

# A Questionnaire-Based Survey on Food Safety Knowledge during Food-Handling and Food Preparation Practices among University Students

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## Abstract

The objective of the study was to assess the level of food safety handling knowledge and practices among university students and to explore the association between their knowledge/practices and the socio-demographic and academic characteristics. Participants were undergraduate students enrolled in the University of Agriculture Peshawar. They completed a questionnaire containing six questions of food safety grouped into two subsections: food microbiology/cross-contamination and food storage (chilling). Students from faculties delivering health-related programs significantly outperformed those from humanity-sciences programs on food safety knowledge during food preparation practices. Females obtained considerably better food-handling scores than males. An educational background relevant to food safety was a significant predictor of responding accurately to a wide range of study questions. These results substantiate the need for educational initiatives tailored to develop the food safety knowledge and food-handling practices of students of university of agriculture Peshawar.

**Keywords:** Food safety; Demographic characteristics; Gender; University students

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## 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. Food safety is an international concern. Considerable proportion of food borne diseases is owing to unsafe food-handling practices. WHO reported that these diseases were found to affect more than 30% of the population in developed countries? The problem is expected to be even more severe in developing countries. Thus, 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 [1].

Consumers in many societies seemed to be unfamiliar with the ideal refrigeration temperature. Large numbers of consumers did not use a thermometer during food preparation. Most consumers lack awareness of the different classes of bacteria and especially the pathogenic ones. Potential undesirable compounds in foods cover a broad range, from natural (e.g. mycotoxins) and environmental contaminants (e.g. dioxins) to agrochemicals

(e.g. pesticides, and veterinary drug residues) and many more [2]. Food safety has become a major issue of public concern as bacterial outbreaks, and assumed reduced consumer confidence in the healthiness of food products. Reinstating confidence in food now presents a major commercial challenge to the food industry.

Even in societies with highly developed food safety systems such as the European “farm-to-fork” and the American “farm-to-table” approach a “weak link” can cause significant morbidity and mortality from food borne illness [3].

There are five major pathogen control factors that should be highlighted in food safety education programs for consumers. These control features include practicing personal hygiene, prevention of cross contamination, avoiding foods from unsafe sources, cooking foods adequately and keeping foods at safe temperatures. Few researches about food safety handling and

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practices among young adults in universities have been recently published. A recent study showed that more than 50% of the Saudi college participants consumed raw eggs and raw white cheese and 34% believed that there is no risk of food poisoning from eating cooked food kept at room temperature for one day if covered.

Two types of food safety include objective measures and subjective perception. Objective food safety is the task of scientist's measure who find out the reasons of risks that are due to specific food. Subjective measure is a consumer's behavior towards the safety of a specific food. It is mostly observe that both the food safety measures interlinked in many of the conditions. European and other established countries are very conscious about their health risks regarding food safety and proper hygienic standards by Andersen et al. [4].

The results of consumer studies concerning food safety knowledge and practices have shown that consumers are aware of and are thinking about food safety, although there are also many gaps in food safety knowledge and practices that may result in food borne diseases by Medeiros et al. [5].

Beside the fact that public greatly concerned about food-related risks, the growth in food poisoning cases suggests that people still make decisions of food consumption, food storage and food preparation that are less ideal from a health and safety perspective by Jevšnik et al. [6].

Safe food is one of the most important human rights and in developed society's protection from diseases and improvement of human health is of primary importance, and is important for both governments and industries but also for consumers themselves.

Therefore, the main focus of the study was to assess the self-reported food safety practices and knowledge of university participants from various field of study and to find out any relationships between the food safety awareness and demographic characteristics.

## Material and Methods

### Research design

A cross-sectional study was conducted on food safety knowledge and handling practices from September to December 2014. The respondents were undergraduate participants of different food related Department like (Food Science and technology, Human nutrition, Food Chemistry, Bio Technology and Animal Nutrition) and non-food related departments like ( Plant Protection, Plant Pathology, Entomology, Agronomy, Horticulture and Soil Science) of University of Agriculture Peshawar whose age ranged between 21-26 years.

### Development of questionnaire

A questionnaire was developed in order to assess the food safety knowledge and food handling practices among university participants of university of agriculture Peshawar.

The questionnaire was subjected to a preliminary validation [7] to assess its clarity, the suitability of wording, and the average time

needed for its completion. Based on this pilot study, necessary modifications were identified and resolved, whereas its results were not included in the final survey. The questionnaire took approximately 5 min to be completed.

The demographic characteristics surveyed include:

1. Gender;
2. Age;
3. Field of Study;
4. Maternal Status;
5. Residential Status.

The questionnaire consists of 6 questions which were grouped into 2 sections food microbiology/cross-contamination and food storage (chilling). All questions were multiple-choice questions or statements with 2-4 possible answer choices including true/false and yes/no statements.

### Data collection

The study data was collected by 3 interviewers, each of whom distributed 100+ questionnaires. Interviewers were in their graduation studies that visited selected departments and distributed questionnaires in each department in University of agriculture Peshawar Pakistan [8]. The distributors asked the help of some class teachers to distribute the survey forms to their participants randomly and the survey forms were returned after the end of class period. The objectives of the study were briefly explained to respondents.

## Results and Discussion

### Profile of respondent

355 Questionnaires were distributed, but only 311 questionnaires have been collected back (154 respondents from Food related departments and 157 respondents from non-Food related departments). Percentages of male and female respondents were about 53.5% (165) and 46.95% (146) respectively. The majorities of respondents were aged 23 to 24 of a total of 42.76% (133) and followed by those who aged 21 to 22 around 35.04% (109) and of age 25 to 26 were around 22.18% (69). Most of the surveyed participants (55%) were hostel residents and home resident respondents were 45%. Based on Maternal status of participants 80.38% belongs to family having House wives and 19.61% belongs to a working women family (**Table 1**).

Food related participants scored significantly better than nonfood related participants. The percentage of the correct answer of food related participants were about 54% and that of Non- food related participants were 46%. The female participants also scored significantly better than male participants giving correct answer which is 69.4% and that of males is 46.1%. Participants having house wives mother score significantly better than that of working women which is 58% and that of working women is 50%. Participants living in hostel and those living with their parents having not much difference in their score which is 64% for both (**Table 2**).

**Table 1** Demographic characteristics of the study population.

Demographic variables	Variables	Respondents	Percentage
Gender	Male	165	53.05%
	Female	146	46.94%
Age	21-22 years	109	35.04%
	23-24 years	133	42.76%
	25-26 years	69	22.18%
Department	Food related	154	49.5%
	Non-food related	157	50.5%
Maternal status	House wife	250	80.38%
	Working woman	61	19.61%
Residential status	Boarder	140	45%
	Day scholar	171	55%

**Table 2** Freezing kills harmful germs in food.

Demographic variables	Variables		True	False
Gender	Male	Count	89	76
		%age	53.9%	46.1%
	Female	Count	46	100
		%age	31.5%	69.5%
Age	21-22 years	Count	38	71
		%age	34.9%	65.1%
	23-24 years	Count	74	59
		%age	55.7%	44.3%
	25-26 years	Count	23	46
		%age	33.4%	66.6%
Department	Food related	Count	70	84
		%age	45.5%	54.5%
	Non-food related	Count	85	72
		%age	54%	46%
Maternal status	House wife	Count	105	145
		%age	42%	58%
	Working woman	Count	30	31
		%age	49.2%	50.8%
Residential status	Boarder	Count	50	90
		%age	35.7%	64.3%
	Day scholar	Count	61	110
		%age	35.6%	64.4%

Both the department (food related and non-food related) participants were having more knowledge about storage issue that freezing does not eliminates harmful germs in food, that keeping foods refrigerated is an important way of avoiding food borne disease.

**Best practice or option is in italic:** The score of food related participants is better than that of non-food related participants regarding the knowledge of the maximum safe temperature of freezing (-18°C) only around 34% participants of food related and 31% of non-food related participants properly recognized it [8,9]. The score of male participants is significantly better than that of female's participants which were 51% while that of female participants were 41% showing sufficient knowledge about recommended temperature of freezer. Participants having their mother as house wives and working women score exactly the same that is 46%. Participants residing in hostel were having

significantly high score than those living with their families which was 52% and that of day scholars was 41.5% (**Table 3**).

This results shows that the knowledge regarding to the question is appreciable in both departments (food related and non-food related). The male participants which were hostalized were much aware of the temperature for freezing. The recommended temperature for freezer is from (-17°C to -18°C).

**Best practice or option is in italic:** Food related participants and non-food related participants have almost the same score of 38% and 37.5% which shows their lack of knowledge and low level of education about the recommended temperature of refrigeration. This question shows surprisingly the same score for male and females participants, 38% for males and 37.8% for female's participants. Participants having their mother as house wives scored significantly higher than working women which is 37% for house wives and 33% for working women. According to

residential status both the participants shows almost the same percentage i.e., 38% and 37 % for hospitalized and day scholar respectively (**Table 4**).

The optimum temperature for home fridges is between 1°C and 4°C. Maintaining the optimum temperature inside a fridge is

important to minimize the growth of bacteria that can cause food poisoning and spoilage:

1. Too warm and food poisoning bugs can start to grow.
2. Too cold and foods can freeze, which will damage some foods.

**Table 3** Recommended temperature for freezer.

Demographic variables	Variables		1-18°C	-18°C	38°C	40°C
Gender	Male	Count	41	84	32	08
		%age	24.5%	51%	19.5%	5%
	Female	Count	53	60	23	10
		%age	36.7%	41%	15.3%	7%
Age	21-22 years	Count	27	55	18	09
		%age	24.6%	50.3%	16.1%	09%
	23-24 years	Count	43	62	22	06
		%age	32.3%	46.3%	16.4%	5%
	25-26 years	Count	24	27	15	03
		%age	34.6%	39.3%	12%	4.1%
Department	Food related	Count	56	53	34	11
		%age	36.3%	34.4%	22.3%	7%
	Non-food related	Count	38	50	31	38
		%age	24.2%	31.6%	20%	24.2%
Maternal status	House wife	Count	76	116	42	16
		%age	30%	46%	17.3%	6.7%
	Working woman	Count	18	28	13	02
		%age	29.6%	46%	21%	3.4%
Residential status	Hostalized	Count	34	73	28	05
		%age	24.5%	52%	20%	3.5%
	Day scholar	Count	60	71	27	13
		%age	35%	41.5%	15.5%	8%

**Table 4** Recommended temperature for fridge.

Demographic variables	Variables		1-4°C	2-4°C	2-12°C	4-16°C
Gender	Male	Count	63	60	30	12
		%age	38%	36%	19%	7%
	Female	Count	55	45	34	12
		%age	37.6%	30%	23%	9.4%
Age	21-22 years	Count	45	25	32	07
		%age	41%	23%	29%	7%
	23-24 years	Count	46	61	17	09
		%age	34%	46%	12%	08%
	25-26 years	Count	27	19	15	08
		%age	40%	27%	21%	12%
Department	Food related	Count	59	46	33	16
		%age	38%	29%	21%	12%
	Non-food related	Count	59	59	31	08
		%age	37.5%	37.5%	19%	6%
Maternal status	House wife	Count	92	80	56	22
		%age	37%	32%	22%	9%
	Working woman	Count	20	25	08	8
		%age	33%	41%	13%	13%
Residential status	Hostalized	Count	52	53	26	09
		%age	37%	38%	18%	7%
	Day scholar	Count	66	52	38	15
		%age	38%	30%	22%	10%

**Best practice or option is in italic:** Food related a participant shows a good response than non-food related participants that raisin is not needed to be refrigerated there percentage is 43% and that of non-food related participants is 33%. Females showed a good response and have more knowledge about refrigeration than male and score 39% and that of male were 37%. Participants having their mother house wives scored significantly higher than working women which was 36.8% and that of working women was 32%. Participants living in hostel had a better score than those living with their families which was 39% and those living with their families were 37% and those participants with age range from 23-24 years had a better knowledge about refrigeration which is 53% (Table 5) [10-13].

So the food product having high moisture rate must be refrigerated in order to avoid microorganism. Raisins have lower moisture so it does need to be refrigerated and its quality lasted almost for 1 year without opening the can of raisin.

Those participants who stated their mothers as working women answered better than those whose mothers were house wives. From another aspect it is observed in many surveys that participants scored well who lived with their educated working women where they noticed the different handling practices from their mother and had high food safety practicing knowledge compare to those who lives with housewives. The reason is that as working women are educated and have go through the food safety basics in their studies compares to these housewives who run the food handling traditionally by following unhygienic practices.

**Best practice or option is in italic:** Food related participants have much better knowledge than non-food related securing a total score of 46% and that of non-food related participants is 41% similarly the female student scored significantly than male by securing a total score of 62% and non-food relate participants is 55 %. Participants showing their mother as working women has high knowledge about food poisoning than house wives by gaining score of 68.8% and house wives scored a total of 56% participants living with their families have a much better knowledge of microorganism causing food poisoning in human than living in hostels and there score is 63% and of hostelryes is 53% (Table 6).

Bacteria are the main cause of food poisoning in human beings. Bacteria related food poisoning is the most common, but fewer than 20 of the many thousands of different bacteria actually are the culprits. More than 90 percent of the cases of food poisoning each year are caused by *Staphylococcus aureus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter*, *Listeria monocytogenes*, *Vibrio parahaemolyticus*, *Bacillus cereus*, and Enteropathogenic *Escherichia coli*. These bacteria are commonly found on many raw foods. Normally a large number of food-poisoning bacteria must be present to cause illness [14-17].

**Best practice or option is in italic:** The food related participants scored significantly better than non-food related participants which is 52% and 44% shows that food related participants have much knowledge of temperature range in which bacteria can grows than non-food related participants. Both the males and

Table 5 Foods that does not need to be refrigerated.

Demographic variables	Variables		Salad	Open can of peas	Raisin	Cooked meal
Gender	Male	Count	48	35	62	20
		%age	29%	21%	37.5%	12.5%
	Female	Count	45	20	57	24
		%age	30%	13%	39%	18%
Age	21-22 years	Count	45	22	30	12
		%age	41%	20%	27%	12%
	23-24 years	Count	21	21	71	20
		%age	15.7%	15.7%	53%	15.6%
	25-26 years	Count	27	12	18	12
		%age	39%	17.3%	26.4%	17.3%
Department	Food related	Count	43	16	67	28
		%age	28%	10%	43%	19%
	Non-food related	Count	50	39	52	16
		%age	31.8%	24%	33%	11.2%
Maternal status	House wife	Count	73	45	92	40
		%age	29.2%	18%	36.8%	16%
	Working woman	Count	20	10	20	11
		%age	32.7%	16%	32.7%	18.6%
Residential status	Hostelized	Count	42	28	55	15
		%age	30%	20%	39%	11%
	Day scholar	Count	51	27	64	29
		%age	28.8%	15%	37%	19.2%

**Table 6** Microorganism most likely cause food poisoning.

Demographic variables	Variables		Parasite	Fungi	Bacteria	Virus
Gender	Male	Count	26	36	91	12
		%age	15.7%	21.8%	55%	7.5%
	Female	Count	12	30	91	13
		%age	8.2%	20.5%	62%	9.3%
Age	21-22 years	Count	13	24	63	09
		%age	12%	22%	57.6%	8.4%
	23-24 years	Count	16	26	81	10
		%age	12%	19.5%	61%	7.5%
	25-26 years	Count	09	16	38	06
		%age	13%	23%	55%	9%
Department	Food related	Count	24	44	72	14
		%age	15.5%	28.5%	46%	10%
	Non-food related	Count	29	32	65	31
		%age	18%	20%	41%	21%
Maternal status	House wife	Count	31	55	140	24
		%age	12%	22%	56%	10%
	Working woman	Count	07	11	42	01
		%age	11%	18%	68.8%	2.2%
Residential status	Boarder	Count	21	34	74	11
		%age	15%	24%	52.8%	7.2%
	Day scholar	Count	17	32	108	14
		%age	10%	18%	63%	9%

females participants have somewhat the same knowledge and idea about ideal temperature and their score is 50% and that of female participants is 48% similarly participants living in hostel and those living with their families have the same level of knowledge and awareness about the ideal temperature range for bacterial growth which is from 5-6°C and there score is 49% and that of working women is 48%. participants showing their mother status as house wives has a significantly better score than those with working women there score is 45% and that of participants with working women is 41% it shows that those participants belongs to house wives families has a better knowledge of bacteria and there temperature of growth and causing diseases (**Table 7**).

Best practice or option is in italic: The temperature range in which most bacteria grow is between 40°F (5°C) and 140°F (60°C). Raw and cooked foods should not be kept in this danger zone any longer than absolutely necessary. Undercooking or improper processing of home-canned foods can cause very serious food poisoning [18-22].

### Limitation of the Study

This survey was carried out among students of University of Agriculture Peshawar so the results should not be for all the students of university or all the residential of entire Peshawar city. Self-reported practices are blamed for possibly not reflecting actual behavior due to social desirability bias hence, inclusion of some self-reported practices in this study may be considered to be a limitation. Nevertheless, these reports give the important information about food safety and shows that consumers have some ideas about the right practice even if they do not practice their knowledge all the time. The problem is not people are

saying what they are practicing instead; the main concern is to enhance their knowledge about handle food hygienically.

The limited samples involved in this study have made it difficult for the researchers to generalize to all students of higher learning institutions. It would be worthwhile if future research can be undertaken by considering more variety of students' profiles such as their major of study. Future research can be done to explore the relationship between food safety knowledge level and attitude between health and hospitality major. Little participation by the higher learning institution also specifically limits the sample size. In the future, it is suggested that these kind of study which is known to have huge impact nationally, should be done as a national initiative and with collaboration from relevant government agencies such as the Ministry of Health or other related agencies.

### Conclusion and Recommendations

It is concluded on the basis of these results that respondents are not familiar with their role in the food safety chain or with the importance of maintaining a cold chain, and that they allow numerous opportunities for microbiological contamination of food. The most important issues is the lack of knowledge regarding refrigeration temperatures, lack of knowledge concerning cross- contamination and its control, and a lack of knowledge with respect to hand hygiene. The results indicated that women adhered to safer food handling practices to a greater degree than men.

The results of this study support the hypothesis that the development and delivery of a food safety education program for participating food recovery agency personnel and volunteers

**Table 7** Temperature range of bacteria causing diseases.

Demographic variables	Variables		30-70°C	5-60°C	40-60°C	20-60°C
Gender	Male	Count	19	82	51	13
		%age	11%	50%	30%	9%
	Female	Count	29	70	41	6
		%age	19.5%	48%	28%	4.5%
Age	21-22 years	Count	23	76	02	08
		%age	21%	70%	2%	7%
	23-24 years	Count	09	30	89	05
		%age	6.7%	22.5%	67%	3.8%
	25-26 years	Count	16	46	01	06
		%age	23%	66.6%	1.4%	9%
Department	Food related	Count	27	81	37	09
		%age	17.5%	52.5%	24%	6%
	Non-food related	Count	30	70	37	20
		%age	19%	44.5%	23.5%	13%
Maternal status	House wife	Count	41	117	78	14
		%age	16%	45.8%	31%	7.2%
	Working woman	Count	10	25	16	10
		%age	16.3%	41%	26.4%	16.3%
Residential status	Hostelized	Count	19	69	47	05
		%age	13.5%	49.2%	33.5%	3.8%
	Day scholar	Count	29	83	45	14
		%age	16.9%	48%	27%	8.1%

will increase food safety knowledge and indication of adoption of safe food handling behaviors. This will presumably decrease the risk and incidence of food-borne illness in those receiving assistance.

We should adopt similar programs locally those are being adopted by developed countries such as "Fight BAC ("BAC" stands for "bacteria")" and "Home Food Safety.

Food safety agencies should play an important role in the

education of consumers. Educational material about Good Housekeeping Practice should be available to the general public from many sources. Food safety messages should focus on the younger members of a population with educational programs, but more importantly, with relevant training. It is also of vital importance to properly educate teaching staff in order to transmit food hygiene principles to children, and through them, to their parents. Only safety-conscious consumers can become active partners within the food safety circle.

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