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## Refrigerated food safety awareness and attitude in relation to food borne disease incidences

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### Abstract

The aim of the present study is to determine awareness and attitude regarding food safety among urban households of Ludhiana district, Punjab. Results revealed that middle age group from (35-45 years), mostly males, with joint families, belonging to service class, mainly postgraduates and above and having family income more than 10 lakhs were found to have good food safety awareness scores. Results also revealed that female respondents had better attitude pertaining to food safety as compared to male respondents. A better attitude towards food safety was found in the respondents who were in middle aged group (35-45 years), from the joint families, belonged to both (business and service) class and having annual family income of more than 10 lakhs. Higher the education qualification better was the attitude of respondents so it clearly reflects that post graduates and graduates were found to have better attitudes towards food safety. Food safety awareness were significantly negatively correlated ( $p < 0.01$ ) with the food borne disease incidences. The incidences of food borne disease were also negatively correlated with attitude of respondents towards food safety, though which was found to be non-significant.

**Practical applications:** Homemakers in their homes rarely considered their own food safety practices as hazards. And as such no specific regulations were followed during the preparation, handling and storage of food at home. Therefore there is a need of effective risk communication to educate consumers/homemakers of the possible health risks of food borne diseases and encourage safer food handling, preparation and storage practices at home is probably the best way to ensure food safety at the consumer end of the food chain.

**Keywords:** Food safety awareness, food safety practices, attitude, refrigeration, food borne disease incidence

### Introduction

Food safety is defined as the degree of confidence that food will not cause harm to the consumer when it is prepared, served and eaten according to its intended use (FAO/WHO, 2003) [10]. Poor food handling and hygiene practices in the domestic kitchen are thought to cause a significant number of food borne illnesses. Foods can be mishandled during preparation, processing or storage (Mederios *et al.*, 2001) [14]. A considerable amount of food preparation, handling and storage take place in the domestic environment, especially at our homes, so by understanding the behaviors of the consumers and assuring the education of the consumers regarding the risk of unsafe food handling practices is an essential element of the prevention of food-borne diseases. Home behaviors of the consumers may act like a good reflection of their knowledge and awareness or at least what they believe regarding food safety. (Surujlal and Badrie, 2004) [22]. The most challenging areas to achieve consumer food safety includes poor hand washing practices, cross-contamination, and improper storage of food items. Common mistakes identified include, serving contaminated raw food, cooking or heating food inadequately, infected persons handling implicated food and poor hygiene practices. In addition, a part of food borne illnesses in the home result from eating raw foods of animal origin or engaging in unsafe food preparation practices in the home (Redmond and Griffith, 2003). Food prepared at home has been identified as a major source of food poisoning (Anderson *et al.*, 2004) [4]. Homemakers rarely consider their own food practices a hazard. There are no regulations were followed during the preparation, handling and storage of food at home (Ususan, 2007) [24]. The changing demographics and lifestyle, as well as emergence of resistant and exceptionally hazardous strains of food borne microorganisms, create a situation that could lead to major outbreaks of life threatening food borne illness (Sharma and Sangha, 2015) [21]. In response to the increasing number of food borne illnesses, governments all over the world are intensifying their efforts to improve food safety (WHO, 2009) [26].

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It is thought that consumer's behaviors and attitudes toward safe food should be taken into account in order to completely define the term "food safety" and to determine the wrong behaviors and beliefs of the consumers. Also it should be so important to educate the consumers through understanding their diverse food safety issues relevant to them (Wilcock *et al.*, 2004) [27]. An effective risk communication to inform consumers of the possible health risks of food borne diseases and encourage safer food handling practices at home is probably the best way to ensure food safety at the consumer end of the food chain (Patil *et al.*, 2005) [17]. Obtaining enough information on the knowledge, awareness and practices is essential for the development of effective health education programs. Based on these data, the study was aimed to determine awareness and attitude of respondents on various parameters (gender, family type, occupation, annual family income) regarding food safety.

### Materials and Methods

The present study was undertaken to explore awareness and attitude of respondents pertaining to food safety. A random selection of 300 respondents from urban households was done from Ludhiana district (Punjab). Data was collected by personally administering the pre-structured food safety questionnaire to the respondents on food safety awareness. For finding out the awareness of the respondents, they were asked 25 basic questions pertaining to food safety. Depending upon the correctness of the responses, one mark is awarded for each correct response to these statements and zero mark to each wrong answer and they were given awareness score out of 25. For determining the attitude of the respondents towards food safety 14 statements were included in the questionnaire.

These statements were used for finding out predispositions of home food preparers about food safety. The respondents were asked to rate the statements about the extent of their agreement (from 'Strongly Agree' to 'Strongly Disagree'). For the purpose of analysis, the option of 'Strongly Agree' and 'Strongly Disagree' were given scores of 5 and 1 respectively. Questionnaire was pretested by undertaking a pilot study involving 10 urban households from locality to ensure the validity of questionnaire. On the basis of the feedback received, the questionnaire was finalized by incorporating the changes and this sample size was excluded from the final sample.

### Data analysis

The findings were analyzed with respect to the household respondents of Ludhiana district. The data was analyzed with SPSS Software (Statistical Package for Social Science version 16.00). Mean and standard deviation were calculated for each table and all the data presented in the tabular form. Independent t- test and one way ANOVA were used to evaluate the significant difference ( $p < 0.05$ ) and Tukey-HSD among respondents pertaining to awareness and attitude regarding food safety. In addition, in terms of correlation between disease incidence and storages practices, Pearson correlation coefficient was also used in the evaluation of food safety awareness and attitude of respondents.

### Results and Discussion

Mean awareness scores obtained by the respondents have been presented in Table 1 according to various parameters such as age, gender, type of family, family size, education, occupation and annual family income.

**Table 1:** Comparison of Food Safety Awareness Score across various categories (N=300)

Category		Mean Score $\pm$ SD	F-Value/t-value (p value)
Total (N= 300)		20.24 $\pm$ 2.85	
Age	18-25 years(n=34)	20.15 $\pm$ 2.78	0.69 (0.56)
	25-35 years(n=83)	20.37 $\pm$ 2.82	
	35-45years(n=108)	20.43 $\pm$ 2.70	
	45 and above(n=75)	19.85 $\pm$ 3.11	
Sex	Male (n=79)	20.34 $\pm$ 2.49	0.38 (0.70)
	Female (n=221)	20.19 $\pm$ 2.97	
Type of the family	Nuclear (n=99)	19.89 $\pm$ 2.87	1.49 (0.14)
	Joint (n=201)	20.41 $\pm$ 2.82	
Family size	Four or less(n=161)	20.53 $\pm$ 2.71	1.95 (0.051)
	More than 5(n=139)	19.89 $\pm$ 2.97	
Education	Up to 12 <sup>th</sup> standard (n=52)	18.31 $\pm$ 4.10	26.20** (0.001)
	Graduate (n=140)	20.01 $\pm$ 1.84	
	Post graduation (n=108)	20.24 $\pm$ 2.61	
Occupation	Business (n= 163)	19.63 $\pm$ 2.79	4.21** (0.00)
	Service(n=135)	20.98 $\pm$ 2.75	
Annual family income	<Rs. 2.5 lakhs (n=33)	18.94 $\pm$ 2.74	4.87** (0.003)
	Rs. 2.5 -5 lakhs(n=118)	19.93 $\pm$ 3.18	
	Rs. 5- 10 lakhs(n=112)	20.65 $\pm$ 2.46	
	>Rs.10 lakhs(n=37)	21.11 $\pm$ 2.45	

\*\*Significant at 1% level

\*significant at 5% level

It can be observed from the above table that mean awareness score of all the respondents came out to be 20.24 out of a maximum of 25. From the available data, it can be stated that the respondents were quite aware about the food safety issues. As evident from the table, the mean awareness score of the respondents, aged 35-45 years came out to be highest i.e. 20.43 among the various age categories. Mean awareness score for the respondents aged 25-35 and 18 -25 years came out to be 20.37 and 20.15, while the awareness score of 19.85

was observed for the respondents aged 30-45 years. Thus the middle aged category of 35-45 years was having better awareness towards food safety as compared to others. The present results were supported by Patil *et al.*, (2005) [17] stated that middle aged adults had better awareness towards food safety as compared to other age categories. There was no significant difference in the mean awareness score of various age groups.

On the basis of gender, the respondents were divided into two categories. It can be seen from the table that a highest mean score of 20.34 was observed in case of male respondents as compared to female respondents (20.19/25) and no significance difference was found in the respondents belonging to male and female category.

On the basis of educational qualification, the respondents were divided into three categories. It can be seen from the table that the highest mean score of 20.24 was observed in case of postgraduates followed by the graduates (mean score-20.01) and then lastly upto 12<sup>th</sup> standard (mean score-18.31). There was a significant difference in the mean awareness score obtained by various categories segregated on the basis of the educational qualification ( $p < 0.01$ ). It was concluded from the results that mean awareness score about food safety issues increased with increase in the educational level of the respondents. Similarly Sharma and Sangha (2015) [21] in a study reported that mean awareness about food safety issues increased with an increase in the educational qualification of the respondents.

On the basis of type of family respondents belonging to joint family were having higher mean score of 20.41 as compared to the respondents that belong to the nuclear family (19.89/25). There was no significant difference between these two categories.

The respondents from the service class were having mean score of 20.98 about the food safety issues, while the respondents from the business class were having less mean awareness score of 19.63. There was a significant difference among the means of the business and service class ( $p < 0.01$ ). Higher mean awareness score in case of service class as compared to that of business class can be attributed to the usual trend of obtaining higher education in case of service class as compared to the business class.

Respondents having four or less family members were having highest mean awareness score of 20.53 while the respondents with the family size more than 5 were having mean awareness score of 19.89. There was no significant difference among means of various groups based on the family size.

Further, it can be seen from the table that the respondents having family income of more than Rs 10 lakhs were having relatively higher mean awareness score of 21.11 as compared to the other groups, segregated on the basis of annual family income. The respondents having annual family income from Rs.5 to 10 lakhs were found to have mean awareness score of 20.65 followed by annual family income Rs.2.5 to 5 lakhs (mean score- 19.93). While the least mean awareness score of 18.94 was found in the annual family income less than Rs.2.5 lakhs. The mean scores of the four groups made on the basis of annual family income were significantly different ( $p < 0.001$ ).

#### Attitude of respondents towards issues related to food safety

The mean scores of the attitude of respondents towards issues related to food safety presented in Table 2. It can be seen from the table that the respondents were agreeing to the statement that hand washing with soap was important before cooking with the highest mean score of 4.84. Similarly Wilcock *et al.*, (2004) [27] conducted a study in the US showing that 86% of the respondents are aware of the fact that hand washing practice prevent food poisoning, only 66% of them washed their hands only after touching raw meat and poultry. A study was conducted by Anderson *et al.*, (2004) [4] that hand washing was inadequate. Unwashed hands were the most common reason of cross-contamination. Thus consumers made many foods handling errors during its procurement, preparation and storing thus increasing risk of food borne illness. The respondents understood the importance of the personal hygiene which was important for food safety with second highest mean score of 4.83. Respondents also showed agreement on the fact that the “food we consume for eating should be kept covered”, as the mean score came out to be 4.75. It was very important to ensure that food should be cooked thoroughly for appropriate time and temperature. The respondents agreed with this statement with a mean score of 4.71.

**Table 2:** Attitude of respondents towards food safety

	Parameters	Mean $\pm$ SD (n= 300)	Z value (p-value)
1	Food should be kept covered.	4.75 $\pm$ 0.56	54.57** (<0.0001)
2	Freshly prepared food is good for health.	4.70 $\pm$ 0.46	64.15** (<0.0001)
3	Leftover foods cause health problems.	4.61 $\pm$ 0.58	48.05** (<0.0001)
4	Hand washing with soap is important before cooking.	4.84 $\pm$ 0.50	63.48** (<0.0001)
5	Sterilization of utensils is important.	4.15 $\pm$ 0.82	24.49** (<0.0001)
6	Boiling water before consumption is effective.	4.56 $\pm$ 0.54	49.97** (<0.0001)
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	4.03 $\pm$ 0.81	21.98** (<0.0001)
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	4.38 $\pm$ 0.66	36.44** (<0.0001)
9	Personal hygiene is important for food safety.	4.83 $\pm$ 0.39	81.57** (<0.0001)
10	Thawing perishable food on the kitchen counter is good.	2.80 $\pm$ 1.01	3.36** (<0.001)
11	It is important to use thermometer while cooking?	2.78 $\pm$ 0.92	4.14** (<0.0001)
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	4.61 $\pm$ 0.50	55.35** (<0.0001)
13	It is important to ensure that food is always cooked thoroughly.	4.71 $\pm$ 0.45	65.52** (<0.0001)
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	4.59 $\pm$ 0.75	36.80** (<0.0001)

Mean compared against midpoint of the scale i.e. 3

\*\*Significant at 1% level \*significant at 5% level

The respondents also agreed to the statement on using freshly prepared food as it was always good for health and provides nutrients to the body with the mean score of 4.70. “Always avoid eating leftover food” as they were not good for the health and can cause health problems. The respondents were agreeing with this statement with the mean score of 4.61. The respondents attitude towards serving cooked products on

clean plates with clean utensils with clean hands was important gained a mean score of 4.61, which indicated that the respondents were in agreement with the statement. Respondents showed agreement to the statement that purchasing branded food items with products certification – ISI, AGMARK etc. was necessary and the mean score was found to be 4.59. The respondents were asked to give the

extent of their agreement to the fact that “boiled water before consumption is effective”. The respondents were agreed and gave the mean score of 4.56. The respondents attitude towards knowing the temperature of refrigerator helps in reducing the risk of food borne illness was given a mean score of 4.38. The respondents also understood the importance of sterilization of utensils and gave the statement to a mean score of 4.15. It was good to tie hair, wear apron and gloves while working in the kitchens. The respondents agreed to the statement and gave mean score of 4.03. Alrabadi *et al.*, (2013) [3] reported that only 24 % of the respondents frequently wear gloves in case of cut and wounds and while the other respondents didn't use gloves. The overall attitude of respondents towards thawing of perishable foods on the kitchen counter and use of food

thermometer while cooking was poor as the value were quite below the midpoint of scale i.e.3.

From the available results, it can be stated that all the respondents were having good attitude about food safety as they knew the importance of food safety as the mean score was found to be higher than the midpoint of the scale i.e.3. Results also indicated that personal hygiene; food safety practices were given more importance so as to reduce health related risks. Also Lee *et al.*, (2017) [12] reported that the respondents showed overall good practices towards food safety issues. Akabanda *et al.*, (2017) [2] reported that respondents were very knowledgeable about cleanliness, sanitation procedures and hygiene practices.

**Table 3:** Attitude of respondents towards food safety issues on the basis of gender

S No.	Statements	Mean ± SD		Z value (p- value)
		Male (n = 79)	Female (n=221)	
1	Food should be kept covered.	4.73±0.44	4.76±0.59	0.29 (0.77)
2	Freshly prepared food is good for health.	4.62±0.49	4.73±0.45	1.81 (0.07)
3	Leftover foods cause health problems.	4.72±0.48	4.58±0.61	1.94 (0.054)
4	Hand washing with soap is important before cooking.	4.81±0.56	4.86±0.48	0.68 (0.49)
5	Sterilization of utensils is important.	3.89±0.81	4.24±0.80	3.29** (0.001)
6	Boiling water before consumption is effective.	4.43±0.55	4.61±0.53	2.56* (0.01)
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	3.98±0.78	4.05±0.82	0.67 (0.51)
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	4.28±0.63	4.42±0.66	1.61 (0.11)
9	Personal hygiene is important for food safety.	4.89±0.32	4.81±0.41	1.59 (0.11)
10	Thawing perishable food on the kitchen counter is good.	2.62±0.88	2.87±1.05	1.88 (0.06)
11	It is important to use thermometer while cooking?	2.73±0.92	2.79±0.92	0.52 (0.60)
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	4.57±0.52	4.62±0.49	0.76 (0.45)
13	It is important to ensure that food is always cooked thoroughly.	4.72±0.45	4.71±0.45	0.19 (0.85)
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	4.62±0.69	4.58±0.77	0.47 (0.64)

Mean compared against midpoint of the scale i.e. 3

\*\*Significant at 1% level \*significant at 5% level

The attitude of the respondents towards food safety was studied on gender basis. It can be seen from the Table 3 that overall results showed that female respondents had better attitude towards safety regarding personal hygiene- especially hand washing; tying of hairs and wearing aprons, freshly preparation of food, sterilization of utensils and serving of cooked foods on clean utensils, consuming boiling water before consumption and knowing the temperature of refrigerator helps in reducing illnesses compared to male respondents. Bryd-Bredbenner *et al.*, (2008) [6] reported that studies performed showed that more information and higher perception is being possessed in women than men in terms of food safety practices. Fawzi and Shama (2009) [11] concluded that while practicing personal hygiene, all women washed

their hands after going toilet and 88.5% washed their hands before food preparation. Though only 20% used to wash their hands with warm water and soap. The women also recognized the importance of proper hand washing for preparing safe food, and the majority mentioned that hands should be free of wounds (94.4%), with short and clean nails (95.6%), and cooked food should not be tasted by fingers or by placing unclean spoons (81.9%); while the lowest (33.7%), appreciated the role of apparently health persons as a source of food contamination. Another study of Angelillo *et al.*, (2001) observed that level of education was an indicator of food safety knowledge and additionally women among the respondents had showed a positive attitude and approach towards food-borne diseases at a high degree.

**Table 4:** Attitude of respondents towards food safety issues on the basis of family type

S. No	Statements	Mean±SD		Z value (p-value)
		Joint (n= 99)	Nuclear (n= 201)	
1	Food should be kept covered.	4.81±0.39	4.72±0.61	1.27 (0.20)
2	Freshly prepared food is good for health.	4.69±0.46	4.70±0.46	0.08 (0.94)
3	Leftover foods cause health problems.	4.63±0.71	4.60±0.51	0.048 (0.63)
4	Hand washing with soap is important before cooking.	4.97±0.17	4.78±0.59	3.09** (0.002)
5	Sterilization of utensils is important.	4.24±0.82	4.11±0.81	1.33 (0.19)
6	Boiling water before consumption is effective.	4.61±0.55	4.54±0.54	0.96 (0.34)
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	3.93±0.92	4.07±0.74	1.31 (0.19)
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	4.24±0.74	4.44±0.59	2.57* (0.01)
9	Personal hygiene is important for food safety.	4.79±0.43	4.84±0.37	0.89 (0.37)
10	Thawing perishable food on the kitchen counter is good.	2.79±1.08	2.81±0.98	0.06 (0.95)
11	It is important to use thermometer while cooking?	2.53±0.95	2.90±0.88	3.28** (0.001)
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	4.67±0.47	4.58±0.51	1.45 (0.15)

13	It is important to ensure that food is always cooked thoroughly.	4.72±0.45	4.71±0.45	0.10 (0.92)
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	4.38±0.98	4.69±0.58	3.36** (0.001)

Mean compared against midpoint of the scale i.e. 3

\*\*Significant at 1% level \*significant at 5% level

Attitude of respondents towards food safety was studied on the basis of the family type of respondents. It was observed from the table 4 that overall results revealed that the joint families had better attitude towards food safety as compared to nuclear families with respect to hand washing, covering of cooked food, ensuring thorough cooking of freshly prepared foods, avoid using of left over foods, boiling of water and sterilization of utensils and serving cooked foods in clean plates and utensils. Abuga *et al.*, (2017) [1] observed that 90.9% (355) of the participants had a positive attitude with the proposition that hand washing with soap and running water during food preparation prevents food contamination, 89.6% (345) of the participants had a positive attitude that keeping surface clean reduces risks of contamination.

However, 46.8% (180) had a negative attitude on the statement that using different cutting boards and knives for raw and cooked foods or ready to eat foods is not necessary. A study demonstrates that there was insufficient knowledge among the consumer public on food-borne diseases, hand-washing routines, purchasing food, separating raw and cooked food, thawing and cooling of frozen food therefore, there is need for consumers to undertake education on food safety (Surujlal and Badrie, 2004) [22]. Another study reported by Varghese *et al.*, (2013) [25] majority of the samples (52%) had average knowledge of practice on food safety, 40% had poor knowledge of practice on food safety and 8% had good knowledge of practice on food safety.

**Table 5:** Attitude of respondents towards food safety issues on the basis of occupation

S. No.	Statements	Mean ± SD		Z value (P- value)
		Business (n= 163)	Service (n=135)	
1	Food should be kept covered.	4.79±0.41	4.71±0.69	1.15 (0.25)
2	Freshly prepared food is good for health.	4.68±0.47	4.73±0.45	0.84 (0.40)
3	Leftover foods cause health problems.	4.68±0.56	4.53±0.59	2.19* (0.03)
4	Hand washing with soap is important before cooking.	4.88±0.43	4.81±0.58	1.19 (0.23)
5	Sterilization of utensils is important.	4.02±0.84	4.31±0.77	3.05** (0.002)
6	Boiling water before consumption is effective.	4.55±0.56	4.59±0.52	0.74 (0.46)
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	3.91±0.87	4.17±0.72	2.81* (0.005)
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	4.34±0.68	4.44±0.63	1.30 (0.19)
9	Personal hygiene is important for food safety.	4.85±0.36	4.80±0.42	1.18 (0.24)
10	Thawing perishable food on the kitchen counter is good.	2.88±1.04	2.71±0.99	1.41 (0.16)
11	It is important to use thermometer while cooking?	2.77±0.95	2.78±0.89	0.04 (0.97)
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	4.62±0.51	4.60±0.49	0.34 (0.74)
13	It is important to ensure that food is always cooked thoroughly.	4.69±0.46	4.73±0.44	0.64 (0.52)
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	4.53±0.81	4.10±0.65	1.61 (0.11)

Mean compared against midpoint of the scale i.e. 3

\*\*Significant at 1% level \*significant at 5% level

Attitude of respondents towards food safety was also studied on the basis of the occupation of respondents. From the table 5, the overall results showed that both the classes (business and service class) had better attitude towards food safety with respect to personal hygiene- especially hand washing, wearing apron and gloves during kitchen work, sterilization of utensils, preparation of fresh food, avoiding left over foods,

cooking food thoroughly and purchasing branded food items. Thelwell-Reid, (2014) [23] reported that the majority of food handlers reported satisfactory practices with respect to hand washing questions in that 78% of food handlers washed hands before touching cooked foods and 65.4% before touching unwrapped raw foods. Eighty-one percent always or sometimes sanitized utensils after washing them.

**Table 6:** Attitude of respondents towards food safety issues on the basis of educational qualification

S. No	Statement	Category	Mean ± SD	F-value (p value)
1	Food should be kept covered.	Upto 12th standard	4.75 <sup>a</sup> ±0.44	0.42 (0.655)
		Graduation	4.72 <sup>a</sup> ±0.61	
		Post - graduation	4.79 <sup>a</sup> ±0.53	
2	Freshly prepared food is good for health.	Upto 12th standard	4.69 <sup>a</sup> ±0.47	2.06 (0.130)
		Graduation	4.65 <sup>a</sup> ±0.48	
		Post - graduation	4.77 <sup>a</sup> ±0.42	
3	Leftover foods cause health problems.	Upto 12th standard	4.31 <sup>b</sup> ±0.85	10.19** (0.000)
		Graduation	4.72 <sup>a</sup> ±0.45	
		Post - graduation	4.62 <sup>a</sup> ±0.52	
4	Hand washing with soap is important before cooking.	Upto 12th standard	4.87 <sup>a</sup> ±0.34	0.28 (0.760)
		Graduation	4.86 <sup>a</sup> ±0.35	
		Post - graduation	4.82 <sup>a</sup> ±0.69	
5	Sterilization of utensils is important	Upto 12th standard	4.23 <sup>ab</sup> ±0.92	4.95**

		Graduation	4.00 <sup>b</sup> ±0.85	(0.008)
		Post - graduation	4.32 <sup>a</sup> ±0.68	
6	Boiling water before consumption is effective.	Upto 12th standard	4.40 <sup>b</sup> ±0.69	4.41*
		Graduation	4.54 <sup>ab</sup> ±0.49	(0.013)
		Post - graduation	4.67 <sup>a</sup> ±0.49	
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	Upto 12th standard	3.71 <sup>b</sup> ±1.01	5.02**
		Graduation	4.11 <sup>a</sup> ±0.73	(0.007)
		Post - graduation	4.07 <sup>a</sup> ±0.76	
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	Upto 12th standard	4.23 <sup>a</sup> ±0.83	1.64
		Graduation	4.41 <sup>a</sup> ±0.56	(0.196)
		Post - graduation	4.41 <sup>a</sup> ±0.67	
9	Personal hygiene is important for food safety.	Upto 12th standard	4.77 <sup>a</sup> ±0.43	0.71
		Graduation	4.84 <sup>a</sup> ±0.37	(0.494)
		Post - graduation	4.83 <sup>a</sup> ±0.39	
10	Thawing perishable food on the kitchen counter is good.	Upto 12th standard	2.81 <sup>a</sup> ±1.29	1.49
		Graduation	2.90 <sup>a</sup> ±0.93	(0.226)
		Post - graduation	2.68 <sup>a</sup> ±0.95	
11	It is important to use thermometer while cooking.	Upto 12th standard	2.52 <sup>a</sup> ±1.04	2.54
		Graduation	2.83 <sup>a</sup> ±0.86	(0.080)
		Post - graduation	2.83 <sup>a</sup> ±0.92	
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	Upto 12th standard	4.77 <sup>a</sup> ±0.43	3.45*
		Graduation	4.59 <sup>b</sup> ±0.52	(0.033)
		Post - graduation	4.56 <sup>b</sup> ±0.49	
13	It is important to ensure that food is always cooked thoroughly.	Upto 12th standard	4.65 <sup>a</sup> ±0.48	1.00
		Graduation	4.75 <sup>a</sup> ±0.43	(0.369)
		Post - graduation	4.69 <sup>a</sup> ±0.46	
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	Upto 12th standard	4.06 <sup>b</sup> ±1.29	17.73
		Graduation	4.72 <sup>a</sup> ±0.49	(0.000)
		Post - graduation	4.67 <sup>a</sup> ±0.53	

Mean compared against midpoint of the scale i.e. 3

Tukey HSD ( $p < 0.05$ ) : means with different superscripts are significantly different

\*\*Significant at 1% level \*significant at 5% level

Attitude of respondents towards food safety was studied on the basis of the educational qualification of respondents. It can be seen from the table 6 that the postgraduates and graduates agreed with the statement that personal hygiene was important for food safety with a mean score of 4.84 and 4.83 as compared to 12<sup>th</sup> pass respondents (4.77). Also the higher mean score of 4.41 was given by the postgraduates and graduates to the statement that knowing the temperature of refrigerator helps in reducing the risk of food borne illness as compared to 12<sup>th</sup> pass respondents. Post graduates were more aware about that food should be kept covered showing agreement to the statement with a mean score of 4.79 as compared to graduates and 12<sup>th</sup> pass respondents. It was important to use freshly prepared food which was good for health. The postgraduates were in agreement with the statement with a highest mean score of 4.77. Boiling water before consumption was effective were also given by the postgraduates with a higher mean score of 4.67 showing a significant difference ( $p < 0.05$ ) in the mean score given by the three categories. Sterilization of utensils was important and the higher score (4.32) were given by the post graduates respondents showing a significant difference ( $p < 0.01$ ) in the mean score given by the three categories. A significantly ( $p < 0.01$ ) higher mean scores were given by the graduate respondents to the practices: leftover foods cause health problems (4.72) and it was good to tie hairs, wear apron and

gloves while working in the kitchens (4.11) compared to other categories. Also graduates respondents agreed that it was important to ensure that food should be cooked thoroughly and purchasing branded food items with products certification – ISI, AGMARK etc. was necessary with a mean score of 4.75 and 4.72 respectively. And a significantly ( $p < 0.05$ ) higher mean scores were given up to 12<sup>th</sup> class respondents to the statement that serving cooked products on clean plates with clean utensils with clean hands was important with a mean score (4.77) as compared to other categories.

The overall results showed that the higher the education qualification better was the attitude of respondents so it clearly reflects that post graduates and graduates had better attitudes towards food safety. The present study was supported by Sharma and Sangha (2015) [21] reported that post graduates and graduates were having better attitude towards food safety as compared to 12<sup>th</sup> pass respondents. On the contrary Lee *et al.*, (2017) [12] reported the respondents who had not received any formal education had better attitude towards food safety than those who had received primary education. A study demonstrates that there is insufficient knowledge among the consumer public on hand-washing routines, purchasing food, separating raw and cooked food, thawing and cooling of frozen food therefore, there is need for consumers to undertake education on food safety (Surujlal and Badrie, 2004) [22].

**Table 7:** Attitude of the respondents towards food Safety on basis of various parameters

S. No	Statement	Age	Family income	Family size
1	Food should be kept covered.	6.72** (0.000)	1.92 (0.126)	1.83 (0.07)
2	Freshly prepared food is good for health.	1.87 (0.134)	1.01 (0.389)	0.17 (0.86)
3	Leftover foods cause health problems.	0.13 (0.941)	0.21 (0.889)	0.35 (0.73)
4	Hand washing with soap is important before cooking.	4.48** (0.004)	5.77** (0.001)	1.56 (0.12)
5	Sterilization of utensils is important.	4.01** (0.006)	2.00 (0.114)	0.24 (0.81)
6	Boiling water before consumption is effective.	0.37 (0.778)	1.18 (0.320)	0.92 (0.36)
7	It is good to tie hairs, wear apron and gloves while working in the kitchens.	1.08 (0.357)	5.22** (0.002)	2.41* (0.02)
8	Knowing the temperature of refrigerator helps in reducing the risk of food borne illness.	2.81* (0.040)	3.19* (0.024)	0.67 (0.50)
9	Personal hygiene is important for food safety.	0.69 (0.561)	0.88 (0.454)	0.27 (0.79)
10	Thawing perishable food on the kitchen counter is good.	2.52 (0.058)	2.59 (0.053)	0.53 (0.59)
11	It is important to use thermometer while cooking?	1.99 (0.115)	2.21 (0.087)	1.94* (0.05)
12	Serving cooked products on clean plates with clean utensils with clean hands is important.	4.16** (0.007)	6.74** (0.000)	1.46 (0.15)
13	It is important to ensure that food is always cooked thoroughly.	1.66 (0.176)	0.26 (0.851)	0.29 (0.77)
14	Purchasing branded food items with products certification – ISI, AGMARK etc. is necessary.	2.63* (0.05)	6.22** (0.000)	2.59* (0.01)

Values in cells are F- value with p- value in parenthesis

\*\*Significant at 1% level \*significant at 5% level

Data obtained from the respondents regarding their attitude towards food safety was further analyzed on the basis of age, family size and family income of the respondents in table 7. Data showed the significant difference in the mean scores given by the respondents segregated on the basis of various age categories with respect to importance of hand washing, sterilization of utensils, food should be kept covered, serving cooked products on clean plates and utensils and always purchasing branded food items ( $p < 0.01$ ). Further it was revealed that the respondents aged between 35 to 45 years, mostly the middle aged adults having better attitude towards food safety.

It can be seen from the table that there was significant difference among the mean score given by the various categories of the respondents segregated on the basis of their family income with respect to some statements related to attitude towards food safety issues ( $p < 0.01$ ) with respect to hand washing, wearing aprons and gloves and serving food on clean plates and purchasing branded items. Further it can be seen that the respondents having annual family income  $> Rs. 10$  lakhs per annum were having better food safety awareness.

Significant difference was found across various groups made on the basis of family size of the respondents.

It can be seen that significant difference ( $p < 0.05$ ) was found in the means of various categories devised on the basis of family size with respect to importance of tying hairs, wearing apron gloves while working in kitchens and use of thermometer while cooking and purchase of branded items. It can be seen that respondents belonging to the family having less than 4 members were having better attitude towards food safety. Also the statement knowing the temperature of refrigerator helps in reducing the risk of food borne illness there was significant difference in the mean score given by the respondents segregated on the basis of age and income ( $p < 0.05$ ) and a higher mean score was given by the age category from 35 to 45 years and income category of  $> Rs 10$  lakhs per annum. Roseman and Kurzynske (2006) [19] in a study, they found that age, sex, income, occupation and educational levels all influence the food safety knowledge and behaviors of the consumers. Choudhury *et al.*, (2011) [7] also revealed that there was high degree of association between average incomes with knowledge on food safety.

**Table 8:** Over all correlation between awareness and attitude of respondents with food borne disease incidences

S No.	Parameters	Correlation With Food Borne Disease Incidence
1	Awareness regarding Food safety	-0.19**
2	Attitude regarding food safety	-0.09

For the purpose of finding out the overall food safety awareness and attitude of respondents with incidence of food borne diseases correlation analysis was used. Results obtained

from the correlation analysis have been presented in table 8. It can be seen from the table that significant negative correlation ( $p < 0.01$ ) was found between awareness and incidence of food

borne diseases. Thus indicating that respondents with better food safety awareness were having low incidences of food borne diseases. A study conducted by Meer and Mishner (2000) [15] concluded that consumers have inadequate knowledge and awareness about procedures needed to prevent food borne illness at home. Muinde and Kuria (2005) [16] determined the hygienic awareness and sanitary practices of vendors of street foods in Kenya, it was reported that street food vendors were not aware of hygienic and sanitary practices that further lead to a high incidence of food borne diseases. The incidences of food borne disease were also negatively correlated with attitude of respondents towards food safety, though it was found to be non-significant. This clearly indicates that better attitude towards food safety translated into good food safety practices which reduce the incidences of food borne diseases. According to Cosby *et al.*, (2008) [8] food handlers with good food safety practices reduce contamination risk of food utensils. Some bacteria survive on food utensils if cleaning and sanitizing are ineffective. Liu *et al.*, (2015) [13] conducted a study showing better attitude towards food safety practices in which majority (95.90%) of respondents agreed that everyone should play a role in ensuring food safety, (93.60%) believed it is very important for prevention of food poisoning to improve food safety training, and (92.40%) expected to receive food safety training. The minority (13.50%) of the respondents believed it is unnecessary to have a medical examination, because they were healthy.

The incidence of food borne disease in comparison with the awareness and attitude pertaining to food safety was assessed. The below average mean score of disease incidence was 20.56 and the above mean score found to be 19.98 in relation with food safety awareness. While the below average mean score of disease incidence 4.35 and the above mean score found to be 4.28 in relation with attitude of respondents pertaining to food safety. Thus indicating, that the respondents with better awareness and attitude regarding food safety were having low incidence of food borne diseases.

### Conclusion

The study concluded that all the respondents of Ludhiana district were having quite good food safety awareness scores and better attitude pertaining to food safety issues as the mean score of most of the statements was found above the mid value of 3. Food safety awareness were found to be significantly negatively correlated ( $p < 0.01$ ) with the food borne disease incidences. The incidences of food borne disease were also negatively correlated with attitude of respondents towards food safety, though which was found to be non-significant thus indicating that the respondents who were following better food safety awareness and attitude pertaining to food safety were having quite low chances of incidence of food borne diseases. Therefore there is pertinent need to spread knowledge and awareness among households' members regarding good food safety practices such as personal hygiene especially hand washing with soap, freshly preparation of food, thorough cooking of food, and storage of food at appropriate time-temperature in refrigerator in order to reduce the risk of microbial contamination.

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