

Relation between Food Safety Awareness and Disease Incidence: A Study of Home Food Preparers in Punjab

Sonika Sharma and Jasvinder Kaur Sangha

*Department of Food and Nutrition, College of Home Science, Punjab Agricultural University,
Ludhiana 141 004, Punjab, India
Telephone: 081461-22277, E-mail: drsonika@pau.edu*

KEYWORDS Awareness. Correlation. Food Borne Diseases. Food Safety. Incidence

ABSTRACT A random selection of 240 home food preparers was done from rural and urban areas of the Ludhiana District in Punjab and then enquired about food safety awareness and incidence of food borne diseases. The results revealed that mean awareness score of all the respondents came out to be 9.25 out of a maximum of 15, indicating that the respondents were considerably aware about the food safety issues. There was a significant difference in the mean awareness score of the various categories made on the basis of their background. Respondents belonging to the Urban High Income category had the highest awareness score of 10.88 followed by the respondents belonging to Urban Medium Income category (10.52), while the lowest score of 7.82 was observed of the respondents belonging to Rural High Income category. The respondents from the rural areas had a relatively lower mean awareness scores. A significant negative correlation was found between food safety awareness with the incidence of food borne diseases. The paper emphasizes the need to increase the food safety awareness especially in the rural areas.

INTRODUCTION

Food safety is defined as the degree of confidence that food will not cause sickness or harm to the consumer when it is prepared, served and eaten according to its intended use (FAO/WHO2003). The FAO/WHO International Conference on Nutrition held at Rome in 1992, declared, "...access to nutritionally adequate and safe food is a right of each individual". Seen from this perspective, food safety must be given higher priority by governments, industry and consumers themselves.

Food can be mishandled at many places during food preparation, handling and storage (Knabel 1995; Worsfold and Griffith 1995) and several studies indicate that consumers have inadequate knowledge about procedures needed to prevent foodborne illnesses at home (Altekruse et al. 1996; Knabel 1995; Woodburn and Raab 1997; Mederios et al. 2001; Meer and Misner2000; Redmond and Griffith 2003).

The most challenging areas to achieve consumer food safety include 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 foodborne illnesses in the home result from eating raw

foods of animal origin or engaging in unsafe food preparation practices in the home.

Most homemakers are not concerned about the pesticides and microbiological contamination, despite solid evidence that of all the hazards these are the most likely to cause foodborne diseases. Many homes have unsafe food storage and preparation practices. Homemakers rarely consider their own food practices a hazard. There are no regulations for the preparation, handling and storage of food at home. The changing demographics and lifestyle, as well as emergence of resistant and exceptionally hazardous strains of foodborne microorganisms, create a situation that could lead to major outbreaks of life threatening foodborne illness. It has been revealed that food handlers at all ages seem to think that they know how to handle food safely, but their self-reported food handling behaviors do not support this confidence (Redmond and Griffith 2003). Johnson et al. (1998) assessed the food storage knowledge of elderly people living at home in Nottingham, United Kingdom. Results revealed that seventy percent of the refrigerators were too warm for safe storage of food.

Hand washing is a simple and effective, but easily overlooked way to reduce cross-contamination and the transmission of foodborne pathogens. Mir et al. (2014) reported that washing hands with soap before food preparation leads

to a reduction in the probability of reported food-borne illness. A survey of Irish consumers was conducted in order to examine their concerns for the safety of food, their level of knowledge of safe food practices and their awareness of institutional structures to ensure the safety of Irish beef. Sixty-four percent of the sample expressed concern for the safety of food. Concerns cited included freshness of food, antibiotic residue, hygiene standards and bacteria. They perceive many causes of food poisoning and their level of awareness of pathogens varies, depending on the pathogen (Riordan et al. 2002).

Cates et al. (2009) conducted a survey in USA to characterize older adults' food safety knowledge, attitudes, and practices. It was found that although older adults consider themselves to be knowledgeable about food safety, many are not following recommended food safety practices.

The current status of food safety in India is that the problem is due to microbial contamination, natural toxicants and a plethora of adulterants, compounded by the widespread consumption of unsafe street foods, especially in urban areas, unhygienic environment in public catering places, and sometimes improper handling in the household. Home food safety is controlled through the education of the consumer. There is a need for continued efforts toward educating consumers on the hazards of improper food handling. Awareness and training can be effective interventions to deal with food safety problems (Mehrdad et al. 2004; Lin et al. 2005; Gurudasani and Sheth 2009; Buccheri et al. 2010).

The knowledge, attitudes, and practices of the foodservice staff regarding food hygiene in Iran were studied by Mehrdad et al. in 2004. It was seen that personnel had little knowledge regarding the pathogens that cause foodborne diseases and the correct temperature for the storage of hot or cold ready-to-eat foods. A dire need for education and increased awareness among foodservice staff regarding safe food handling practices was suggested.

Lin et al. (2005) investigated the awareness of foodborne pathogens among US consumers. Awareness of four major microbial pathogens—was examined (*Salmonella*, *Campylobacter*, *Listeria* and *Escherichia coli*) as foodsafety problems, using a multivariate probit model. The findings suggest that awareness of microbial pathogens is associated with demographics.

A study on the evaluation of Food Hygiene Knowledge, Attitudes, and Practices of Food Handlers' was done in Turkey by Bas et al. (2006). The study demonstrated that food handlers in the Turkish food businesses often lack knowledge regarding basic food hygiene. It was concluded that there is an immediate need for education and increasing awareness among food handlers regarding safe food handling practices.

In a study on students, Gomes (2007) reported a significant proportion of food handlers lacked basic knowledge and understanding of microbiological hazards, hygiene and safety rules. The results point to the need to improve training and increasing awareness of the measures imposed by food safety laws in Europe.

Buccheri et al. (2010) investigated the knowledge, attitudes and practices of foodservice staff in nursing homes in Sicily, Italy. The education level, length of service in the employment and attending courses on food hygiene influenced the knowledge, attitudes and practices of foodservice staff. This study has evidenced the need for continuous training among foodservice staff regarding foodsafety in nursing homes.

A number of studies related to food safety awareness have been conducted but no specific study has been conducted on finding the relation between food safety awareness and incidence of foodborne diseases in Northern India. This study is an attempt to fill the existing research gap.

RESEARCH METHODOLOGY

The present study was undertaken to explore food safety awareness among rural and urban home food preparers. The methodology used for the study included the survey of the rural and urban home food preparers in the Ludhiana District of Punjab, an agrarian state of India. For selection of rural households, two blocks from Ludhiana district, namely Ludhiana-I and Sudhar were selected randomly. Further, three villages were randomly selected from these two blocks, making a total number of villages that were covered, six. Kailpur, Baddowal and Jhande were selected from Ludhiana –I, while Raqba, Tussa and Halwara were selected from Sudhar. Each village was divided into 2 strata that is, high-income households and relatively low-income households and 10 households from each of the stratum were randomly selected, to make a sample size of rural householdsto be 120.

For selection of urban households, Ludhiana city was divided into three localities, that is, developed localities (Bhai Randhir Singh Nagar, Sarabha Nagar), semi-developed (Haibowal, Dugri) localities and localities on the outskirts of Ludhiana (Salem Tabri, Jamalpur). From these three localities, 40 households were randomly selected in each locality depending on the plot size. In each plot size of more than 250 square yards, 101 to 250 square yards and 100 square yards or less were randomly selected. Thus making the sample size for urban households 120. The total sample size for rural and urban households was thus 240.

Data was collected by personally administering the questionnaire to the rural and urban home food preparers on the food safety awareness. For finding out the awareness of the respondents, they were asked 15 basic questions pertaining to food safety. Depending on the correctness of the responses, the respondents were given an awareness score out of 15.

For finding the incidence of the foodborne diseases among the households included in the

survey, an inventory of prevalent foodborne diseases was prepared by undertaking a survey of the doctors. The respondents were asked to indicate the incidence and frequency of these diseases in their household in the past 4 to 5 years. In case a disease had occurred in the household multiple times, the frequency was added up for analysis of the data. Responses obtained in case of each household were added to obtain a disease incidence score for that household.

RESULTS

The following section deals with the results obtained from the study.

Food Safety Awareness

Awareness scores obtained by the respondents have been presented in Table 1, according to various parameters such as the background of the respondents, age, educational qualification, occupation, annual family income and family size.

It can be seen from the Table that the mean awareness score of all the respondents came out to be 9.25 out of a maximum of 15. From the available data, it can be stated that the respondents were considerably aware about the food safety issues. As evident from the data, the mean awareness score of the respondents, aged more than 45 years came out to be the highest (10.05) among the various age categories. The mean awareness score for the respondents aged less than 30 years came to be 9.33, while the lowest awareness score of 8.99 was observed for the respondents aged 30 to 45 years. There was no significant difference in the mean awareness of various groups.

On the basis of educational qualification, the respondents were divided into four categories. It can be seen from the table that the highest mean awareness score of 12.60 was observed in case of postgraduates followed by the graduates (mean score 9.77), 10+2 (8.15) and lastly matriculation and below (7.35). There was a significant difference in the mean awareness score obtained by the various categories segregated on the basis of their educational qualification ($p < 0.01$). It can be concluded from the results that the mean awareness about food safety issues increased with an increase in the educational level of the respondents.

Table 1: Comparison of food safety awareness score

Category	Mean score \pm S D	F-value
Total	9.25 \pm 2.01	-
Age Category		
< 30 years	9.33 \pm 2.00	2.47
30-45 years	8.99 \pm 1.99	
> 45 years	10.05 \pm 1.98	
Educational Qualification		
Matric and below	7.35 \pm 0.75	375.13**
10+2	8.15 \pm 0.79	
Graduate	9.77 \pm 0.83	
postgraduate	12.60 \pm 1.03	
Occupation		
Business	8.88 \pm 1.83	21.49**
Service	10.16 \pm 2.15	
Annual Family Income		
< Rs. 2 lacs	9.28 \pm 1.72	3.39*
Rs. 2-5 lacs	9.06 \pm 1.98	
> Rs. 5 lacs	9.91 \pm 2.16	
Family Size		
Four or less	9.41 \pm 1.99	1.03
5-8	9.02 \pm 2.07	
More than 8	9.33 \pm 1.82	
Background		
Rural lower income	8.00 \pm 1.01	48.70**
Rural higher income	7.82 \pm 1.09	
Urban higher income	10.88 \pm 1.73	
Urban medium income	10.52 \pm 1.96	
Urban lower income	10.38 \pm 1.84	

* significant at 5% level

** significant at 1% level

The respondents from the service class had a mean awareness score of 10.16 about food safety issues, while the respondents from business class had a relatively lesser mean awareness score of 8.88. There was a significant difference in the means of the business class and service class ($p < 0.01$). A higher mean awareness 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.

Further, it can be seen from the Table that the respondents with an annual family income of more than INR 500,000 had a relatively higher mean awareness score of 9.91 as compared to the other groups, segregated on the basis of annual family income. The respondents with an annual family income of less than INR 200,000 obtained a mean awareness score of 9.28, while the respondents with an annual family income from INR 200,000 to INR 500,000 were found to have a mean awareness score of 9.06. The mean awareness of the three groups made on the basis of annual family income was significantly different ($p < 0.05$). The family size did not have any effect on the awareness of the respondents. Respondents having four or less family members had the highest mean awareness score of 9.41 among the three groups devised on the basis of family size. The respondents with more than eight family members scored a mean awareness score of 9.33, while the respondents with family size ranging from 5 to 8 were found to have a mean awareness score of 9.02.

The background of the respondents had an effect on their awareness regarding food safety. On the basis of the background of the respondents, it can be seen from the Table that the respondents belonging to the Urban High Income category had the highest awareness score of 10.88 followed by the respondents from the Urban Medium Income category with a mean awareness score of 10.52. Respondents from the Urban Lower Income category had a mean awareness score of 10.38. The respondents from the rural areas had a relatively lower mean awareness score that is a mean score of 8.00 in case of the Rural Lower Income category, while a mean awareness score of 7.82 for the respondents from the Rural High Income category. Available data was tested for difference in the mean score of the various categories. There was a signifi-

cant difference among the mean awareness of the various categories ($p < 0.01$).

Relation between Awareness and Disease Incidence

For the purpose of finding out the relation between awareness about food safety and incidence of foodborne diseases, the Pearson correlation coefficients were calculated.

Results obtained from the correlation analysis have been presented in Table 2. It can be seen that for all the respondents included in the study, a strong negative correlation was found between food safety practices and incidence of foodborne diseases with a coefficient of -0.744 ($p < 0.01$). This shows that with an increase in food safety awareness score there was a decrease in the disease incidence score. There was a significant negative correlation between food safety awareness and incidence of diseases in

Table 2: Overall correlation between awareness and disease incidence (n=240)

Category	Awareness and disease incidence
Total	-0.744**
<i>Background</i>	
Rural lower income	-0.531**
Rural higher income	-0.505**
Urban higher income	-0.866**
Urban medium income	-0.686**
Urban lower income	-0.693**
<i>Age</i>	
< 30 years	-0.754**
30-45 years	-0.702**
> 45 years	-0.833**
<i>Educational Qualification</i>	
Matric and below	-0.301*
10+2	-0.568**
Graduate	-0.627**
Postgraduate	-0.279
<i>Occupation</i>	
Business	-0.744**
Service	-0.713**
<i>Annual Family Income</i>	
< Rs. 2 lacs	-0.807**
Rs. 2-5 lacs	-0.688**
> Rs. 5 lacs	-0.870**
<i>Family Size</i>	
Four or less	-0.759**
5-8	-0.754**
More than 8	-0.541*

*significant at 5% level

**significant at 1% level

case of all categories based on background, age, occupation and annual family income at one percent level of significance.

A regression analysis was applied, taking disease incidence as the dependent variable and food safety as the independent variable. Separate regression analyses were carried out for the total sample, the urban sample and the rural sample. The results of the regression analyses have been presented in Table 3. It can be seen that in all the regression models, food safety awareness came out to be the significant explanatory variable. Further, it can be seen that there was an inverse relation between the food safety awareness and the disease incidence. In case of total respondents, a unit increase in the awareness is expected to reduce the disease incidence by 0.478 units. For urban and rural samples, these coefficients were -0.428 and -0.556, respectively.

The value of R^2 indicates that in case of the total sample and the urban sample, 55.42 percent and 54.23 percent of the variation in the dependent variable was being explained by the food safety awareness. The explanatory power of the regression model in case of the rural sample came out to be 26.51 percent only, indicating that apart from food safety awareness, other variables were also affecting the disease incidence in the rural areas. This can be possibly explained by the fact that general hygiene as well as the quality of nutrition available in the rural areas is usually poorer than that of urban areas.

DISCUSSION

The study aims to assess the awareness of the consumers regarding food safety and attempts to find a correlation between awareness and the incidence of foodborne diseases. In case of developing countries like India where the rate of literacy is low, more emphasis is being laid on

food security rather than food safety. This further leads to a low awareness level regarding food safety, as a result the incidence of foodborne diseases is on a rise in these countries.

Firstly, there is a need to emphasize on the importance of food safety awareness in the reduction of incidence of foodborne diseases and the present study is an attempt in this direction. Unusan (2007) studied the knowledge and behaviors related to food safety among consumers who had the primary responsibility for food preparation at home in Turkey. A significant difference was found among education levels concerning attitude towards food safety and knowledge. The results of this study also indicate that education affects the level of food safety awareness. Findings of Meer and Misner (2000), and Redmond and Griffith (2003) show that consumers have inadequate knowledge about procedures needed to prevent foodborne illnesses at home. In another study conducted by Muinde and Kuria (2005) to determine 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 foodborne diseases.

Secondly, the present study conclusively proves that food safety awareness affects the incidence of foodborne diseases. It has been estimated that between fifty percent and eighty-seven percent of reported foodborne disease outbreaks have been associated with the domestic kitchen (Redmond and Griffith 2003) and the World Health Organization report (Tirado and Schmidt 2000) mentioned that 45.6 percent of foodborne disease outbreaks were due to temperature abuse during food processing, poor refrigeration and inappropriate storage temperatures of leftover or recently cooked meals accounted for 23.5 percent and 12.6 percent of the cases, respectively. Foodborne diseases are one of the health hazards and causes of morbidity

Table 3: Results of linear regression models

	<i>Total sample (n=240)</i>		<i>Urban sample (n=120)</i>		<i>Rural sample (n=120)</i>	
	<i>Intercept</i>	<i>Awareness</i>	<i>Intercept</i>	<i>Awareness</i>	<i>Intercept</i>	<i>Awareness</i>
Estimate	10.259	-0.478	9.709	-0.428	10.906	-0.556
Std error	0.263	0.027	0.389	0.036	0.680	0.085
t -Ratio	39.01	-17.20	24.91	-11.83	16.04	-6.52
p-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
R^2	0.5542	0.5423	0.2651			

and mortality in developing countries. Sudershan et al. (2014) indicated the need to take up foodborne disease surveillance under the Indian context and to identify the common high-risk food commodities for microbial contamination and identification. Therefore, increased awareness about the food safety issues can be instrumental in reducing the disease incidence leading to economic savings, higher productivity and a healthy life for the citizens.

Lastly, regression models indicated that a unit increase in the food safety awareness in rural areas could be more productive as compared to urban areas. There is a need to give special attention to the food safety awareness in the rural areas for effective tackling of foodborne diseases. Ajayi and Salaudeen (2014) identified some of the risky eating habits and determined the level of consumer awareness in Nigeria. It was reported that there were statistical associations between gender, age, level of income, marital status, risky eating habits and awareness of food hazards. Consumers may claim to know about hazards in foods, but the knowledge has not translated to changes in eating behavior, therefore it was suggested that the campaigns should be targeted at improving food safety education in Nigeria.

CONCLUSION

Food safety awareness is instrumental in dealing with the problem of foodborne diseases. The level of food safety awareness varies across demographic variables such as background, income and education. An inverse relation was found between food safety awareness and the incidence of foodborne diseases. The results of the study indicate that an increase in food safety awareness can be relatively more productive in the rural areas. To prevent foodborne disease incidences, appropriate educative and preventive measures should be taken up. The health authorities should strengthen considerably the foodborne disease surveillance system and follow it with efficient education and extension activities or various aspects of food safety. The initiatives like epidemiological and laboratory components should be incorporated in the country to conduct appropriate surveillance programs, so that the real burden of foodborne diseases can be determined at various national levels. Therefore, for overall prosperity and well-being, an emphasis should be placed

on increasing food safety awareness among the masses.

RECOMMENDATIONS

Based on the findings of the study the following recommendations are being made, especially in the Indian context. Increasing the awareness level can lower the disease incidence. Therefore, there is a need to disseminate food safety awareness in the rural areas and lower income classes effectively through campaigns in simple and local languages. It was observed that the respondents with lower educational qualification had a relatively lower awareness about food safety as compared to graduates and postgraduates. Therefore, an emphasis must be placed on food safety education at the school level.

REFERENCES

- Ajayi OA, Salaudeen T 2014. Consumer food safety awareness and knowledge in Nigeria. *Agricultural Journal Year*, 9: 191-198.
- Altekruse DA, Street SB, Fein S, Levy AS 1996. Consumer knowledge of food-borne microbial hazards and food handling practices. *Journal of Food Protection*, 59: 287-294.
- Bas M, Azmi SE, Gökhan K 2006. The evaluation of food hygiene knowledge, attitudes, and practices of food handlers' in food businesses in Turkey. *Food Control*, 17: 317-322.
- Buccheri C, Mammina C, Giammanco S 2010. Knowledge, attitudes and self-reported practices of food service staff in nursing homes and long-term care facilities. *Food Control*, 21: 1367-1373.
- Cates SC, Kosa KM, Karns S, Godwin SL, Speller HL, Harrison R, Draughon FA 2009. Food safety knowledge and practices among older adults: Identifying causes and solutions for risky behaviors. *Journal of Nutrition for Elderly*, 28: 112-126.
- FAO/WHO 2003. *Codex Alimentarius, Basic Text on Food Hygiene*. 3rd Edition. Italy.
- Gettings MA, Kiernan NE 2001. Practices and perceptions of food safety among seniors who prepare meals at home. *Journal of Nutrition and Education*, 33: 148-154.
- Gomes NE 2007. Food handling: Comparative analysis of general knowledge and practice in three relevant groups in Portugal. *Food Control*, 18: 707-712.
- Gurudasani R, Sheth M 2009. Food safety knowledge and attitude of consumers of various food service establishments. *Journal of Food Safety*, 29: 364-380.
- Johnson AE, Donkin AJM, Morgan K, Lilley JM, Neale RJ, Page RM, Silburn R 1998. Food safety knowledge and practice among elderly people living at home. *Journal of Epidemiology and Community Health*, 52: 745-748.
- Knabel SJ 1995. Foodborne illness: Role of home food handling practices- scientific status summary. *Food Technology*, 49: 119-131.

- Lin CT, Jordan KL, Jensen ST 2005. Awareness of foodborne pathogens among US consumers. *Food Quality Preference*, 16: 401-412.
- Mederios V, Hillers P, Kendall A, Mason A 2001. Evaluation of food safety education for consumers. *Journal of Nutrition Education and Behavior*, 33: S27-S34.
- Meer RR, Misner SL 2000. Food safety knowledge and behavior of expanded food and nutrition education program participants in Arizona. *Journal of Food Protection*, 63: 1725-1731.
- Mehrdad A, Gholamhosein K, Aminbaig M, Memish ZA, Peyman J 2004. Knowledge, attitudes and practices of food service staff regarding food hygiene in Shiraz, Iran. *Infection Control and Hospital Epidemiology*, 25: 16-20.
- Mir A, Linda V, Yuanting Z 2014. Self-reported hand washing behaviors and foodborne illness: A propensity score matching approach. *Journal of Food Protection*, 77: 352-358.
- Muinde OK, Kuria E 2005. Hygienic and Sanitary practices of vendors of street foods in Nairobi, Kenya. *African Journal of Food Agriculture and Nutritional Development*, 5(1). From <<http://www.ajfand.net/Issue-VIIIfiles/pdfs/AJFAND%20Vol%205%20No%201%20Peer%20Reviewe%20Article%20No%207.>>
- Redmond EC, Griffith CJ 2003. Consumer food handling in the home: A review of food safety studies. *Journal of Food Protection*, 66: 130-161.
- Riordan N, Cowan C, Mccarthy M 2002. Safety of Irish beef-concerns, awareness and knowledge of Irish consumers. *Journal of Food Safety*, 22: 1-15.
- Sudershan RV, Kumar RN, Kashinath L, Bhaskar V, Polasa K 2014. Foodborne Infections and Intoxications in Hyderabad India. *Epidemiology Research International*, 14: 1-5
- Tirado C, Schmidt K 2000. World Health Organization Surveillance Program for Control of Food-Borne Infections and Intoxications in Europe, 7th Report, 1993-1998, BGVV-FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses/World Health Organization, Geneva.
- Unusan N 2007. Consumer food safety knowledge and practices in the home in Turkey. *Food Control*, 18: 45-51.
- Woodburn MJ, Raab CA 1997. Household food preparers' food-safety knowledge and practices following widely publicized outbreaks of foodborne illness. *Journal of Food Protection*, 60: 1105-1109.
- Worsfold D, Griffith C 1995. A generic model for evaluating consumer food safety behavior. *Food Control*, 6: 357-363.