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A Study Design to Determine Parents' Knowledge, Attitude and Preventive Practice and Associated Factors to Combat Food Poisoning: A Cross-sectional Survey from Lahore, Pakistan

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Abstract Food-borne diseases, especially food poisoning, have become more common in recent decades, threatening the health and economic well-being of many people all over the globe. This research was intended to evaluate knowledge, attitude, and preventive practice of parents about food poisoning and the factors associated with it. By using a well-structured questionnaire, we conducted a cross-sectional study targeting mainly parents in the city of Lahore. A Chi-square test was performed to measure the effect of sociodemographic variables on these three attributes and binary logistic regression analysis to identify predictors of parents' knowledge, attitude, and practice. Pearson correlation coefficient was also calculated. We observed good knowledge and attitude in 62.6% (241) and 60.8% (234) parents, respectively, but good preventive practice only in 42.1% (162) of parents. Regarding food poisoning knowledge, only age, education level and monthly income were significantly associated ($p < 0.05$) with it. On the other hand, all socio-demographic variables (age, gender, education level, number of children and monthly income) were significantly ($p < 0.05$) associated with both attitude and preventive practice. Besides, a significant positive correlation was observed between knowledge and attitude ($r = 0.797$, $p = 0.001$), knowledge and practice ($r = 0.594$, $p = 0.002$) and attitude and practice ($r = 0.545$, $p < 0.001$). The majority of the parents demonstrated good knowledge and attitude but poor preventive practices towards food poisoning. Parents who had good knowledge also exhibited a positive attitude and practice. Thus, we can improve parents' attitudes and practices by improving food poisoning knowledge. Therefore, this study provides a baseline for health authorities to emphasize increasing parental knowledge and strategies to change parents' attitudes toward food poisoning while also polishing their good practices.

Keywords: *Food-borne diseases (FBDs), food poisoning, knowledge, attitude, practice, parents*

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1. Introduction

Food as a vehicle is used by so many pathogenic and toxigenic agents to induce food-borne diseases (FBDs) [1]. Food-borne diseases (FBDs), also known as 'Food Poisoning' and Food-borne illness, have become more common in recent decades, threatening the health and economic well-being of many people in both developed and developing nations [2]. According to the WHO (World Health Organization), 1 out of every 10 people in the globe becomes sick after eating contaminated food, and the majority of instances occur at home. Moreover, it is reported that food poisoning kills over 2 million people per year, mostly in developing nations [3]. By definition, food-borne disease (FBD) is a set of diseases by pathogenic microbes (bacteria and viruses), toxic chemicals, radioactive substances, and other harmful substances that cause more than 250 different diseases ranging from diarrhea to cancer [4]. Heavy metals or naturally existing poisons can also contaminate food, causing long-term health issues including cancer and neurological disorders [5].

The term "food poisoning" is occasionally used interchangeably with the terms "food-borne illnesses" or "food-borne disease," which are both characterized by a rapid onset of symptoms, an acute illness, and primarily gastrointestinal symptoms [6]. Food poisoning is triggered by eating food that has been tainted with microorganisms

or their poisons, that can occur as a result of inadequate storage methods, poor handling practices, cross-contamination from food contact surfaces, or people concealing germs in their nails and skin [7]. Disease-causing organisms such as bacteria, viruses, and other food-borne microorganisms can proliferate and spread due to insufficient sanitary procedures during food preparation, handling, and storage. [8]. Reportedly, Toxigenic food poisoning signs usually occur within 24 hours after consuming contaminated food and some key signs are nausea, vomiting, diarrhea, headache, abdominal pain, and fever. On the other hand, life-threatening neurologic, hepatic, and renal disorders may also appear many days after intestinal infection and result in chronic impairment or death [9].

The popularity of FBDs is influenced by several variables i.e.; food manufacturing, processing, and storage procedures, as well as food users' hygiene behaviors, which all have a significant impact on the threat of FBDs [10]. The incorrect storage or reheating of food accounts for around half of all occurrences of food poisoning, while cross-contamination accounts for the other half. FBDs risk is also determined by a variety of characteristics including gender, age, education, financial level, and cultural influences [11]. Houses in developing nations are major contributors to FBDs outbreaks and the reason is the mixing of raw food with cooked food, a lack of food safety knowledge, poor personal hygiene practice and inappropriate food handling [12]. Cross-contamination can also occur when cutting boards, utensils and related cooking stuff are not cleaned. To avoid the transmission of food-borne infections, proper personal hygiene practice is recommended [13].

Lahore is the second-largest city in Pakistan and an abrupt change is observed in food demand and the number of food places due to the rapid population increase in Lahore. In such a densely populated metropolitan city, the importance of food safety becomes exponentially when an individual's survival, well-being, and health cannot be compromised. Cases of FBDs are increasing in Lahore and well-reported data is not available. As a result, there is a knowledge gap on this critical public health issue. Therefore, this research was aimed to appraise parents' knowledge, attitude and preventive practice about food-borne diseases (food poisoning) in Lahore, Pakistan. We observed that the phrase "food poisoning" is often used and understood in the examined community. Therefore, in this study, the phrase "food poisoning" is employed. Moreover, to the best of our knowledge, this issue has not yet been the subject of any studies. Therefore, the outcomes of this study will assist public health policymakers in the establishment of a practical, effective, and relevant health intervention program to teach people how to correctly handle food and avoid food-borne diseases.

2. Material and Methods

2.1. Study Area

Lahore is the study area of our research. Lahore is located in the northeastern region of Punjab, Pakistan, and has a population of 12,642,000 people according to a recent census. It covers 1772 square kilometers and is located at 31° 34' 55.3620" N latitude and 74° 19' 45.7536" E longitude. Below, Figure 1 shows the location of the research site, where red symbols are presenting the locations and numbering inside each block is showing the number of parents who participated in survey from each location respectively.

2.2. Study Design and Sampling Strategy

We conducted a descriptive cross-sectional study targeting mainly Parents in Lahore city, Pakistan. The study period was from 1st April 2022 to 30th June 2022. To conduct this study approval was taken by the institutional review committee of Wuhan University, China.

An online software program named 'Rao-soft Sample Size Calculator" was used to calculate our sample size. As a result, the calculated sample size for the study was 385 participants, with a 5% margin of error, a 95% confidence level, and a 50% response distribution. [14]. We took consent from all participants after explaining to them the importance and need of this research. We made them sure that data will be kept confidential and used only for research purposes. Following Figure 2 is showing the overall methodology of our research.

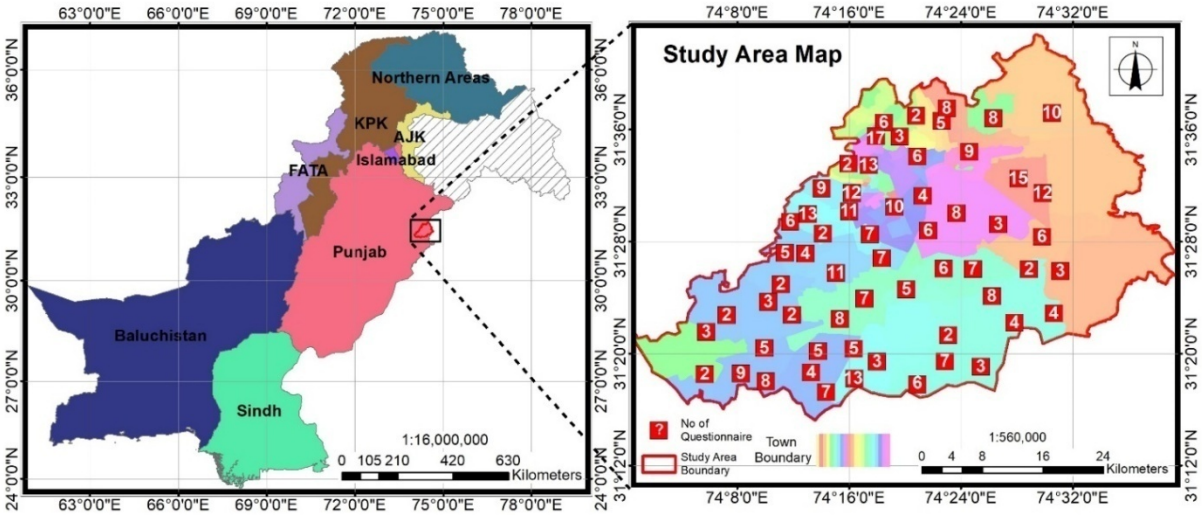

Figure 1. Study area on Map

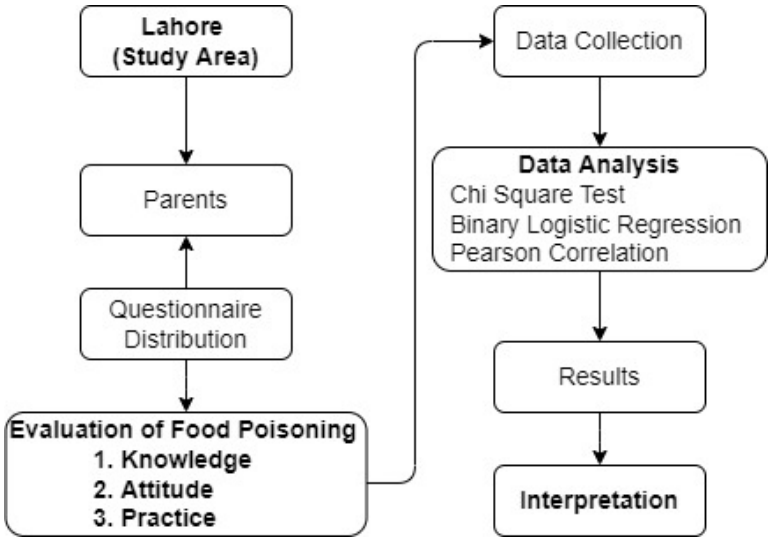

Figure 2. Data flow diagram for this Research

2.3. Data Collection Tool and Quality Measures

Following a review of the literature and consultation with experts, we utilized a pre-validated questionnaire used in previous studies [6,12]. By using this questionnaire, we assessed our participants on three primary parameters: knowledge, attitude, and preventive practice. Each questionnaire had four sections.

1. The first section included demographic details, e.g., age, gender, education, monthly income, etc.
2. The second section was designed to evaluate the food poisoning knowledge of participants. This section contained 15 questions with three likely responses; 'Agree', 'Not Sure' and 'Disagree'.
3. The third section contained 15 questions to evaluate the food poisoning attitude of participants. Each question had three likely responses; 'Agree', 'Don't Know' and 'Disagree'.
4. The fourth section contained 20 questions to evaluate the food poisoning preventive practice routine of participants. Each question had three likely responses; 'Yes', 'Not Always' and 'No'.

We ranged our measurement scale of response from 1 to 3 values. For positive statements direction of the scale was 3 to 1 and for negative statements direction of the scale was 1 to 3. In this way, a value less than 3 was considered a negative response (incorrect answer), and a value of 3 was considered a positive response (correct answer). In this study, responses were analyzed as categorical variables (right and wrong answers). In every section, the correct answer was given a score of "1" and the wrong answer was given a score of "0" (including Don't Know, Not Sure and Not Always). The same method of assessment has been used in the previous study [15]. It was considered "poor" knowledge, attitude and practice level of respondents, if the cumulative scores were below 70% of correct answers and scores higher than or equal to 70%, were considered as "good" [16,17].

Before the data was collected, a pilot study with 30 parents was undertaken. To build the best appropriate questionnaire, minor tweaks were made in reaction to participant comments. The knowledge domain had a Cronbach's alpha of 0.745, the attitude domain had a Cronbach's alpha of 0.823, and the ready to practice domain had a Cronbach's alpha of 0.715. We did not use this pilot data in our study for further analysis.

2.4. Data Analysis

We checked the questionnaire manually before coding and analyzing it into the SPSS (Statistical Packages for Social Science) software. We used frequencies and percentages to represent categorical variables like gender, age, etc. and responses to each question. For all statistical analysis, a p-value of less than 0.05 ($p < 0.05$) was considered statistically significant. The Chi-square test was used to observe the relationship between socio-demographic variables and parents' knowledge, attitude, and preventive practice level. We also applied binary logistic regression to find the predictors of parents' knowledge, attitude, and preventive practice level. To analyze the correlation between knowledge, attitude, and practice, we used the Pearson correlation coefficient. To assess the strength of correlation we used the same classification suggested by Davis such as; negligible (0.01-0.09), low (0.10-0.29), moderate (0.30-0.49), substantial (0.50-0.69), and strong ($\geq$ 0.70) [18].

3. Results

3.1. Socio-Demographic Data

We interviewed 385 parents according to our sample size and the response rate was 100% for our study. The majority of the respondents 33% (n=127) were of age between 20 to 30 years and the majority of the respondents were females 73.5% (n=283) in our study. Results of education level show that the highest education level of respondents was secondary 34.3% (n=132). Looking at monthly income, we found out that 40.3% (n=132) of the participants had 30,000-45,0000 PKR (Pakistani Rupees) monthly income. Detailed results of demographic variables are shown in Figure 3.

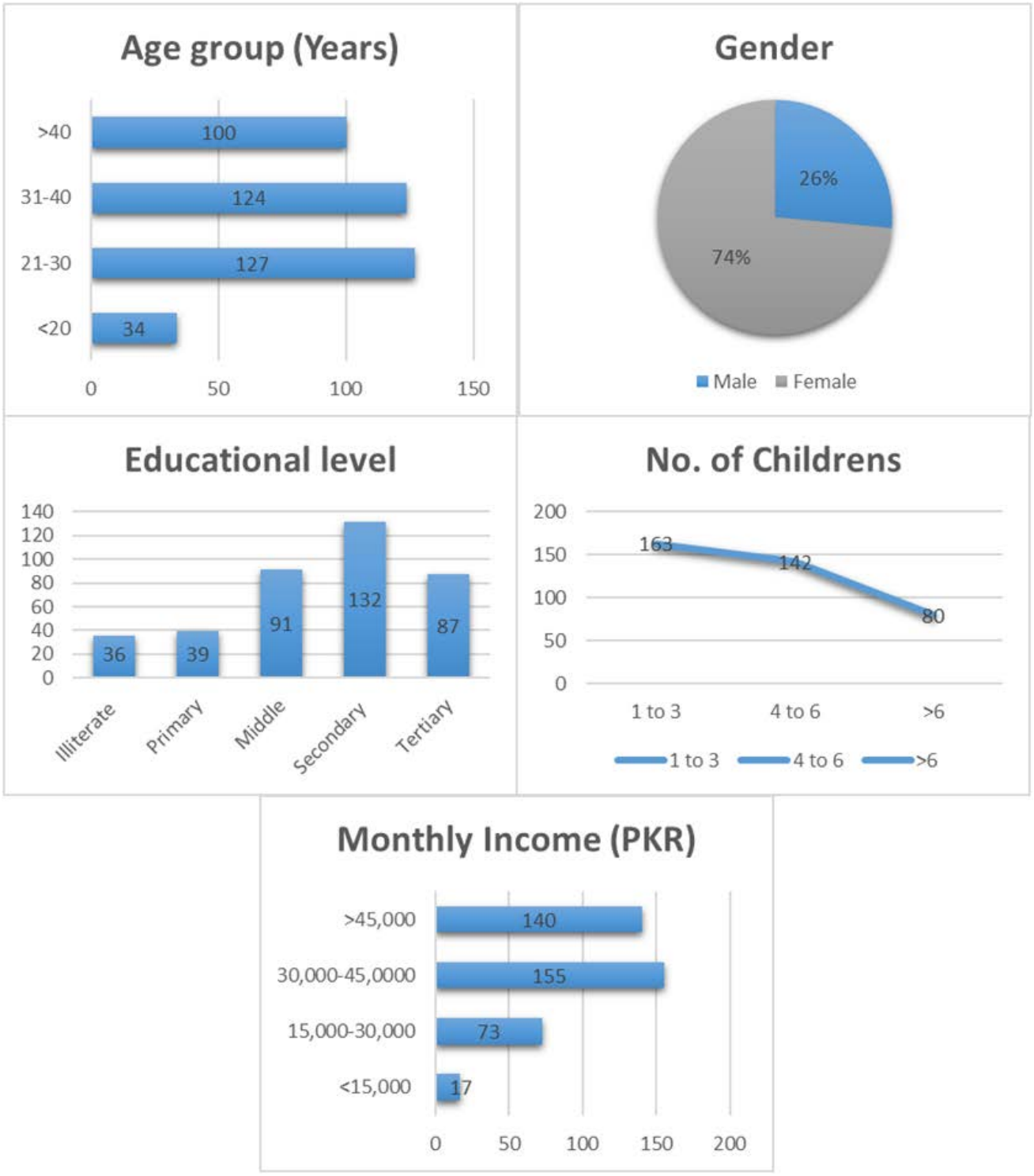

Figure 3. Socio-demographic data of respondents

3.2. Knowledge about Food Poisoning

In Table 1, we represented the responses of participants (parents) regarding food poisoning knowledge along with two additional columns to show the frequency of good knowledge (correct answers) and poor knowledge (wrongs answers) of every question respectively. Overall, Good knowledge about food poisoning was noticed in 62.6% (241) parents. It was revealed that Around 87% of the respondents agreed that pathogenic microbes cause food poisoning. A total of 78.2% of parents agreed that eating raw unwashed vegetables is highly risky for food poisoning and 77.7% agreed that drinking raw milk is highly risky for food poisoning. Moreover, 80.8%, 96.4% and 74% of the respondents respectively agreed correctly that use of gloves while handling food, hand washing before cooking and hand washing after handling raw food prevents foodborne disease. A total of 84.4% and 63.6% of parents agreed that contaminated water and food handlers with unhygienic practices could be the source of microbial contamination of the food which causes food poisoning. The majority of respondents agreed that well-cooked food is free from microbes that cause food poisoning (84.2%) and that keeping food in the refrigerator will slow down the microbial growth and multiplication thus preventing food poisoning (95.1%).

Approximately 57.9% of the respondents agreed Leftover food smelling good is still safe to eat. Only 44.7% of parents correctly agreed that children, pregnant women, and older individuals are more at risk of food poisoning and 55.3% agreed that Food poisoning can have health and economic effects on society. About 82.6% of the respondents agreed that drinking surface water like rivers, streams, and rainwater reservoirs without any treatment is a high risk to cause food poisoning. On the other hand, only 55.3% of the respondents correctly agreed there is no risk of food poisoning from eating leftover cooked food kept in the refrigerator for 2–3 days.

Table 1. Questions to evaluate Knowledge about food poisoning

No.	Questions	Agree		Not Sure		Disagree		Good Knowledge		Poor Knowledge	
		(n)	%	(n)	%	(n)	%	(n)	%	(n)	%
1	Food poisoning is caused by pathogenic microbes.	**335**	**87**	39	10.1	11	2.9	335	87	50	13
2	Use of gloves while handling food reduces the risk of food contamination.	**311**	**80.8**	32	8.3	42	10.9	311	80.8	74	19.2
3	Drinking raw milk is highly risky for food poisoning.	**299**	**77.7**	39	10.1	47	12.2	299	77.7	86	22.3
4	Hand washing before cooking reduces the risk of food contamination.	**371**	**96.4**	9	2.3	5	1.3	371	96.4	14	3.6
5	Washing of hands after handling raw food prevents foodborne disease.	**285**	**74.0**	63	16.4	37	9.6	285	74.0	100	26
6	Eating raw unwashed vegetables and unwashed fruit is highly risky for food poisoning.	**301**	**78.2**	26	6.8	58	15.1	301	78.2	84	21.8
7	Contaminated water can be a vehicle for foodborne disease transmission.	**325**	**84.4**	57	14.8	3	0.8	325	84.4	60	15.6
8	Food handlers with unhygienic practices could be the source of microbial contamination of the food which causes food poisoning.	**245**	**63.6**	87	22.6	53	13.8	245	63.6	140	36.4
9	Well cooked food is free from microbes which cause food poisoning.	**324**	**84.2**	47	12.2	14	3.6	324	84.2	61	15.8
10	Leftover food smelling good is still safe to eat.	67	17.4	95	24.7	**223**	**57.9**	223	57.9	162	42.1
11	Food poisoning can have health and economic effects on the society.	258	67.0	73	19.0	54	14.0	258	67.0	127	33
12	Children, pregnant women and older individuals are more at risk of food poisoning .	172	44.7	193	50.1	20	5.2	172	44.7	213	55.3
13	Keeping food at refrigerator temperature will slow down microbial growth and multiplication, thus preventing food spoilage and food poisoning.	366	95.1	18	4.7	1	0.3	366	95.1	19	4.9
14	Drinking surface water like rivers, streams, and rainwater reservoirs without any treatment such as boiling or adding chlorine, is at high risk to cause food poisoning.	318	82.6	19	4.9	48	12.5	318	82.6	67	17.4
15	There is no risk of food poisoning from eating leftover cooked food kept in refrigerator for 2–3 days.	213	55.3	78	20.3	94	24.4	213	55.3	172	44.7
Overall Knowledge Level						**Good Knowledge** 241 (62.6%)				**Poor Knowledge** 144 (37.4%)	

Table 2. Questions to evaluate attitude about food poisoning.

No.	Questions	Agree		Don't Know		Disagree		Good Attitude		Poor Attitude	
		(n)	%	(n)	%	(n)	%	(n)	%	(n)	%
1	Raw milk is more healthy and nutritious than pasteurized or boiled milk.	53	13.8	48	12.5	**284**	**73.8**	284	73.8	101	26.2
2	Consumption of expired food can cause foodborne illness.	**379**	**98.5**	4	1.0	2	0.50	379	98.5	6	1.5
3	Defrosted food should not be frozen again.	**139**	**36.1**	152	39.5	94	24.4	139	36.1	246	63.9
4	It is not safe to store raw and cooked food together.	**162**	**42.1**	191	49.6	32	8.3	162	42.1	223	57.9
5	Food and personal hygiene training are not important to you.	50	13.0	75	19.5	**260**	**67.5**	260	67.5	125	32.5
6	The best place to store raw meat or chicken in the freezer is on the bottom shelf.	**86**	**22.3**	233	60.5	66	17.1	86	22.3	299	77.7
7	Only wiping vegetables or fruits make them safe to be eaten.	133	34.5	2	0.52	**250**	**64.9**	250	64.9	135	35.1
8	There is no risk of disease from eating cooked food kept at room temperature for one day if covered.	27	7.0	25	6.5	**333**	**86.5**	333	86.5	52	13.5
9	Towels used in the toilet can be used in the kitchen.	13	3.4	26	6.8	**346**	**89.8**	346	89.8	39	10.2
10	Frequent hand washing help to prevent foodborne diseases.	**370**	**96.1**	8	2.1	7	1.81	370	96.1	15	3.9
11	Proper cooking of food could prevent food poisoning.	**350**	**90.9**	24	6.2	11	2.9	350	90.9	35	9.1
12	Eggs should be properly washed before cooking or frying.	**136**	**35.3**	123	31.9	126	32.7	136	35.3	249	64.7
13	Washing hands with soap and water before eating food is necessary to prevent food poisoning.	**364**	**94.5**	6	1.6	15	3.9	364	94.5	21	5.5
14	Food poisoning could cause severe diseases that end in hospitalization and sometimes death.	**342**	**88.8**	20	5.2	23	6.0	342	88.8	43	11.2
15	Washing hands with soap and water before preparing food is necessary to prevent food poisoning.	**351**	**91.2**	29	7.5	5	1.3	351	91.2	34	8.8
Overall Attitude Level						**Good Attitude** 234 (60.8%)				**Poor Attitude** 151 (39.2%)	

3.3. Attitude towards Food Poisoning

Overall, a good attitude towards food poisoning was observed in 60.8% (234) of parents. Responses in Table 2 reveal that a total of 73.8% correctly disagreed that raw milk is healthier than boiled milk and 67.5% disagreed that food and personal hygiene training are not important to you. The majority of the parents (98.1%) agreed that the consumption of expired food can cause foodborne illness. Moreover, less number of parents correctly agreed that defrosted food should not be frozen again (36.1%), it is not safe to store raw and cooked food together (42.1%), and the best place to store raw meat or chicken is the bottom shelf of the refrigerator (22.3%) and eggs should be properly washed before cooking or frying (35.3%). Regarding fruits and vegetables, 64.9% of parents have correctly disagreed that only wiping vegetables or fruits make them safe to be eaten. Approximately, 86.5% and 89.5% of parents disagreed that there is no risk of disease from eating cooked food kept at room temperature for one day if covered and towel used in the toilet can be used in the kitchen. The majority of the parents 96.1%, 90.9%, 94.5%, 88.8%, and 91.2% respectively correctly agreed that frequent hand washing help to prevent foodborne diseases, proper cooking of food could prevent food poisoning, washing hands with soap and water before eating food is necessary to prevent food poisoning, food poisoning could cause severe diseases that end in hospitalization and sometimes death and washing hands with soap and water before preparing food is necessary to prevent food poisoning.

3.4. Preventive Practice Regarding Food Poisoning

Results of our study show that the poor preventive practice trend is greater in parents. Good preventive practice level was observed only in 42.1% (162) parents. In Table 3, parents' responses suggested that 84.9% of parents wash fresh vegetables and fruits before eating. It is observed that 58.7% wash their hands with soap and water before eating their meal, 57.4% wash hands with water and soap before preparing food and 58.7% use their hand to cover their mouth while coughing or sneezing. Almost, 76.9% wash r hands with soap and water after using the toilet, and 62.6% wash and rinse cutting boards, knives and plates used for raw meat before using them for other food. On the other hand, only 45.5% cover their cut with a bandage and use gloves before cooking. About 71.9% store raw chicken or meat separately from other food, 84.2% protect raw food from insects and rodents and 92.5% protect cooked food from insects and rodents. Over 60% 0f parents Don't eat raw eggs, Don't eat raw meat, Don't taste and dish out food with unprotected hands and Don't drink raw cow or goat milk (67.5%, 66.8%, 61.8% and 66.2% respectively). Moreover, 53.2% of parents read expiry date of packaged food before purchasing and 53.5% read conditions of use and storage of packaged food. On the other hand, 33.2% of parents don't eat cooked food left at room temperature for over 6 h without sufficient heating, 78.7% don't eat food from a restaurant looks not clean, 75.6% don't drink from rainwater or surface stream water without any treatment and 66.2% parents don't eat food, like meat and rice and soup, by hand from a big bowl shared by several people.

Table 3. Questions to evaluate practice routine

No.	Questions	Yes		Sometimes		No		Good Practice		Poor Practice	
		(n)	%	(n)	%	(n)	%	(n)	%	(n)	%
1	Do you wash fresh vegetables and fruits before eating?	**327**	**84.9**	48	12.5	10	2.6	327	84.9	58	15.1
2	Do you wash your hands with soap and water before eating your meal?	**226**	**58.7**	88	22.9	71	18.4	226	58.7	159	41.3
3	Do you wash your hands with water and soap before preparing food?	**221**	**57.4**	133	34.5	31	8.1	221	57.4	164	42.6
4	Do you use your hand to cover your mouth while coughing or sneezing?	**226**	**58.7**	73	19.0	86	22.3	226	58.7	159	41.3
5	Do you wash your hands with soap and water after using the toilet?	**296**	**76.9**	65	16.9	24	6.2	296	76.9	89	23.1
6	Do you wash and rinse cutting boards, knives and plates used for raw meat before using them for other food?	**241**	**62.6**	87	22.6	57	14.8	241	62.6	144	37.4
7	Do you cover your cut with a bandage and use gloves?	**175**	**45.5**	77	20.0	133	34.5	175	45.5	210	54.5
8	Do you store raw chicken or meat separately from food?	**277**	**71.9**	22	5.7	86	22.3	277	71.9	108	28.1
9	Do you protect raw food from insects and rodents?	**324**	**84.2**	38	9.9	23	6.0	324	84.2	61	15.8
10	Do you protect cooked food from insects and rodents	**356**	**92.5**	0	0	29	7.5	356	92.5	29	7.5
11	Do you eat raw eggs?	88	22.9	37	9.6	**260**	**67.5**	260	67.5	125	32.5
12	Do you eat raw meat?	95	24.7	33	8.6	**257**	**66.8**	257	66.8	128	33.2
13	Do you taste and dish out food with unprotected hands?	56	14.5	91	23.6	**238**	**61.8**	238	61.8	147	38.2
14	Do you drink raw cow or goat milk?	112	29.1	18	4.7	**255**	**66.2**	255	66.2	130	33.8
15	Do you read labels with the use by or expiry date of packaged food before purchasing?	**205**	**53.2**	56	14.5	124	32.2	205	53.2	180	46.8
16	Do you read the conditions of use and storage of packaged food?	**206**	**53.5**	47	12.2	132	34.3	206	53.5	179	46.5
17	Do you eat cooked food left at room temperature for over 6 h without sufficient heating?	182	47.3	75	19.5	**128**	**33.2**	128	33.2	257	66.8
18	Do you eat food from a restaurant/cafeteria looks not clean?	16	4.2	66	17.1	**303**	**78.7**	303	78.7	82	21.3
19	Do you drink from rainwater collected in reservoir or surface stream water without any treatment?	33	8.6	61	15.8	**291**	**75.6**	291	75.6	94	24.4
20	Do you eat food, like meat and rice and soup, by hand from a big bowl shared by several people?	63	16.4	67	17.4	**255**	**66.2**	255	66.2	130	33.8
Overall Practice Level						**Good Practice** 162 (42.1%)				**Poor Practice** 223 (57.9%)	

Table 4. Association between socio-demographic characteristics and food poisoning knowledge, attitude and practice attributes

Variables	Knowledge			Attitude			Practice		
	Good n (%)	Poor n (%)	*p*-Value	Good n (%)	Poor n (%)	*p*-Value	Good n (%)	Poor n (%)	*p*-Value
	241(62.6)	144 (37.4)		234 (60.8)	151 ()		162 ()	223 ()	
Age									
<20	7 (2.9)	27(18.8)		9 (3.8)	25 (16.6)		8 (4.9)	26 (11.7)	
21-30	76 (31.5)	51(35.4)		81 (34.6)	46 (30.5)		47 (29.0)	80 (35.9)	
31-40	91 (37.8)	33(22.9)	0.001*	80 (34.2)	44 (29.1)	0.003*	54 (33.3)	70 (31.4)	0.011*
>40	67 (27.8)	33(22.9)		64 (27.4)	36 (23.8)		53 (32.7)	47 (21.0)	
Gender									
Male	56 (23.2)	46(31.9)	0.061	52 (22.2)	50 (3.1)	0.018*	33 (20.3)	69 (30.9)	0.020*
Female	185 (76.8)	98(68.1)		182 (77.8)	101(66.9)		129 (79.7)	154 (69.1)	
Education									
Illiterate	5 (2.1)	31 (21.5)		4 (1.7)	32 (21.2)		4 (2.5)	32 (14.3)	
Primary	7 (2.9)	32 (22.2)		2 (0.9)	37 (24.5)		6 (3.7)	33 (14.8)	
Middle	27 (11.2)	64 (44.4)		27 (11.5)	64 (42.3)		18 (11.1)	73 (32.7)	
Secondary	122 (50.6)	10 (6.9)	<0.001*	118 (50.4)	14 (9.3)	0.001*	78 (48.1)	54 (24.2)	0.003*
Tertiary	80 (33.2)	7 (4.9)		83 (35.5)	4 (2.7)		56 (34.6)	29 (13.0)	
No. of Children									
1-3	100 (41.5)	63 (43.7)		112 (47.9)	51 (33.8)		52 (32.1)	111 (49.8)	
4-6	97 (41.2)	45 (31.3)	0.131	90 (38.5)	52 (34.4)	0.001*	74 (45.7)	68 (30.5)	0.005*
>6	44 (18.3)	36 (25.0)		32 (13.6)	48 (31.8)		36 (22.2)	44 (19.7)	
Monthly Income									
<15,000	5 (2.1)	12 (8.3)		1 (0.4)	16 (10.6)		5 (3.1)	12 (5.4)	
15,000-30,000	17 (7.1)	56 (38.9)	0.003*	25 (10.7)	48 (31.8)	0.001*	20 (12.3)	53 (23.8)	0.001*
30,000-45,0000	102 (42.3)	54 (37.5)		90 (38.5)	65 (43.0)		60 (37.1)	95 (42.6)	
>45,000	118 (48.5)	22 (15.3)		118 (50.4)	22 (14.6)		77 (47.5)	63 (28.2)	

3.5. Association between Socio-demographic Characteristics and Food Poisoning Knowledge, Attitude, and Preventive Practice Attributes

We conducted a chi-square test for assessing the association of socio-demographic characteristics of parents with their food poisoning knowledge, attitude and preventive practice attributes. Detailed results of the chi-square test are shown in Table 5. All demographic characteristics (age, level of education and monthly income) except for "gender" and "no. of children" presented a significant association ($p < 0.05$) with food poisoning knowledge of parents. It is perceived from detailed results that parents of age between 31-40 years, with a statistical significance ($p = 0.001$), had good food poisoning knowledge. Parents with high education levels (secondary) had good food poisoning knowledge ($p < 0.001$). Moreover, parents with the highest monthly income (>45000PKR) had good food poisoning knowledge ($p = 0.003$).

In respect of attitude, Table 4 shows that all socio-demographic characteristics (age, gender, level of education, no. of children and monthly income) were significantly ($p < 0.05$) associated with food poisoning attitude. It is revealed that parents of age between 21-30 years had a good attitude about food poisoning, with a statistical significance ($p = 0.003$). Likewise, Female parents had a good attitude as compared to male parents ($p = 0.018$). Moreover, parents with high education level (secondary), parents with the highest monthly income (>45000PKR) and parents of 1-3 kids also had a good food poisoning attitude, with a statistical significance ($p = 0.001$).

Similarly, a chi-square test was also carried out between the socio-demographic attributes and food poisoning preventive practice. All socio-demographic variables were considerably ($p < 0.05$) associated with food poisoning practice. It is shown in Table 5 that the parents of age between 31-40 years had a good preventive practices with a statistical significance ($p = 0.011$). Female parents had more good preventive practices as compared to male parents ($p = 0.020$). Besides, parents with high education level (secondary), parents of 4-6 kids and parents with the highest monthly income (>45000PKR) also had good food poisoning preventive practices, with a statistical significance ($p = 0.003$, $p = 0.005$ and $p = 0.001$ respectively).

3.6. Determining predictors of Parents' Knowledge, Attitude and Preventive Practice Regarding Food Poisoning

We performed binary logistic regression analysis to identify predictors of parents Knowledge, Attitude and Practice about food poisoning. Results of binary logistic regression are shown in Table 5. It is revealed that all independent variables of our study (age, gender, education, no. of children and monthly income) are significantly associated with knowledge, and attitude but in the case of practice level, only education level is significantly associated.

Table 5. Binary logistic regression for predictors of parents' knowledge, attitude, and preventive practice level of food poisoning

Variables	Knowledge				Attitude				Practice			
	p-Value	OR_A	95 % CI		*p*-Value	OR_A	95 % CI		*p*-Value	OR_A	95 % CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Age												
<20		1				1				1		
21-30	0.030	1.482	1.040	2.113	0.003	1.735	1.209	2.490	0.075	0.595	0.415	0.852
31-40	**0.001**	**2.548**	**1.723**	**3.769**	**0.002**	**1.787**	**1.238**	**2.580**	0.154	0.773	0.542	1.102
>40	0.002	1.974	1.304	2.989	0.007	1.751	1.165	2.631	0.549	1.127	0.761	1.670
Gender												
Male		1				1				1		
Female	**0.000**	**1.849**	**1.449**	**2.361**	**0.001**	**1.773**	**1.391**	**2.259**	0.139	1.138	0.963	1.059
Education												
Illiterate		1				1				1		
Primary	0.005	0.135	0.051	0.356	0.008	0.166	0.068	0.408	0.036	0.135	0.051	0.356
Middle	0.003	0.443	0.284	0.692	0.005	0.372	0.234	0.590	0.003	0.299	0.183	0.487
Secondary	0.001	6.350	3.861	10.444	0.002	5.457	3.406	8.745	0.007	1.624	1.143	2.307
University	**0.000**	**7.389**	**3.863**	**14.133**	**0.000**	**7.451**	**3.853**	**14.125**	0.000	**2.341**	1.480	3.704
No. of Children												
1-3		1				1				1		
4-6	**0.001**	**2.080**	**1.464**	**2.955**	**0.005**	**1.708**	**1.215**	**2.401**	0.615	1.088	0.783	1.512
>6	0.373	1.221	0.786	1.897	0.079	0.670	0.429	1.048	0.373	0.819	0.527	1.272
Monthly Income												
<15,000		1				1				1		
15,000-30,000	0.005	0.344	0.203	0.581	0.010	0.533	0.329	0.862	0.080	0.405	0.244	0.672
30,000-45,0000	0.002	1.982	1.420	2.766	0.047	1.381	1.004	1.899	0.067	0.724	0.526	0.996
>45,000	**0.000**	**4.173**	**2.743**	**6.347**	**0.000**	**3.941**	**2.609**	**5.952**	0.239	1.221	0.876	1.704

Significant at p< 0.05, CI: confidence interval, OR_A: adjusted odds ratio and 1 is the reference.

In the 1st column under the heading of knowledge (Table 5), the odds ratio of 2.548 reveals that parents of age between 31-40 years are 2.548 times more likely to have good food poisoning knowledge than other age groups [OR_A= 2.54, (95% CI 1.723-3.769), p = 0.001]. In the same manner, female parents are 1.849 times more likely to have good food poisoning knowledge levels than male parents [OR_A= 1.849, (95% CI 1.449-2.361), p < 0.001]. Moreover, results of binary logistic regressions show that parents with tertiary education levels are 7.389 times more likely to have good knowledge of food poisoning as compared to other education level groups [OR_A= 7.389, (95% CI 3.863-14.133), p < 0.001]. Further detailed results can be seen in Table 5.

An odd ratio of 1.787 in the 2nd column under the heading of attitude (Table 5), reveals that parents of age between 31-40 years are 1.787 times more likely to have a good food poisoning attitude than other age groups [OR_A= 1.787, (95% CI 1.238-2.580), p = 0.002]. The odd ratio of 1.773 reveals that female parents are 1.773 times more likely to have a good food poisoning attitude level than male parents [OR_A= 1.773, (95% CI 1.391-2.259), p = 0.001]. Moreover, the result shows that parents with tertiary education level are 7.451times more likely to have a good food poisoning attitude as compared to other education level groups [OR_A= 7.451, (95% CI 3.853-14.125), p < 0.001]. Further detailed results are shown in Table 5.

Results in the 3rd column under the heading of practice (Table 5) reveal education is the only predictor of parents' food poisoning practice. The result shows that parents with a university education level are 2.341 times more likely to have a good food poisoning practice [OR_A= 2.341, (95% CI 0.876-1.704), p < 0.001].

3.7. Correlations between Knowledge, Attitude and Practice Level Regarding Food Poisoning

Findings of Pearson correlation are presented in Table 6. It is revealed from the findings that there is a strong positive association between parents' knowledge and attitude about food poisoning (r = 0.797, p = 0.001). Moreover, a substantial positive association is observed between parents' knowledge and practice (r = 0.594, p = 0.002). Likewise, the result shows a substantial positive relationship between parents' attitudes and food poisoning practice as well (r = 0.545, p < 0.001). As a result, it is reasonable to assume that as knowledge grows, so will attitude and practice.

Table 6. Correlations between Knowledge, Attitude and Practice Level Regarding Food Poisoning

		Knowledge	Attitude	Practice
Knowledge	Pearson Correlation	1	0.797**	0.594**
	Sig. (2-tailed)		0.001	0.002
Attitude	Pearson Correlation	0.797**	1	0.545**
	Sig. (2-tailed)	0.002		<0.001
Practice	Pearson Correlation	0.594**	0.545**	1
	Sig. (2-tailed)	0.002	<0.001	

**Correlation is significant at the 0.01 level (p < 0.01), 2-tailed.

4. Discussion

Our findings disclose vital information about parents' knowledge, attitude, and preventive practice about food poisoning. According to recent studies, knowledge, attitude, and practice, are important aspects in minimizing the occurrence of food-borne infections in the food manufacturing and distributing areas [19]. These aspects themselves, on the other hand, are impacted by a variety of numerous factors. According to reports, the most significant factors influencing knowledge, attitude, and practice are age, gender, education level, and socioeconomic status [20,21]. In this research, the majority of respondents were females, who demonstrated higher levels of knowledge, attitude, and practice than male respondents. The highest possible reason could be that women in the developing world are more commonly responsible for family care, cleaning and organizing the house, cooking food, and for the well-being of their children, as a wife and as a mother [22,23].

In this study more than half of the parents (62.6%) had a good knowledge level of food poisoning and it is in accordance with the result of previous studies [6,24]. In our study, the majority of the parents agreed that pathogens are responsible for food poisoning, drinking raw milk, eating raw meat, unwashed vegetables and fruits are highly dangerous in terms of food-borne infections, and food handlers are a potential source of microbial contamination. Many parents are aware that well-prepared food is devoid of microorganisms, and almost half of the parents are aware that it is not safe to eat leftover food that smells good, and leftovers preserved in the refrigerator for 2–3 days are still safe to eat. Similar outcomes were seen in other studies conducted in Palestine and Saudi Arabia [1,4]. It was shown that knowledge was substantially connected with age, educational level, and monthly income status. These findings tend to support previous research [4] that also found a connection between educational level and knowledge score. Gender was not substantially connected with knowledge level in our study, but it was strongly associated with attitude and practice. This data supports the notion that women are more aware of proper food handling approaches. The study cited earlier backs up these findings of our study [7].

Food safety and practice are influenced by attitude, which helps to reduce the occurrence of food-related diseases [25]. According to this study, the majority of parents (60.8 %) had a positive attitude regarding food poisoning. Our research findings are similar to studies from Ghana and Haiti [26,27], but not similar to research from Malaysia [28]. The current study found that the great majority of parents were unaware that storing raw and cooked foods together is unsafe, which contradicts a study conducted in Haiti [27]. This process of separating fresh foods from cooked meals may assist to reduce cross-contamination, which in turn may help to prevent infections and FBDs. Moreover, results of our study revealed that only a few parents knew that defrosted food should never be frozen again. This result is in line with previous studies [29,30,31]. Repeated melting and freezing of food increases the number of microorganisms in the meal, perhaps posing a health risk. Furthermore, the majority of parents in our survey were unsure that the ideal place to keep raw meat or chicken in the freezer was on the bottom shelf. Tuglo [16] also found the same result. Regarding attitude, gender was found to be an influencing factor. While, a study done in Palestine showed no significant link between gender and food poisoning attitudes [4]. Parents with higher education also had a better attitude than those with a lower level of education. Studies were done in Turkey and China also showed similar results [32,33]. Income level was also shown to have an impact on attitude level and these findings back up the prior findings [32,34].

Food poisoning preventive practice is essential for ensuring the preparation of healthy food with no chance of infection. Despite having strong knowledge and attitude, most parents (57.9%) showed poor preventive practices in our study. It contrasts with prior research where more than half of the parents had good food poisoning preventive practices [35]. In certain investigations, it was shown that food safety knowledge and attitudes do not match with practice. Few people who have good knowledge about food safety change their practice routine in response to it [36]. According to the findings, the majority of parents wash their hands before and after eating, as well as after using the toilet. These findings are consistent with earlier research by Zyoud and Shati [1,4]. In our study, more than half of the parents do not cough straight into their hands, which contradicts findings from prior research in Malaysia and the United States [37,38]. According to our study, the great majority of parents wash their cooking equipment before using them for multiple meals, which is inconsistent with a prior study that found food handlers do the same [39]. In our research, only 45.5% of parents cover their injuries with bandages and wear gloves while handling food. This outcome is not in line with the study of Tokuc, who discovered that nearly all (93.2%) of their food workers bandage their injuries and use gloves while handling food [31]. Practice regarding food poisoning was shown to be strongly associated with age, gender, education level, and monthly income. It is revealed in a study that persons of low age have higher risky behaviors and food safety awareness increases with age [40]. It is also stated in a previous study that more education confers greater knowledge, which influences one's mindset and, ultimately, hygienic behaviors [26]. Researchers discovered that females possess higher knowledge about food safety and proper food handling techniques than males [41,42]. One possible reason for this outcome is that male parents have less food preparation expertise than female parents. Furthermore, food handlers with greater monthly income were shown to have better practices than those with lower monthly income [43,44]. All these studies mentioned above are supporting the findings of our study.

In our study results of the Pearson correlation coefficient revealed that knowledge is positively related to attitude and practice and in the same manner attitude is positively related to practice. These results back up the findings of Al-Shabib and colleagues [45] but contradict the findings of Fariba and Soon [37,39]. All these results provide a baseline for health authorities to emphasize increasing parental knowledge and schemes to change parents' attitudes toward food poisoning while also polishing their good practices

Moreover, this study has some limitations. The use of face-to-face interviews to collect data is the main limitation of this study. It means that respondents may answer in a way that makes them appear knowledgeable but does not provide real answers. As a result, we can only assess and compare stated practices and have no chance of knowing if respondents do what they claim. In addition, the sample size of our study was small, hence it cannot be generalized to the entire community. In our study, females made up a large portion of the respondents, and they are more likely to be aware of food poisoning risks and motivated to practice properly to avoid food poisoning. As this study is localized to Lahore, this research does not reflect all Pakistani parents but only those in the city of Lahore.

5. Conclusion

In a summary, it is found that the majority of the parents have good knowledge and attitude about food poisoning but poor preventive practice. According to this study, gender, educational level, number of children, and monthly income were also found to have a substantial impact on parents' knowledge, attitude, and practice. Furthermore, parents with good knowledge displayed a positive attitude and practice. Therefore, the current findings are crucial in that they may be used to educate parents about effective food poisoning prevention practices. As a result, health sectors in the local area can focus on fostering parental knowledge, developing strategies to change parents' attitudes and polishing their good practices about food poisoning. Additionally, this data may also provide a baseline of knowledge for Pakistani policy planners and health authorities for encouraging them to reinforce health education campaigns for parents and other population.

Abbreviations

Food-borne diseases – FBDs

Ethics Approval and Consent to Participate

The study is approved by the research ethics committee of Wuhan University. All participants contributed voluntarily and informed consent was taken before the procedure.

Consent for Publication

The authors have taken the consent of all contestants who participated in the research questionnaire.

Availability of Data and Material

All the data and material will be provided when required.

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