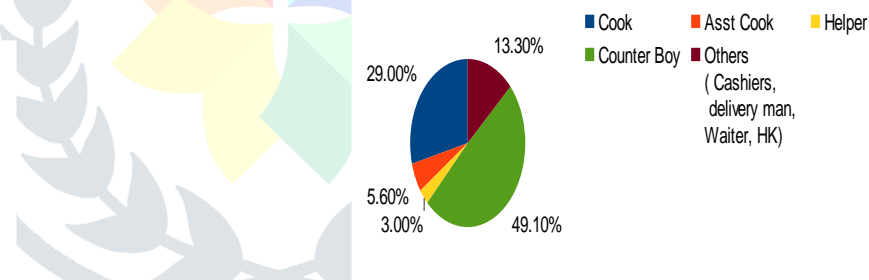


Figure 2: Job Titles of the food handlers (N=287)

As seen from the figure 3, half of the food handlers 52.7% (150) had never undergone any training sessions and rest others had attended internal trainings 45.6% (131) with very little proportion 1.7% (6) had attended external food safety training like HACCP/ISO and FSSAI.

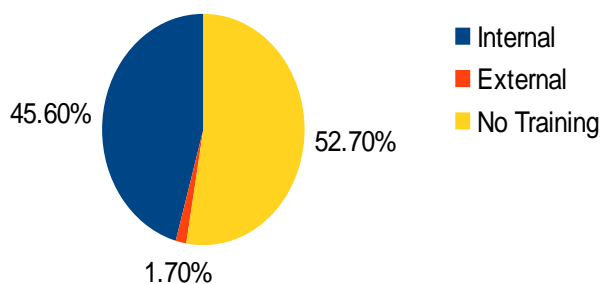


Figure 3: Training Status of Food Handlers (N=287)

**KNOWLEDGE, ATTITUDE AND PRACTICE ASSESSMENT**

Mean Knowledge, attitude and practices scores are shown in table 2. It can be seen that the food handlers had low mean knowledge and practices scores as compared to attitude scores.

**Table 2: Summary of KAP Score**

Scores	Mean	Standard Deviation	Median	Standard Error Mean	Mode	Range (Maximum – Minimum)	Maximum Possible Score
Knowledge	61.9	11.89	60	.7022	65	75 (90-15)	100
Attitude	17.12	8.97	18	.5290	9	50(37-(-13)	+40 to – 40
Practices	44.45	13.46	45	.7947	45	75(85-10)	100

**Knowledge of Food Safety**

The mean knowledge score of food handlers was  $61.9 \pm 11.89$  and ranged from 15-90 as shown in table 2. It was also observed that very few food handlers 29.61 % (85) could get the minimum acceptable passing score of 70% or more as set by FSSAI.

**Table 3: Number of food handler's qualified the knowledge test (n=287)**

Minimum Passing Score	Frequency	Percentage
$\geq 70\%$	85	29.61%

Overall knowledge scores of food handlers are shown in table 4 and it revealed that very less proportion of food handlers 7.2% (21) could get high scores ranged between 80 -100 , 61%(162) got medium scores and 31.7%(104) got scores less than 60% and didn't qualify the knowledge survey .The similar results were observed in other studies (Angelillo , 2000; Webb & Morancie, 2015; Samapundo , 2015) .

**Table 4 : Overall Knowledge Scores of Food Handlers working in Selected Catering Establishments (N=287)**

Knowledge Score Range	Responses%(n)		
	High	Medium	Low
80-100	7.2 (21)	.	
60-79		61(162)	
0-59			31.7(104)

**Food Handler's Correct Response for Each Knowledge Question Category**

The food safety knowledge questions were categorized into seven sections in order to get a better insight about the food handlers food safety knowledge during various stages of food handling, production and serving and the results are summarized in table 5. Frequencies were calculated based on correct responses . Lowest mean knowledge score was observed for cleaning and sanitation (43.4%) followed by time and temperature (53%) and cross contamination (58.02%). Although, they depicted satisfactory knowledge about training (73.7%) and pest control and waste segregation (70.79%) but they scored low on basic food safety knowledge (65.41%) and personal hygiene (65.32%). It was found that the food handlers were aware of high risk foods (80.8%), work place hygiene (76%) , uniform policy (96.9%), when to wash hands (79.8%), physical hazard identification (79.8%) , usage of potable water (84.32%), waste management (87.11%) and on the contrary they had demonstrated low knowledge towards the domain areas like biological and chemical hazard identification (69%) and (36.24% ) respectively , disease condition in which food handlers were restricted to work ( 44.6%), duration of hand washing procedures (29.3%), product storage height from the ground (27.53%),product labeling (56.1%), time and temperature control with

respect to holding(56.8%) and reheating(65.85%) of food items, ideal thawing procedures (35.1%), sanitation of vegetables (36.6%) and dish washing (50.24%) .

**Table 5: Percentage of Food Handler's with correct response for each knowledge question category (N=287)**

Category	Question Correct Response	Correct Responses % (n)	F	P Value
<b>Basic food safety knowledge</b>	Good bacteria are found in which of the following foods ( <i>Curd</i> )	69(198)	0.4125	0.746*
	Which of the following food is considered unsafe to eat? ( <i>Puffed Canned Food</i> )	80.8(232)		
	Which of the following water should be used for cooking? ( <i>RO treated water</i> )	84.32(242)		
	How much height from the ground, food should be stored? ( <i>6 inches</i> )	27.53(79)		
<b>Mean Correct Response % (n)</b>		<b>65.41(188)</b>		
<b>Personal Hygiene</b>	If the worker does not keep his work area clean so what will be the ill effect? ( <i>employees can get sick and food also get contaminated</i> )	76 ( 218)		
	Which of the following is allowed to wear at the workplace? ( <i>Uniform</i> )	96.9(278)		
	Which of the following illness should you not go to the workplace? ( <i>Acne and pimples on skin</i> )	44.6(128)		
	When should you wash hands? ( <i>Before touching food and after coughing and sneezing</i> )	79.8(229)		
	How long the hands should be washed?( <i>30 seconds</i> )	29.3(84)		
<b>Mean Correct Response % (n)</b>		<b>65.32(187)</b>		
<b>Cross Contamination</b>	Which of the following substances do not contaminate food? ( <i>Salt and Spices</i> )	79.8%(229)		
	Which of the following food items can be kept on the newspaper before serving? ( <i>None of the food</i> )	36.24(104)		
	<b>Mean Correct Response % (n)</b>		<b>58.02%(166)</b>	
<b>Safe Time and Temperature</b>	Which of the following methods is considered safe for defrosting frozen food? ( <i>In fridge</i> )	36.24(104)		
	For how many hours the cooked rice can be kept safely at room temperature? ( <i>Two hours</i> )	56.8(163)		
	How many times the cooked food can be reheated? ( <i>Only once</i> )	65.85(189)		
	<b>Mean Correct Response % (n)</b>		<b>53% (152)</b>	
<b>Cleaning and sanitation</b>	Which of the following sanitizers should be used to clean the raw vegetables? ( <i>Chlorine</i> )	36.6(106)		
	Which of the following processes should be done in the first sink while washing utensils? ( <i>Scrapping and washing</i> )	50.2(144)		
	<b>Mean Correct Response % (n)</b>		<b>43.4(87)</b>	
<b>Pest and Waste Management</b>	How many types of dustbins should be used to throw garbage in the restaurant? ( <i>Two types</i> )	87.11(250)		
	For Which of the following reasons the food should be kept away from pesticides? ( <i>It makes the food harmful for health</i> )	72.47(208)		

<b>Mean Correct Response % (n)</b>		<b>70.79%(229)</b>		
<b>Product Information and Training</b>	<i>Which of the following labels must be written on packaged food items? ( Expiry date and FSSAI License number)</i>	56.1(61)		
	<i>What should be done to improve work efficiency in the workplace? (Participate in training programme)</i>	91.3( 262)		
<b>Mean Correct Response % (n)</b>		<b>73.7%(162)</b>		

\* ANOVA: Significant at 0.05 level

### Attitude towards Food Safety

The mean attitude score of food handlers was  $17.12 \pm 8.97$  and shown in table 2. The attitude score ranged between +574 to -574 and individual statement scores and sums are displayed in table 6. It can be seen that the food handlers positively agreed (54.75) that it was not difficult to implement all the norms of FSSAI as compared to food handlers who showed a negative response (41.8%). A vast majority of food handlers also agreed that one should be away from substance abuse specially at work 92.7% (266) , 78.4% (225) agreed that personal accessories like rings and watches interfere with work and 90.3%(259) agreed that it was important to wear designated uniform at work. Good number of respondents 79.10%(227), 84.66%(243), 83.62%(240), 81.53%(234 ) , 88.5%(254 ) , 81.88%(235 ) , 72.82%(209) , 71.10(204) and 81.53%(234 ) agreed that washing hands with only water is not safe , physical examination of food handlers is necessary, mobiles should not be used at work, food shouldn't be cooked on floor, food should never be stored uncovered in fridge, only covered dustbins to be used , iron knives not to be used , gloves are not being used to attract the customer rather being used to protect food from contamination from naked hands and participation in training program respectively. Minority of the respondents 34.1 % ( 98) due to their religious beliefs opposed shaving on specific days. Very few also accepted 27.53 % ( 79) that they attend work after taking medicines for infectious diseases. Almost one fourth 25.78% (78) and three fourth 73.86% (212) of the food handlers also accepted that there was no harm using clothes for drying hands and utensils after washing. Almost equal response (both agreement and disagreement) was observed for keeping cooked food at normal temperature for four hours.

**Table 6: Food Handler's Attitude Response in Percentage and Attitude Scores (N=287)**

Statements	Strongly Agreed % (n) (+2)	Agreed% (n) (+1)	Neutral% (n) (0)	Disagreed% (n) (-1)	Strongly Disagreed% (n) (-2)	Sum of Scores
<i>It is difficult to implement all the norms of FSSAI.</i> Score	36.6(105) (+210)	18.1(52) (+52)	3.5(10) (0)	15.3(44) (-44)	26.5(76) (-152)	(+66)
<i>Wearing personal accessories like rings and watches doesn't interfere with work.</i> Score	60.6(174) (+348)	17.8(51) (+51)	1.7(5) (0)	10.5(30) (-30)	9.4(27) (-54)	(+315)
<i>Tobacco, gutkha and smoking etc. can be consumed while working.</i> Score	77.4(222) (+444)	15.3(44) (+44)	0.7(2) (0)	2.1(6) (+6)	4.5(13) (-26)	(+456)
<i>Many a times due to some religious factors work can be done without shave.</i> Score	43.2(124) (+248)	17.1(49) (+49)	5.6(16) (0)	25.4(73) (-73)	8.7(25) (-50)	(+174)
<i>Sanitizing hands is considered as hand washing</i> Score	33.4(96) (+192)	16.7(48) (+48)	4.9(14) (0)	17.8(51) (-51)	27.2(78) (-156)	(+33)
<i>It is considered safe to wash hands</i>	51.2(147)	27.9(80)	2.4(7)	9.1(26)	9.4(27)	



<i>only with water.</i> Score	(+294)	(+80)	(0)	(-26)	(-54)	(+294)
<i>After washing hands, it can be dried with any cloth.</i> Score	40.1(115) (+230)	27.5(79) (+79)	6.6(19) (0)	15.7(45) (-45)	10.1(29) (-58)	(+206)
<i>Gloves are used only to attract customers.</i> Score	48.1(138) (+276)	23.0(66) (+66)	4.5(13) (0)	9.8(28) (-28)	14.6(42) (-84)	(+230)
<i>It is very important to be examined physically on regular basis for good health.</i> Score	57.5(165) (+330)	27.2(78) (+78)	2.8(8) (0)	6.3(18) (-18)	6.3(18) (-36)	(+354)
<i>Employees can work after taking medicines while suffering from infectious diseases.</i> Score	47.0(135) (+270)	20.6(59) (+59)	4.9(14) (0)	15.3(44) (-44)	12.2(35) (-70)	(+215)
<i>Listening to music on mobile phone increases the productivity during work.</i> Score	63.8(183) (+366)	19.9(57) (+57)	1.7(5) (0)	6.6(19) (-19)	8.0(23) (-46)	(+358)
<i>Food can be cooked by sitting on the floor.</i> Score	62.0(178) (356)	19.5(56) (+56)	5.9(17) (0)	5.2(15) (-15)	7.3(21) (-42)	(+355)
<i>Instead of wearing a designated apron, any polyethylene can be worn as an apron.</i> Score	68.3(196) (+392)	22.0(63) (+63)	1.7(5) (0)	5.2(15) (-15)	2.8(8) (-16)	(+424)
<i>It is safe to keep fried foods on the newspaper before serving.</i> Score	60.6(174) (+348)	17.1(49) (+49)	5.6(16) (0)	8.7(25) (-25)	8.0(23) (-46)	(+326)
<i>Any Cooked food can be kept out at normal temperature for 4 hours.</i> Score	27.5(79) (+158)	20.2(58) (+58)	5.9(17) (0))	20.6(59) (-59)	25.8(74) (-148)	(+9)
<i>Food can be placed uncovered in the fridge.</i> Score	62.7(180) (+360)	25.8(74) (+74)	2.4(7) (0)	3.8(11) (-11)	5.2(15) (-30)	(+393)
<i>Iron knife can be used to cut vegetables.</i> Score	53.3(153) (+306)	19.5(56) (+56)	2.4(19) (0)	3.8(32) (-32)	5.2(27) (-54)	(+276)
<i>Wet utensils take time to dry themselves, so they have to be dried with clothes.</i> Score	10.1 (29) (+58)	9.8(28) (+28)	6.3(18) (0)	33.8(97) (-97)	40.1(115) (-230)	(-241)
<i>During work without lid dustbins can be used to throw garbage.</i> Score	63.4(182) (+364)	18.5(53) (+53)	3.5(10) (0)	6.6(19) (-19)	8.0(23) (-46)	(+352)
<i>It is mandatory for every worker to take training in hand washing process.</i> Score	53.7(154) (+308)	27.9(80) (+80)	3.8(11) (0)	4.5(13) (-13)	10.1(29) (-58)	(+317)

Attitude score of food handler's for all the 20 items can be seen from the figure 4. The crests and troughs are expressing the overall attitude score of food handlers. Although, positive attitude was observed except for

item 18 (related to dishwashing drying mechanism) which is highly negative. Similarly, the attitude is positive for items 1 (FSSAI Law implementation in catering establishments), 5 (hand washing frequency) and 15 (fried food serving method) but the scores are more towards the neutral side.

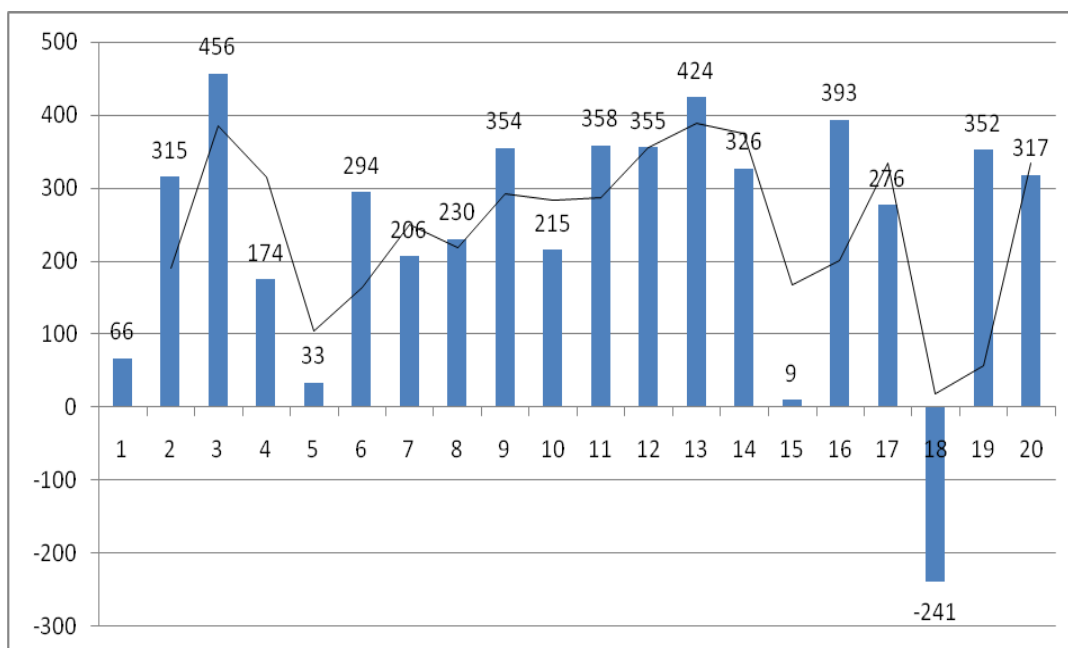


Figure 4: Attitude Score of Food Handlers (N=287) Ranged from +574 to -574.

**Practices towards Food Safety**

The mean practice score of food handlers was  $44.45 \pm 13.46$  as shown in table 2. Also, the food handlers practices are shown in table 7 and can be seen that the food handler’s uniform policy was not practiced as per the FSSAI regulation. A little more than half of the food handlers (54.35%) were changing uniform in changing rooms as per prescribed regulation whereas 10.45% (30) of the food handlers didn’t receive the uniform from the management, 1.05% (3) didn’t feel the need to wear uniform at work place and 34.5% (99) wear the uniform but directly from home and were not changing at work place. As far as personal belongings are concerned, the food handlers were keeping their personal belonging either under the table (7%) or in containers (5.92%) or purse (3.48%) and 33.8% (97) were not carrying personal belongings. Majority of the food handlers were attending work during sickness like headache and fever (57.14%) and also during cold and cough (24.74%). Very small proportion were coming to work during vomiting and diarrhea (1.4%) and during general pain in the body, back and tooth (16.72%). Vast majority of the food handlers were taking tea at their work stations (89.23%). Further, they were rewashing hands in vegetable sink (2.79%) or in any available sink (3.83%) and majority were washing hands after using toilets (72.82%) but very low proportion were practicing hand washing after sneezing and coughing (2.1%). For washing hands, liquid soap was used by 63.76% (183) rest others were using surf (7.66%), soap (27.53%) and just plain water (1.73%). Only single use paper towel for drying hands was used by 3.48% (10) food handlers and maximum were using personal hanky (45.65%), dusters (15.68%), uniform (4.53%) and hand dryers (30.66%). One fourth (25.8%) of the food handlers were not using gloves and 5.23% (15) were blowing air into it while opening. More than half of the food handlers used phones at work (56.45%) because they wanted to stay in touch with family (41.46%), friends (10.10%). Listen songs (0.71%) were the reasons behind usage. Very few proportions were using phones for official reasons (4.18%). It was also observed that few food handlers 7.32% (21) were not using cold room for cooling and storing food and vegetables because of its non availability. Another violation observed was that they were not storing ready to eat food items in correct shelves in cold rooms. Almost half 42.51% (122) of the food handlers were storing them either together with raw food or below the raw food shelf. They were also not sanitizing raw vegetables (65.84%), not keeping cooked food at ideal temperature (79.1%), keeping fried foods on newspaper (16.7%), not using food grade plastic containers for storing sauces and chutneys (81.2%), using

their sensory organs to ensure the safety of foods (82.58%) and were dependent on their colleagues to know the work place policies and not participating in trainings .Half of the food handlers ( 50.5%) were using iron knives for cutting and chopping .The reasons were easily availability (12.54%), sharpness (28.56%) and using the same for many years (9.4%).

**Table 7: Practice Response of each statement (N=287)**

Statements	Response%(n)
<b>You change uniform :</b> a) From Home b) In the changing room c) Uniform does not need to be worn separately d) Live here, no uniform, new joining e) Any Other ) ____	34.5(99) 54.0 (155) 1.05 (3) 10.45(30) 0(0)
<b>Where do you keep your personal belonging like helmet, watch while working?</b> A) Below the counter b) In the lockers c) In any container or bag d) Don't carry personal belongings e) Keep it in purse f)Any Other ) : ____	7.0(20) 49.8 (143) 5.92 (17) 33.8(97) 3.48(10) 0(0)
<b>In which of the following illnesses you are usually present for work at the workplace?</b> A) Cold and Cough b) Vomiting and diarrhea c) Headache and fever d) Any Other ) : Physical pain in the body, tooth ache ,back ache	24.74(122) 1.4 (4) 57.14 (164) 16.72(48)
<b>Which of the following things you eat while working in the work place?</b> A) Taking tea b) Consuming Gutka and tobacco c) Smoking and drinking d) Don't eat anything f)Any Other ) ____	89.23(236) 0.7 (2) 0 (0) 13.94(40) 3.13(9)
<b>When do you wash hands?</b> A) Before touching food b) After sneezing and coughing c) Smoking and drinking d) After using toilets f)Any Other ) : As and when required	15.33(44) 2.1 (6) 5.22(15) 72.82(209) 4.53(13)
<b>Where do you wash your hands?</b> A)In any sink b) In designated hand washing sink c) In vegetable sink d) Any other: No hand washing sink available	3.83(11) 88.85(255) 2.79 (8) 4.53(13)
<b>What do you use to wash hands?</b> A) Surf b) Solid Soap c) Liquid Soap d) Only water e) Using ash f)Any Other ) ____	7.66(22) 27.53(79) 63.76(183) 1.73(3) 0(0) 0(0)
<b>Which of the following things you use to dry your hands.</b> A) Personal Hanky b) Uniform c) Hand dryer d) Tissue Paper e) Duster f)Any Other ) ____	45.65(131) 4.53 (13) 30.66(88) 3.48(10) 15.68(45)
<b>How do you open the gloves before wearing them?</b> A) By blowing air b) By rubbing fingers c) Don't wear gloves d)Any Other ) ____	5.23(15) 69.69(200) 25.08(72) 0(0)

<b>Do you use mobile phones at work place?</b> A) Yes B) No	56.45(162) 43.55%(125)
<b>If your answer is yes than what is the reason of use?</b> A) To be in contact with family b) To be in contact with friends c) To listen to songs or news d) To use in office e) Not applicable f)Any Other ) ____	41.46(119) 10.10(29) 0.71(2) 4.18(12) 43.55(125) 0(0)
<b>Which of the following procedures do you use before cooking raw vegetables?</b> A) Put it in cold room b) Cook them without sanitizing c) Cook them after sanitizing\ d)Any Other ) : No Cold room available	57.84(166) 8.01(23) 26.83(77) 7.32(21)
<b>Do you use iron knife to cut the vegetables at work place?</b> A) Yes B) No	50.5(145) 49.5(142)
<b>If your answer is yes than what is the reason of use?</b> a) Its edges are sharp b) Easily available c) Using it since years d) Not Applicable e)Any Other ) ____	28.56(82) 12.54(36) 9.4(27) 49.5(142) 0(0)
<b>Where do you keep the food after cooking them?</b> a) At room temperature b) In cold room c) In AC room d) Any other: No Cold Room	49.83(143) 20.9(60) 21.95(63) 7.32(21)
<b>How do you store ready to eat foods in the cold room?</b> a) Keeping them with raw foods b) Keeping them above raw foods c) Keeping them below raw foods d) Cold room not available e) Any other	29.61(85) 50.17(144) 12.9(37) 7.32(21)
<b>Where do you keep the fried food items before serving?</b> a) On newspaper b) On butter paper c) On oil siever d) In any other Utensil	16.7(48) 24.0(69) 53.7(154) 5.6(16)
<b>In which container, you use to keep sauces and chutneys?</b> a) Stainless Steel b) Polythene c) Food Grade Plastic Container d) Any other: Plastic Drums/Disposable Containers reused for storing	65.85(189) 5.6(16) 18.8(54) 9.75(28)
<b>How do you ensure that food is safe for eating?</b> a) By smelling the food b) By tasting the food c) By sending them to quality lab d)On seeing the food e) Any other	17.42(50) 44.95(129) 17.42(50) 20.21(58) 0(0)
<b>How do you dry the washed utensils?</b> a) Wiping Cloth b) Air dry them c) Dishwasher dries them automatically d) Any other	75.26(216) 12.89(37) 10.45(30) 1.4(4)
<b>Where do you throw garbage while Cooking food?</b> a) Under the table b) In polythene c) In designated dustbin d)Any other	4.52(13) 1.04(3) 93.4(268) 1.04(3)
<b>What do you do to get the information related to work policies?</b> a) Ask Colleagues b) Take Trainings	62.36(179) 19.86(57)

c) From Newspaper/TV/Radio	4.88(14)
d) There is no source of information	5.9(17)
e) Reads Poster	7.0(20)
f) Any other	

**Association between Knowledge, Attitudes and Practices**

Table 8 shows a statistically significant association between knowledge and attitudes ( $\chi^2=143.6809$ ,  $p<0.00001$ ), attitudes and practices ( $\chi^2=3273.1794$ ,  $p<0.00001$ ), and also knowledge and practices ( $\chi^2=61.5318$ ,  $p<0.00001$ ).

**Table 8: Association between Knowledge, Attitude and Practices**

Variables	Chi Square ( $\chi^2$ )	P Value	Significance $p<0.05$
Knowledge $\alpha$ Attitude	143.6809	<0.00001	Yes
Attitude $\alpha$ Practice	327.1794	<0.00001	Yes
Knowledge $\alpha$ Practices	61.5318	<0.00001	Yes

The statistical significant and positive correlation was observed between knowledge and attitude scores ( $p$  value=0.000689,  $r=0.1992$ ), between attitude and practices score ( $p=0.036124$ ,  $r=0.1237$ ) and also knowledge and practices score ( $p$  value=0.00001,  $r=0.2801$ ) as can be seen from table 9. The strongest positive correlation is between knowledge scores and practices score.

**Table 9: Correlation coefficient between knowledge, attitudes, and practices**

Variables Correlation	P Value	Correlation Coefficient ( r Value)
Knowledge $\alpha$ Attitude	0.000689	0.1992
Attitude $\alpha$ Practice	0.036124	0.1237
Knowledge $\alpha$ Practices	0.00001	0.2801

Table 10 indicates relationship between dependent variable (Knowledge Score) and independent variables (food handler’s age, education, job title, experience, state they belong to and trainings). Although statistical significant differences were not found between age and the knowledge score but respondents aged 41-50 years and above showed a significantly higher knowledge score ( $F=1.2768$ ,  $p>0.05$ ) but the score is less than the cut off value of 70%. Similarly no statistical significant difference was found between education level and knowledge scores ( $F=0.3668$ ,  $p>0.05$ ). Only higher mean knowledge score was observed for graduates but that is also less than the cut off value and rest all other categories irrespective they had attended school not got similar mean knowledge scores but less than the cut off value. Experience was also not statistical significant, ( $F=.25622$ ,  $p>0.05$ ). But, food handler’s with highest experience (>20 years) scored high on knowledge scores. Job titles of the participants shown a significant difference ( $F=4.1035$ ,  $p<0.05$ ). But the mean knowledge score were less than the cut off value for all the job titles like cooks, counter boys, home delivery man etc . The region of the food handler’s had not shown any significant difference ( $F=0.878$ ,  $p > 0.05$ ). But highest knowledge score was found in food handlers of Utrakhand and lowest from Rajasthan. Similarly food handlers existing skills and internal trainings had not made any significant difference in their knowledge scores ( $F=0.1965$ ,  $p>0.05$ ) and ( $F=.42363$ ,  $p>0.05$ ).

**Table 10: ANOVA for food handlers Knowledge Score and Age, Education, Experience, Job titles, State and Training**

Dependent Variable	Independent Variable	Mean		Sum of Squares	Df	Mean Square	F	P Value
Knowledge Score	Age		Between Groups		3		1.2768	0.282
				540.6373		180.2124		

	20-30		<b>Within Group</b>		283			
		60.97		3994.399		1411428		
	31-40	59.91						
	41-50	64.5						
	>50	66.11						
	<b>Education</b>		<b>Between Groups</b>				0.3668	.8996
				315.7236	6	52.6206		
	Up to 5th		<b>Within Group</b>					
		60.5		40168.165	280	143.4577		
	6-8th	61.4						
	9-10th							
		61.76						
	11-12th							
		59.87						
	Graduation							
		62.5						
	Diploma							
		57.5						
	Never went to school							
		60.3						
	<b>Experience</b>							
	0-11 months		<b>Between Groups</b>				0.2562	
		61.84		146.6014	4	30.6504	2	0.9057
	1-5 years		<b>Within Group</b>					
		60.57		40337.381	282	143.0404		
	6-10 years	61.81						
	11-20 years	60.83						
	>20 years	63.7						
	<b>Job Titles</b>							
	Cook		<b>Between Groups</b>					
		60		2226.7814	4	556.6954	4.1035	0.0030
	Assistant Cook		<b>Within Group</b>					
		55		38257.07	282	135.6634		
	Helper	53.33						
	Counter Boy	61.73						
	Others (Home Delivery man /Housekeeping/ waiters etc))	66.05						
	<b>State</b>							
	Attar Pradesh		<b>Between Groups</b>					
		60		747.6172	6	124.6029	0.878	0.5100
	Rajasthan		<b>Within Group</b>					
		56.87		39736.542	280	141.9162		
	Bihar	62.21						
	Utrakhand	64.81						
	Bengal	61.11						
	Nepal	61.19						
	Others ( Delhi/Haryana etc)	60.30						

	Skills							
	Skilled	60.63	Between Groups	55.9539	2	27.9769	0.1965	0.8217
	Semi Skilled	61.59	Within Group	40427.87	284	142.3512		
	Unskilled	60.91						
	Training							
	Internal Training	61.60	Between Groups	120.4165	2	60.2083	0.4236	0.6550
	External Training (HACCP/ISO)	57	Within Group	40363.526	284	142.1251		
	No Training	60.92						

## DISCUSSION

This study discovered a significant lack of knowledge in food safety, as only 29.61% of the surveyed respondents and only 4.8% demonstrated good practices. The results of this study are also in accordance with other studies that have addressed the food safety issue and emphasized on acute need to improve food safety knowledge and practices in the food industry (Webb & Morancie, 2015; Angelillo et al., 2000; Samapundo et al., 2015; Liu et al., 2015). Many previous studies have identified that poor food safety knowledge and handling practices is one of the main causes of food-borne outbreaks (Clayton et al., 2002; Food Standards Agency 2002; Martin et al., 2003; Clayton et al., 2004; Okojie et al., 2005; Green et al., 2006; Hertzman et al., 2007; Mitchell et al., 2007). Okojie *et al.*, (2005) also showed that knowledge and practice were influenced by previous training ( $P = 0.002$ ) and similar results were noticed in the current study. More than half of the food handlers (52.7%) had never attended either internal or external trainings and that was further conformed through low knowledge and practice scores. The previous studies found the most significant error made by catering employees was the lack of personal hygiene practices; more specifically, the lack of proper hand washing whereas proper hand washing was the single most important means of preventing the spread of food borne illness (Clayton and Griffith, 2004; Guzewich and Ross, 1999; Harrington, 1992; Paulson, 2000). In the current study food handlers were practicing frequent hand washing (86.06%), and at designated hand wash stations (88.81%) but 70.3% of the food handlers were lacking knowledge about the total duration of hand washing procedure, 36.24% were not using appropriate hand wash cleanser and 65.86% were not using single use paper towel to dry their hands after washing whereas 67.69% opposed using clothes to dry hands in attitude test.

Although the current study had demonstrated good understanding towards food safety issues but not been translated into practice scores. These findings were similar to that of Clayton et al (2002), it was discovered that food handlers might be aware of the food safety attitudes they should have performed, but 63% of the respondents in the study indicated that they rarely practice positive attitudes.

The majority of the food handlers 63.8% were also lacking knowledge in identifying chemical hazards. Half of them 50.8% were using iron knives for cutting vegetables and newspapers (16.72%) for keeping fried food items whereas they have shown a good understanding score in attitude test for iron knife (77.7%) and newspaper (72.82%).

The present study also revealed violation of one of the five keys to keep food at safe temperatures and it was recognized as a critical control point of food safety (World Health Organization, 2013). The current study and many previous studies have revealed that food handlers' lack knowledge about the critical temperature (Bas, et al., 2006; DeBess et al., 2009; Garayoa et al., 2011) for food storage. Improper food safety practices related to insufficient temperatures needed for cooking and holding foods have led to several food borne outbreaks. A U.S. study reviewing outbreaks associated with food handlers' errors found that 22 outbreaks were associated with insufficient time and temperature during initial cooking or heat processing, during reheating, during inadequate thawing followed by insufficient cooking, and other food preparation procedures that allow pathogenic bacteria to survive (Sumner S. Et al. 2011). In the current study the food

handlers were lacking time and temperature knowledge about holding (43.2% ) and reheating (34.15%) of food items as well lacks knowledge (63.2%) about ideal thawing procedures for frozen food items and thought that the correct method for thawing frozen food is to keep them at room temperature. Only 43.2% food handlers realized that cooked rice can't be stored at room temperature for more than two hours and the findings are almost similar to that of Sufen et al (2014) where only 44.40% realized that cooked food cannot be stored for more than two hours at room temperature.

In the current study the vast majority of the food handlers (82.58%) were using their sensory organs for the assurance of food safety for its consumption. The similar results was observed in other studies . Food handlers between 20.21% and 44.95% wrongly believed that they can tell if food was contaminated with food poisoning bacteria by visual, olfactory or taste checks and the similar results were found in other studies (Gomes-Neves et al 2007; Jevšnik M et al, 2008; Martin et al 2012; Walker E et al 2003).

In our study 73.52% participants were not sanitizing raw vegetables before cooking as only 63.4% of the food handlers were not aware of type of sanitizer to be used .A study of 200 chefs in Ireland showed that 21.5% of all the respondents considered the use of disinfectants in sanitizing worktops as unimportant step (Bolton et al ,2008).

The vast majority of the food handlers 81.2% were not using food grade containers for storing food items. Food handling, preparation, and service practices are other important factors in determining the safety of food. Food storage systems (time and temperature), equipments and containers as well as food handlers' knowledge and practices affect food safety directly or indirectly (Beaver et al, 1984, Tsega & Nadew, 1972; Okubagzhi, 1988).

Proper practices by food handlers are a key factor in food safety, but converting knowledge into practice is a complex process. Powell et al. (2011) had proposed the concept of a food safety culture to correct and maintain proper practices, in which establishing a strong culture of food safety would be of help, including communication among employees, managers, and employers; encouragements for employers; consensus on food safety, and similar workplace values.

## CONCLUSIONS

The results of the present study indicate a definite need for improving food safety knowledge and practices of food handlers .Food handlers play a significant role in the prevention of food borne disease and are the first line of defense to ensure food safety. Their low knowledge score and poor practices may contribute to cause food borne illness and outbreaks. The study revealed that more than half of the food handlers had never attended any training programs .The researcher suggests that they must undergo continuous training session which is needed to produce safe and hygienic food. Through training their knowledge and practices can be improved as they have shown positive attitude towards food safety issues and training programs.

## REFERENCES

1. Adams M.R.and Moss M. O. 2008 "Food Microbiology," 3rd Edition, The Royal Society of Chemistry, Cambridge.
2. Angelillo, I. F., Viggiani, N.M.A., Rizzio, L., & Bianco, A. 2000. Food handlers and food borne diseases: Knowledge, attitudes and reported behavior in Italy. *Journal of Food Protection*, 63(30), 381-385.
3. Azjen, I. & Fishbein, M. 1980. *Understanding attitudes and predicting social behavior*. Prentice all.
4. Bas, M., Ersun, A.S. & Kivanc, G. 2004. The evaluation of food hygiene knowledge, attitudes and practices of food handlers in food businesses in Turkey. *Journal of Food Control*, 17: 317-322.
5. Beaver PC, Jung RC, Cupp EW. 1984. Examination of specimens for parasites. In: Beaver PC, Jung RC, Cupp EW, editors. *Clinical parasitology*, 9th ed. Philadelphia: Lea and Fabiger. 733-758.
6. Bolton D. J. , Meally A., Blair I.S., McDowell D.A. and Cowan C.2008 "Food Safety Knowledge of Head Chefs and Catering Managers in Ireland," *Food Control*, 19(3): 291-300.
7. Bryan, F.L. 1988. Risks of practices, procedures and processes that lead to out-breaks of food borne diseases. *Journal of Food Protection*, 1: 663-673.
8. Choung. J.2010. An Analysis of restaurant food safety violations: human factors, non-human factors, and food-borne illness" .*UNLV Theses/Dissertations/Professional Papers/Capstones*. Paper 458.
9. Clayton, D.A., Griffith, C.J., Price, P., & Peters, A.C. 2002. Food handlers' beliefs and self- reported practices. *International Journal of Environmental Health Research*, 12(1), 25-39.



10. Clayton, D.A. and Griffith, C.J. 2004, "Observation of food safety practices in catering using notational analysis", *British Food Journal*, 106(3): 211-227.
11. Cortina, J. M. 1993. What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78: 98-104.
12. Cronbach, L. J. 1951. Coefficient alpha and the internal structure of test. *Psychometrical*, 16, 297-334
13. DeBess, E. E., E. Pippert, F. J. Angulo, and P. R. Cieslak. 2009. Food handler assessment in Oregon. *Food borne Pathog Dis*, 6:329–335
14. Egan, M.B., Raats, M.M., Grubb, S.M., Eves, A., Lumbers, M.L., Dean, M.S., & Adams, M.R. 2007. A review of food safety and food hygiene training studies in the commercial sector. *Food Control*, 18:1180-1190.
15. Field, A. 2005. *Discovering statistics using SPSS*. London, England: Sage Publications Food Safety and standard Act 2006, Rules 2011. International Law Book Company , 7<sup>th</sup> Edition.
16. Food Standards Agency (2002), Largest Ever Survey of Catering Staff Shows That One in Three doesn't wash their hands after visiting lavatory. Available at: [www.food.gov.uk/news/pressreleases/2002/oct/handwash](http://www.food.gov.uk/news/pressreleases/2002/oct/handwash). Last reviewed on 30<sup>th</sup> Nov 2018.
17. FSSAI, 2017. Guidance Document: Food Safety and Management System. Food Industry guide to Implement GMP/GHP Requirement. Catering Sector .Edition First. Available at [www.fssai.gov.in](http://www.fssai.gov.in). Last reviewed on 25<sup>th</sup> Nov 2018.
18. Garayoa, R., Vitas, A. I., Díez-Leturia, M., & García-Jalón, I. 2011. Food safety and the contract catering companies: food handlers, facilities and HACCP evaluation. *Food Control*, 22(12), 2006-2012.
19. Gomes N.E., Araújo A.C., Ramos E. and. Cardoso A.C.2007. "Food Handling: Comparative Analysis of General Knowledge and Practice in Three Relevant Groups in Portugal," *Food Control*, 18(6): 707- 712.
20. Guzewich J, Ross M.P.1999. Evaluation of risks related to microbial contamination of ready to eat food by food preparation workers and the effectiveness of intervention to minimize those risks. FDA White Paper. Center for Food Safety and Applied Nutrition.
21. Harrington, R.E. 1992, "The role of employees in the spread of food borne disease – food industry views of the problem and coping strategies", *Dairy, Food and Environmental Sanitation*, 12: 62-63.
22. Hertzman, J., & Barrash, D.2007. An assessment of food safety knowledge and practices of catering employees. *British Food Journal*, 109(7):562-576.
23. Howes, M., McEwen, S., Griffiths, M. and Harris, L. 1996, "Food handler certification by home study: measuring changes in knowledge and behavior", *Dairy, Food and Environmental Sanitation*, 16(11):737-44
24. Jevšnik M, Hlebec V.and Raspor P. 2008. "Food Safety Knowledge and 553 Practices among Food Handlers in Slovenia," *Food Control*, 19(2): 1107-1111.
25. Kamoen, N., Holleman, B.C., & Van den Bergh, H.H. 2000). How easy is a text that is not difficult? A meta-analysis about the effect of question wording in text evaluation research, 29: 314–332.
26. Kibret M,Abera B.2012.The sanitary conditions of food service establishments and food safety knowledge and practices of food handlers in Bahir Dar Town. *Ethiop. J. Health Sci.*,22:27-35
27. Krejcie R.V. ,Morgan D.W.1970.Determining sample size for research activities. *Educational and Psychological Measurement*.30:607-610. Retrieved from [https://home.kku.ac.th/sompong/guest\\_speaker/KrejcieandMorgan\\_article.pdf](https://home.kku.ac.th/sompong/guest_speaker/KrejcieandMorgan_article.pdf). Last reviewed on 23 January, 2019.
28. Kumari V., Kapur D., 2018.Understanding Barriers to Compliance to Food Safety Standards in the Catering Establishments Using a Qualitative Research Method: Focus Group Discussion, *International Journal of Scientific Research in Science and Technology*, 4(10):423-440.
29. Liu, S. Liu, Z., Zhang, H., Lu, L., Liang, J., & Huang, Q. 2015. Knowledge, attitude, and practices of food safety amongst food handlers in the coastal resort of Guangdong, China. *Food Control*, 47: 457-461.
30. Martins R. B., Hogg T. and Otero J.G., 2012. "Food Handlers' Knowledge on Food Hygiene: The Case of a Catering Company in Portugal," *Food Control*, Vol. 23(1): 184-190.
31. Mitchell, R. E., Fraser, A. M. & Bearon, L. B. (2007). Preventing food-borne illness in food service establishments: Broadening the framework for intervention and research on safe food handling behaviors. *International Journal of Environmental Health Research*,17(1): 19-24
32. Mederios, L., Hillers, V., Kendall, P. & Mason, A. 2001. Evaluation of food safety education for consumers. *Journal of*

Nutrition Education and Behavior ,33: 27-34

33. Okojie OH, Wagbatsoma VA, Ighoroge AD.2005. An assessment of food hygiene among food handlers in a Nigerian university campus. Niger Postgrad Med J., 12:93-6.
34. Okubagzhi G.1988.Ova, larva and cyst in fingernail contents. Ethiop Med J ,.26:33-6
35. Paulson, D.S. 2000, "Hand washing, gloving and disease transmission by the food preparer", Dairy, Food and Environmental Sanitation, 20(11): 838-45
36. Panchal, P. K., L. Liu, and M. S. Dworkin. 2012. Food safety knowledge differs among Spanish and English speakers. J. Food Prot.,32(1):16–25
37. Powell, D. A., Jacob, C. J., & Chapman, B. J. 2011. Enhancing food safety culture to reduce rates of food borne illness. Food Control, 22(6),:817-822
38. Rattray, J.C., & Jones, M.C. 2007, Essential elements of questionnaire design and development. Journal of Clinical Nursing, 16: 234-243.
39. Samapundo, S., Climat, R., Xhaferi, R., & Devlieghere, F. 2015. Food safety knowledge, attitudes and practices of street food vendors and consumers in Port-au-Prince, Haiti.Food Control, 50:457-466.
40. Santos, J.R.A. 1999. Cronbach's Alpha: A tool for assessing the reliability scales. Journal of Extension; 37(2). Available at <http://www.joe.org/joe/1999april/tt3>. Last reviewed on 20.12.18
41. Sim, J., & Wright, C. 2000. Research in health care: concepts, designs, and methods. Cheltenham, United Kingdom: Stanley Thornes Ltd.
42. Sufen Liu,Zhenhua Liu,Heng Zhang,Lingling Lu,Junhua Liang, Qiong Huang. 2014. Knowledge, attitude and practices of food safety amongst food handlers in the coastal resort of Guangdong, China. Food Control ,47: 457-461
43. Sumner, S., L. G. Brown, R. Frick, C. Stone, L. R. Carpenter, L. Bushnell, D. Nicholas, J. Mack, H. Blade, M. Tobin-D'Angelo, and K. Everstine.2011. Factors associated with food workers working while experiencing vomiting or diarrhea. J. Food Prot., 74(2):215–220
44. Tsega E, Nadew FT.1972. The threat of amoebic cyst carriers among hospital food handlers. Ethiop Med J, 10:43-53.
45. Todd E.C., Greig J.D., Bartleson C.A. and Michaels B.S.2007. "Outbreaks Where Food Workers Have Been Implicated in the Spread of Food borne Disease, Part 3. Factors Contributing to Outbreaks and Description of Outbreak Categories," Journal of Food Protection, 70(9) : 2199-221
46. Waggoner, S. 2004 Food safety knowledge and practices of food recovery agency workers before and after food safety training (Unpublished master's theses), Louisiana State 190 University and Agricultural and Mechanical College, Baton Rouge, LA. Available at [http://digitalcommons.lsu.edu/gradschool\\_theses/3702](http://digitalcommons.lsu.edu/gradschool_theses/3702) . Last reviewed on 20.12.18.
47. Walker, E., C. Pritchard, and S. Forsythe. 2002. Food handlers' hygiene knowledge in small food businesses. Food Control, 14 (2003):339–343.
48. Walker E , Pritchard C. and Forsythe S.2003. "Food Handlers' Hygiene Knowledge in Small Food Businesses," Food Control, 14(5):339-343.
49. Webb, M., & Morancie, A. 2015. Food safety knowledge of foodservice workers at a university campus by education level, experience, and food safety training. Food Control, 50: 259- 264.
50. World Health Organization (WHO) 2000. Foodborne Disease: Focus on Health Education. WHO, Geneva.
51. World Health Organization (WHO). 2013. The five keys to safer food. Available at: <http://www.who.int/foodsafety/consumer/5keys/en/>. Last reviewed on 4th Dec 2018.