

Original Research Article

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Food Safety Knowledge and Procurement Practices in Relation to Food Borne Disease Incidence in Ludhiana District, India

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ABSTRACT

The aim of the present study is to determine knowledge and procurement behavior pertaining to food safety among urban households of Ludhiana district, Punjab. Results revealed that age group from 45 years and above, mostly males, with nuclear families, belonging to business class, mainly postgraduates and having family income from Rs 5 to 10 lakhs were found to have good food safety knowledge scores. Results revealed that female respondents had better procurement practices pertaining to food safety as compared to male respondents. A better procurement behavior towards food safety was found in the respondents who were in middle aged group (35-45 years), from the nuclear families, belonged to service class and having annual family income of more than Rs 10 lakhs. Results also revealed that high level of educational qualification affects the adoption of food procurement practices of respondents as the postgraduates were having better food procurement practices as compared to respondents of 12th standard and graduation. Food safety knowledge of respondents was found to be negatively correlated with the food borne disease incidences. While the incidence of food borne diseases were significantly ($p < 0.05$) negatively correlated with procurement practices of respondents towards food safety. Home environment represents an important site for the spread of pathogens responsible for food borne diseases. Most of the purchased foods are considered safe but there is need to educate consumers adopt good hygiene practices in the home setting, consumers need to be informed about safety procedures followed during purchasing of foods to food handling, storage and preparation of food.

Keywords

Food safety, Knowledge, Procurement practices, Pathogens, Food borne disease incidence

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Introduction

The incidence of food-borne diseases has been on the increase, often associated with outbreaks, and threatens global public health security and raises international concern (Kuchenmuller *et al.*, 2013). Every year, millions of people worldwide die and many are hospitalized from food borne diseases and illnesses as a result of consumption of

contaminated food (Knight *et al.*, 2003). The World Health Organization in 2005 reported that 1.8 million deaths alone resulted from diarrheal diseases, most of which were attributed to the ingestion of contaminated food and drinking water (WHO, 2006). At the moment, most purchased foods are considered safe; however, there still remains the need for consumers to correctly preserve these food items. Indeed, consumers represent the final

step for food preparation and prevention of food borne illnesses (Redmond and Griffith, 2003). It was difficult to identify microbiological hazards during food purchase because of the large range of measures adapted by consumers without any proper education and training. Most of the participants relied upon indirect clues, like the appearance of food while judging food safety which was also found in some previous studies (Grunert, 2002).

Consumers need to obtain necessary information for applying practical measures during food purchase which will significantly impact better decision-making. Consumers also need to be aware of practices that are potentially hazardous while purchasing foods. Although product traceability is mandatory for tracking product origin, survey showed that participants considered the brand name to be more important (Verbeke *et al.*, 2007). The consumers represent the final link in the food safety chain. The purchasing power, level of awareness and knowledge of the consumers are the important factors for ensuring food safety (Sanlier *et al.*, 2011). Thus, by enhancing the consumer knowledge of safety rules would minimize pathogenic microorganisms in food. Great academic interest has been given to investigate the knowledge and self reported practices of food safety overall the world (Redmond and Griffith, 2003). The studies that examined the effect of demographic characteristics on consumer's food safety knowledge and practices generally found that they were more likely to increase with age, the level of education and experience in food preparation [8- 10](Bruhn and Schutz, 1999; Roseman and Kurzynske, 2006; Kleef *et al.*, 2006). Therefore, this study aimed at investigating food-safety knowledge and procurement behavior on various parameters (gender, family type, occupation, annual family income) pertaining to food safety.”

Materials and Methods

The present study was undertaken to explore knowledge and procurement behavior 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 with respect to knowledge of respondents regarding food safety. For finding out the knowledge of the respondents, they were asked 10 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 10. For determining the procurement practices of the respondents towards food safety, 13 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 knowledge and procurement behavior regarding food safety. In addition, in terms of correlation between food borne disease incidence and practices, Pearson correlation coefficient was used in the evaluation of food safety knowledge and procurement practices of respondents.

Results and Discussion

Food safety knowledge

Mean knowledge 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.

It can be seen from the table 1 that mean knowledge score of all the respondents came out to be 7.33 out of a maximum of 10. From the available data, it can be stated that the respondents were quite knowledgeable about the food safety issues. As evident from the table, the mean knowledge score of the respondents, aged 45 and above years came out to be highest i.e. 7.56 followed by the respondents aged between 18 to 25 years with a mean score of 7.53. And mean knowledge score for the respondents aged 25-35 and 35 - 45 years came out to be 7.39 and 7.34 respectively.

The age of the respondents didn't have any effect on the knowledge score of the respondents as each age group is equally knowledgeable about food safety issues. There was no significant difference among the means of various groups based on the age of the respondents. On the contrary in a study the knowledge mean score pertaining to food safety was found to be low among the

participants due to poor food safety knowledge (Green and Knechtges, 2015)

On the basis of gender, the respondents were divided into two categories. It can be seen from the table the highest mean score of 7.66 was observed in case of male respondents as compared to female respondents (7.35 /10) and no significance difference was found in the respondents belonging to the gender category. On contrary both genders were rather equally knowledgeable on the investigated food safety issues, though; women obtained better knowledge mean scores than men as regards food microbiology/ cross-contamination outcomes (Byrd-Bredbenner *et al.*, 2007)

On the basis of type of family respondents belonging to nuclear family were having higher mean score of 7.49 as compared to the respondents that belong to the joint family (7.41/10). There was no significant difference between these two categories.

Respondents having four or less family members were having highest mean knowledge score of 7.40 while the respondents with the family size ranging more than 5 having mean awareness score of 7.24. There was no significant difference among means of various groups based on the family size.

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 7.60 was observed in case of postgraduates followed by the graduates (mean score-7.30) and then lastly up to 12th standard (mean score-6.81).

There was a significant difference in the mean knowledge score obtained by various categories segregated on the basis of the educational qualification ($p < 0.01$). It can be

concluded from the results that mean knowledge score about food safety issues increased with increase in the educational level of the respondents.

The respondents from the business class were having mean score of 7.52 about the food safety issues, while the respondents from the service class were having less mean knowledge score of 7.34. There was a no significant difference among the means of the business and service class.

Further, it can be seen from the table that the respondents having family income of Rs 5 to 10 lakhs were having relatively higher mean knowledge score of 7.46 as compared to the other groups, segregated on the basis of annual family income.

The respondents having annual family income from Rs.2.5 to 5 lakhs were found to have mean knowledge score of 7.36 followed by annual family income of more than Rs 10 lakhs (mean score- 7.27). While the least mean awareness score of 6.82 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 ($p < 0.05$). A study showed that age, sex, income, occupation and educational levels all influence the food safety knowledge and behaviors of the consumers [9]

The effect of demographic characteristics on consumer's food safety knowledge and practices were found to be more likely to increase with age, level of education and experience in food preparation [10]. On contrary the majority of the consumers i.e. 59% of them had poor knowledge on food safety and 41% had average knowledge on food safety and there were no subjects with good knowledge on food safety (Varghese *et al.*, 2013).

Procurement practices

The mean scores of the procurement practices of the respondents towards issues regarding food safety is presented in table 2.

It can be seen from the table that the respondents were agreed to the statement that "attention should be paid to the cleanliness/ place of the store you purchase your food from" with the highest mean score of 4.81. The respondents understood the importance of "checking the expiration date before purchasing food products" with second highest mean score of 4.71. In a study with respect to the purchasing behavior of the respondents, (68%) of them always check the expiration date before purchasing the food products. (32%) always check the food package before purchase and (43%) purchase out very frequently (Alrabadi *et al.*, 2013). Respondents also showed agreement on the fact that "attention should be paid to the trade mark or the producer of the product", as the mean score came out to be 4.57. In contrast with this study (48%) of the consumers in Hyderabad, bought packed foods and majority (78%) did not recognized symbols on food labels (Sudershan *et al.*, 2008). It was very important to check food packages if they have been opened or damaged. The respondents agreed with this statement with a mean score of 4.52.

The respondents also agreed to the statement on "paying attention to the nutritional value of the product" with the mean score of 4.46. "Always put frozen foods in the freezer immediately on reaching home". The respondents agreed with this statement with the mean score of 4.37. The respondents gave a mean score of 4.31 to procurement practices towards "preparation instructions printed on the packs should be followed" which indicated that the respondents were in agreement with the statement. And even the respondents agreed to this statement and also "followed the

storage instructions printed on the food products” with a mean score of 4.16. The respondents were asked to give the extent of their agreement to the fact that “purchasing should be done only from the packaged food items” and a mean score of 4.16 was given which showed that the respondents agreed to the statement. The respondents also understood that “attention should be paid to the ingredients of the product you purchase”. This statement gave a mean score of 4.11. The procurement practices of respondents towards “checking cooling temperature for frozen foods” and “ensuring proper handling of frozen foods” was found to be 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 procurement practices regarding food safety as they knew the importance of food safety in terms of nutritional value, trade mark and expiration date of product as the mean score was found to be higher than the midpoint of the scale i.e.3. In a study (39 %) of the respondents always pay attentions to the trade mark or the producer of the food product, (42%) respondents do it frequently and (84%) of the respondents always or frequently put frozen foods in the freezer immediately on reaching home. Results also indicated that product hygiene and cleanliness were given more importance so as to reduce health related issues (Alrabadi *et al.*, 2013). Another study observed that price was the topmost motivator of food purchasing behaviors and that the energy, nutritional elements and especially the amount of fat in the food as stated on product label have more or less influence on the choices of consumers (Kolodinsky *et al.*, 2008).

The procurement practices of the respondents towards food safety were studied on the basis of their gender. It can be seen from the table 3 that overall results revealed that female

respondents had better procurement behavior towards safety regarding checking the expiration dates before purchasing of food products, checking food packages if opened or damaged, following preparation instructions on packs, putting frozen foods in freezer before reaching home, and attention given to the nutritional value and purchased packed products as compared to male respondents. According to a study 47.3 percent of the respondents preferred grocery shopping on a weekly basis while 39.1 percent of them prefer purchasing on a daily basis and during food purchases, women, married couples, recent graduates workers reported to always control the expiration date. Other important factors considered were integrity of the package, price and appearance of the food. Moreover, females were influenced by the brand name (Langiano *et al.*, 2012). In another study (18 %) of the respondents stated that they would not eat food beyond the best-before date, whereas (70%) said that they first smell and taste the food before discarding it. The remaining respondents said that it depends on the type of food. In comparison, (46%) of the respondents answered that they would not consume a food product after the consume-by date, whereas (30%) of them would first smell and taste the food before discarding it (Marklinder *et al.*, 2004).

Food procurement practices of respondents towards food safety were also studied on the basis of the family type of respondents. It can be seen from the table 4 that results showed that nuclear families had better procurement behavior towards safety regarding checking the expiration dates before purchasing of food products, checking food packages if opened or damaged, following preparation instructions on packs, putting frozen foods in freezer before reaching home, and attention given to the nutritional value, trade mark and purchasing of packed food products as compared to joint families. From a study

(40%) of respondents were aware that the package they purchased had a label on it gives instructions for safe cooking and handling of food products (Nesbitt *et al.*, 2009). Another study reported that (85%) of respondents claimed to read labels and followed cooking and storage instructions for all foods (Léger Marketing, 2011).

Food procurement practices of respondents towards food safety were also studied on occupation basis of respondents. It was observed from the table 5 that overall results showed that respondents of service class had better attitude towards food safety as compared to business class respondents regarding paying attention to the cleanliness of the store/ place, checking the expiration dates before purchasing of food products, checking food packages if opened or damaged, following preparation and storage instructions on packed foods, putting frozen foods in freezer before reaching home, and attention given to the ingredients, nutritional value, trade mark and purchasing of packed food items. A study suggested that most of the food and grocery items are purchased in loose form from the nearby outlets. Fruits and vegetables are mostly purchased daily or twice a week due to their perishable nature, whereas grocery items are less frequently purchased (Ali *et al.*, 2010). In addition to expiry and best before dates, participants looked for storage instructions, cooking or preparation instructions and contents or ingredients on food labels (Phoenix Strategic Perspectives Inc, 2006).

Food procurement practices of respondents towards food safety were studied on the basis of the educational qualification of the respondents in table 6. Data showed that educational qualification of the respondents effect the adoption of food procurement practices as the postgraduates were having better food procurement practices. A

significantly ($p < 0.01$) higher mean scores were given by the post graduate respondents to the practices- “checking the expiration date before purchasing food products”(4.86), “putting frozen foods in the freezer immediately on reaching home”(4.64), “attention paid to the trade mark or the producer of the product”(4.73), “attention paid to the nutritional value of the product”(4.59), preparation instructions printed on the packs” should be followed(4.41) “purchase only the packaged food items” (4.25) and “giving attention to the ingredients of the product you purchase”(4.23) as compared to other categories.

Also higher mean score was again given by the post graduates to the statement that “paying attention to the cleanliness/ place of the store you purchase food from” (4.88) and “always follow storage instructions printed on the food products” (4.20). The post graduates respondents from the household again showed better food procurement practices and an agreement with respect to following statement that “checking food packages if they have been opened or damaged” with a higher mean score of (4.61) showing a significant difference ($p < 0.05$) in the mean scores as compared to other categories. Post graduates were again agreed to the statement that purchasing perishable items on daily basis was necessary having a mean score of 3.33 as compared to other counter parts. Over all data showed that higher the education qualification better was the food procurement practices. Present results were supported by this study in which the respondents having advanced specific knowledge demonstrated significantly for better understanding of food safety issues (Akabanda *et al.*, 2017).

Data obtained from the respondents regarding food procurement practices was further analyzed on the basis of age, family size and family income of the respondents.

Table.1 Comparison of Food safety knowledge score across various categories (N= 300)

Category		Mean Score ± SD	F-value / t- value (p value)
Total (N=300)		7.33±0.06	
Age	18-25 years(n=34)	7.53±0.96	0.40 (0.752)
	25-35 years(n=83)	7.39±0.94	
	35-45years(n=108)	7.34±1.08	
	45 and above(n=75)	7.56±0.26	
Sex	Male (n=79)	7.66±1.71	1.62 (0.106)
	Female (n=221)	7.35±1.32	
Type of the family	Nuclear (n=99)	7.49±0.21	0.43 (0.664)
	Joint (n=201)	7.41±0.07	
Family size	Four or less(n=161)	7.40±1.07	1.38 (0.168)
	More then 5(n=139)	7.24±1.00	
Education	Up to 12 th standard (n=52)	6.81±1.28	10.94** (0.0001)
	Graduate (n=140)	7.31±0.80	
	Post graduation (n=108)	7.60±1.09	
Occupation	Business (n= 163)	7.52±1.64	1.04 (0.299)
	Service(n=135)	7.34±1.15	
Annual family income	<Rs. 2.5 lakhs (n=33)	6.82±1.18	3.43* (0.018)
	Rs. 2.5 -5 lakhs(n=118)	7.36±0.95	
	Rs. 5- 10 lakhs(n=112)	7.46±1.09	
	>Rs.10 lakhs(n=37)	7.27±0.90	

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

Table.2 Food procurement practices of respondents regarding food safety

S. No.	Statements	Mean ±SD (n= 300)	Z value (p-value)
1	Check the expiration date before purchasing food products.	4.71±0.49	59.63** (<0.0001)
2	Purchase only the packaged food items.	4.16±0.76	26.31** (<0.0001)
3	Purchase perishable food items on daily basis.	3.21±1.15	3.16** (<0.002)
4	Check food packages if they have been opened or damaged.	4.52±0.68	38.72** (<0.0001)
5	Check cooling temperature for frozen foods.	2.49±1.08	8.25** (<0.0001)
6	Ensure proper handling of frozen foods daily.	2.69±1.22	4.44** (<0.0001)
7	Follow storage instructions printed on the food products.	4.16±0.85	23.65** (<0.0001)
8	Follow preparation instructions printed on the packs.	4.31±0.69	32.68** (<0.0001)
9	Put frozen foods in the freezer immediately on reaching home.	4.37±0.95	24.93** (<0.0001)
10	Give attention to the ingredients of the product you purchase.	4.11±0.77	25.10** (<0.0001)
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	4.81±0.47	67.23** (<0.0001)
12	Pay attention to the nutritional value on the pack of the product.	4.46±0.57	43.97** (<0.0001)
13	Pay attention to the trade mark or the producer of the product.	4.57±0.72	38.05** (<0.0001)

Mean compared against midpoint of the scale i.e. 3
 **Significant at 1% level *significant at 5% level

Table.3 Food procurement practices regarding food safety of respondents on basis of gender

S.No.	Statements	Mean ± SD		Z value (P-value)
		Male (n = 79)	Female (n=221)	
1	Check the expiration date before purchasing food products.	4.69±0.54	4.72±0.48	0.29 (0.77)
2	Purchase only the packaged food items.	4.32±0.67	4.10±0.79	2.14* (0.03)
3	Purchase perishable food items on daily basis.	3.15±1.23	3.23±1.12	0.52 (0.60)
4	Check food packages if they have been opened or damaged.	4.51±0.57	4.53±0.72	0.26 (0.79)
5	Check cooling temperature for frozen food.	2.69±1.12	2.41±1.05	2.03* (0.04)
6	Ensure proper handling of frozen foods.	2.63±1.06	2.71±1.28	0.46 (0.65)
7	Follow storage instructions printed on the food products.	4.17±0.94	4.16±0.82	0.02 (0.98)
8	Follow preparation instructions printed on the packs.	4.24±0.66	4.34±0.70	1.04 (0.30)
9	Put frozen foods in the freezer immediately on reaching home.	4.33±1.03	4.38±0.92	0.41 (0.68)
10	Give attention to the ingredients of the product you purchase.	4.03±0.78	4.14±0.76	1.15 (0.25)
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	4.84±0.49	4.79±0.46	0.64 (0.52)
12	Pay attention to the nutritional value on the pack of the product.	4.41±0.54	4.48±0.58	-0.93 (0.35)
13	Pay attention to the trade mark or the producer of the product.	4.67±0.59	4.54±0.75	1.41 (0.16)

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

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

Table.4 Food procurement practices regarding food safety of respondents on basis of family type

S.No.	Statements	Mean±SD		Z value (p value)
		Joint (n= 99)	Nuclear (n=201)	
1	Check the expiration date before purchasing food products.	4.69±0.52	4.72±0.48	0.32 (0.75)
2	Purchase only the packaged food items.	4.01±0.74	4.23±0.76	2.41* (0.02)
3	Purchase perishable food items on daily basis.	3.02±1.14	3.30±1.14	2.02* (0.05)
4	Check food packages if they have been opened or damaged.	4.47±0.67	4.54±0.68	0.87 (0.39)
5	Check cooling temperature for frozen foods.	2.42±1.17	2.52±1.03	0.70 (0.48)
6	Ensure proper handling of frozen foods.	2.82±1.21	2.62±1.22	1.31 (0.19)
7	Follow storage instructions printed on the food products.	4.16±0.91	4.16±0.82	0.02 (0.98)
8	Follow preparation instructions printed on the packs.	4.30±0.72	4.31±0.68	0.12 (0.90)
9	Put frozen foods in the freezer immediately on reaching home.	4.10±1.20	4.49±0.76	3.46** (0.001)
10	Give attention to the ingredients of the product you purchase.	4.12±0.86	4.10±0.71	0.18 (0.86)
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	4.84±0.38	4.78±0.49	1.09 (0.28)
12	Pay attention to the nutritional value on the pack of the product.	4.43±0.67	4.47±0.51	0.47 (0.64)
13	Pay attention to the trade mark or the producer of the product.	4.50±0.68	4.57±0.73	.041 (0.97)

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

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

Table.5 Food procurement practices regarding food safety of respondents on basis of occupation

S. No	Statements	Mean ± SD		Z value (p-value)
		Business n= 163	Service n= 135	
1	Check the expiration date before purchasing food products.	4.64±0.54	4.79±0.42	2.69** (0.007)
2	Purchase only the packaged food items.	4.20±0.76	4.10±0.77	1.11 (0.27)
3	Purchase perishable food items on daily basis.	3.12±1.14	3.30±1.16	1.36 (0.18)
4	Check food packages if they have been opened or damaged.	4.45±0.69	4.61±0.66	1.94 (0.05)
5	Check cooling temperature for frozen foods.	2.47±1.05	2.50±1.09	0.25 (0.80)
6	Ensure proper handling of frozen foods.	2.63±1.19	2.76±1.25	0.91 (0.36)
7	Follow storage instructions printed on the food products.	4.16±0.80	4.17±0.92	0.11 (0.91)
8	Follow preparation instructions printed on the packs.	4.19±0.71	4.47±0.64	3.49** (0.001)
9	Put frozen foods in the freezer immediately on reaching home.	4.32±1.02	4.43±0.86	0.99 (0.32)
10	Give attention to the ingredients of the product you purchase.	4.11±0.73	4.12±0.81	0.09 (0.93)
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	4.80±0.43	4.82±0.51	0.206 (0.84)
12	Pay attention to the nutritional value on the pack of the product.	4.43±0.59	4.49±0.56	1.00 (0.32)
13	Pay attention to the trade mark or the producer of the product.	4.61±0.60	4.54±0.84	0.79 (0.43)

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

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

Table.6 Food procurement practices regarding food safety of respondents on basis of educational qualification

S.No	Statement	Category	Mean ± SD	F-value (p-value)
1	Check the expiration date before purchasing food products.	Upto 12th standard	4.48 ^c ±1.29	11.58** (0.000)
		Graduation	4.68 ^b ±0.47	
		Post - graduation	4.86 ^a ±0.35	
2	Purchase only the packaged food items.	Upto 12th standard	3.87 ^b ±0.77	4.94** (0.008)
		Graduation	4.20 ^a ±0.72	
		Post - graduation	4.25 ^a ±0.78	
3	Purchase perishable food items on daily basis.	Upto 12th standard	2.96 ^a ±1.10	1.84 (0.160)
		Graduation	3.21 ^a ±1.14	
		Post - graduation	3.33 ^a ±1.17	
4	Check food packages if they have been opened or damaged.	Upto 12th standard	4.29 ^b ±0.94	4.13* (0.017)
		Graduation	4.54 ^a ±0.58	
		Post - graduation	4.61 ^a ±0.64	
5	Check cooling temperature for frozen foods.	Upto 12th standard	2.14 ^b ±1.05	3.82* (0.023)
		Graduation	2.51 ^{ab} ±1.09	
		Post - graduation	2.63 ^a ±1.05	
6	Ensure proper handling of frozen foods.	Upto 12th standard	2.25 ^b ±1.27	4.12* (0.017)
		Graduation	2.76 ^a ±1.16	
		Post - graduation	2.79 ^a ±1.23	
7	Follow storage instructions printed on the food products.	Upto 12th standard	4.02 ^a ±0.87	0.91 (0.402)
		Graduation	4.19 ^a ±0.76	
		Post - graduation	4.20 ^a ±0.94	
8	Follow preparation instructions printed on the packs.	Upto 12th standard	4.04 ^b ±0.79	5.28** (0.006)
		Graduation	4.33 ^a ±0.66	
		Post - graduation	4.41 ^a ±0.65	
9	Put frozen foods in the freezer immediately on reaching home.	Upto 12th standard	3.44 ^b ±1.61	37.98** (0.000)
		Graduation	4.50 ^a ±0.63	
		Post - graduation	4.64 ^a ±0.50	
10	Give attention to the ingredients of the product you purchase.	Upto 12th standard	4.19 ^{ab} ±0.95	6.15** (0.002)
		Graduation	3.95 ^b ±0.71	
		Post - graduation	4.23 ^a ±0.69	
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	Upto 12th standard	4.75 ^a ±0.44	2.13 (0.121)
		Graduation	4.77 ^a ±0.49	
		Post - graduation	4.88 ^a ±0.42	
12	Pay attention to the nutritional value on the pack of the product.	Upto 12th standard	4.35 ^b ±0.76	4.99** (0.007)
		Graduation	4.39 ^{ab} ±0.52	
		Post - graduation	4.59 ^a ±0.51	
13	Pay attention to the trade mark or the producer of the product.	Upto 12th standard	4.25 ^b ±0.81	8.32** (0.000)
		Graduation	4.57 ^a ±0.68	
		Post - graduation	4.73 ^a ±0.66	

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

Table.7 Food procurement practices of respondents regarding food safety on basis of various parameters

S.No.	Statement	Age	Family Income	Family size
1	Check the expiration date before purchasing food products.	6.15** (0.000)	9.30** (0.000)	1.01 (0.32)
2	Purchase only the packaged food items.	1.16NS (0.326)	5.32** (0.001)	1.86NS (0.06)
3	Purchase perishable food items on daily basis.	7.54** (0.000)	14.87** (0.000)	1.33 (0.19)
4	Check food packages if they have been opened or damaged.	0.83 (0.479)	0.04 (0.989)	1.14 (0.25)
5	Check cooling temperature for frozen foods.	1.59 (0.191)	1.53 (0.207)	0.39 (0.69)
6	Ensure proper handling of frozen foods.	0.65 (0.978)	1.24 (0.295)	0.81 (0.42)
7	Follow storage instructions printed on the food products.	1.58 (0.195)	0.77 (0.514)	0.04 (0.97)
8	Follow preparation instructions printed on the packs.	1.27 (0.286)	2.24 (0.084)	0.32 (0.75)
9	Put frozen foods in the freezer immediately on reaching home.	2.01 (0.113)	2.31 (0.08)	1.71 (0.09)
10	Give attention to the ingredients of the product you purchase.	0.98 (0.402)	0.87 (0.457)	0.56 (0.58)
11	Pay attention to the cleanliness/ place of the store you purchase your food from.	1.26 (0.289)	2.06 (0.105)	1.46 (0.14)
12	Pay attention to the nutritional value on the pack of the product.	3.16* (0.025)	1.38 (0.250)	1.72 (0.09)
13	Pay attention to the trade mark or the producer of the product.	0.48 (0.695)	2.89* (0.036)	1.02 (0.31)

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

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

Table.8 Overall correlation between knowledge and procurement practices of respondents with food borne disease incidences

S No.	Parameters	Correlation With Food Borne Disease Incidence
1	Knowledge regarding food safety	-0.07
2	Procurement practices regarding food safety	-0.14*

It can be seen from the table 7 that there was a significant differences ($p < 0.01$) in the mean score given by the respondents segregated on the basis of their age and income with respect to the statements that checking the expiration date before purchasing food products and purchase of food items on daily basis was important with a highest mean scores given by the age group of 35-45 years and income category of >Rs 10 lakhs per annum. Also the statement that “purchasing only the packaged food items” was significantly different in the mean scores given by the respondents segregated on the basis of income ($p < 0.01$) and a higher mean score was given by the income category of > Rs. 10 lakhs per annum. A significant difference ($p < 0.05$) was found among the mean scores given by the respondents segregated on the basis of age to the statement that “paying attention to the nutritional value of the product” with a higher mean score given by the respondents of the age group 35- 45 years. It can be seen from the table that there was significant difference ($p < 0.05$) among the mean score given by the various categories of the respondents segregated on the basis of their family income >Rs 10 lakhs with respect to the statement “paying attention to the trade mark or the producer of the product”. Further it can be seen that the respondents having annual family income > Rs. 10 lakhs per annum and respondents belonging to age category of 35-45 years were having better food procurement practices. No significant difference was found in case of family size of respondents.

For the purpose of finding out the overall food safety knowledge and procurement practices 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 the incidence of food borne diseases were negatively correlated with better knowledge towards

food safety, but it was found to be non-significant. This clearly indicates that respondents with better knowledge pertaining to food safety may lead to good food safety practices which reduce the incidences of food borne diseases. According to a study food handlers with good knowledge and practices reduce contamination risk of food utensils. Some bacteria survive on food utensils if cleaning and sanitizing are ineffective (Cosby *et al.*, 2008). Another study showed the overall knowledge level of respondents with respect to food safety. Majority of the respondents (96.4%) answered questions related to personal hygiene correctly, half of the respondents knew about cross-contamination (44.6%), temperature and time control (58.7%) as well as the definition of food borne illness (66.1%) (Sani and Siow, 2014). A significant negative correlation ($p < 0.05$) was found between good procurement practices in context to food safety and incidences of food borne disease. Thus indicated that the respondents who were purchasing good quality food commodities (fresh, branded, perishable products purchased on daily basis) had low incidences of food borne diseases. In a study, a strong negative correlation was found between food safety practices and incidence of food borne diseases with a coefficient of -0.744 ($p < 0.01$). This shows that with an increase in food safety awareness score there was less chances of food borne disease incidences and also a significant ($p < 0.01$) negative correlation was also found between food safety awareness and incidence of diseases in case of various categories based on different parameters including-age, background, occupation and annual family income (Sharma and Sangha, 2015).

The incidence of food borne disease in comparison with knowledge and procurement practices pertaining to food safety was assessed. The below average mean score of

disease incidence was 7.38 and the above mean score found to be 7.28 in relation with food safety knowledge. While the below average mean score of disease incidence 4.06 and the above mean score found to be 4.02 in relation with procurement practices of respondents pertaining to food safety. Thus indicating, that the respondents with better knowledge and good procurement practices regarding food safety were having low incidence of food borne diseases.

“The study concluded that all the respondents of Ludhiana district were having quite good food safety knowledge scores and had good procurement practices pertaining to food safety issues as the mean score of most of the statements were found above the mid value of 3. Food safety knowledge were found to be negatively correlated with the food borne disease incidences. The incidences of food borne disease were also significantly ($p < 0.05$) negatively correlated with procurement behavior of respondents towards food safety, thus indicating that the respondents who have better food safety knowledge and follow good procurement practices pertaining to food safety were having quite low chances of incidence of food borne diseases. Therefore there is pertinent need to spread knowledge among households’ members regarding good food hygienic practices with respect to procurement of foods, freshly preparation and storage of food at appropriate time-temperature in refrigerator in order to reduce the risk of bacterial contamination which can further leads to food borne illnesses.

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