Knowledge, Attitudes, and Practices towards Food Poisoning among Parents in Aseer Region, Southwestern Saudi Arabia

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Abstract: Background: Food poisoning is caused by eating contaminated food. Improper food safety knowledge, poor food handling, and inadequate personal hygiene may allow microbes to grow in sufficient numbers to cause a food-borne illness. The aim of this paper was to assess the knowledge, attitudes, and practices regarding food poisoning and its determinants of parents in the Aseer region of Saudi Arabia. Methodology: This is a descriptive cross-sectional study conducted on 3011 parents in the Aseer region in the southwest region of Saudi Arabia. An online questionnaire was used to collect the data. The level of knowledge of the participants was scored as a percentage and further classified as “good” or “poor”. Attitudes were classified as “positive”, “neutral”, or “negative” based on a calculated composite mean score. The participants were asked about standard food hygiene practices, and the practices were recorded based on how often they were performed, with the results recorded as “usually”, “sometimes”, or “never”. Results: The age range of the parents was between 18 and 65 years old, with a mean age of 28.9 ± 10.4 years. Among the participants, 96.2% were Saudi, and 81.8% were female. Almost 53% of the fathers and 41% of the mothers were university graduates. About 55% of the mothers were housewives. Almost equal proportions of the parents had “good” and “poor” levels of knowledge on food poisoning. Around 41% of the parents had positive attitudes towards safe food consumption. Older parents (defined as above 30 years of age), males, university graduates, and urban residents had significantly higher levels of knowledge regarding food poisoning. Conclusions: This study provided much needed information on the knowledge, attitudes, and practices related to food poisoning among parents in the Aseer region of Saudi Arabia. Although most respondents reported satisfactory practices, gaps were identified in knowledge and attitudes. This suggests a need for further investigation focused on the observed practices and strengthening health education activities for the community.

Keywords: food poisoning; foodborne diseases; awareness; attitude; practice; Aseer; Saudi Arabia
food poisoning [4]. In the United States, foodborne illnesses cause 76 million illnesses, 325,000 hospitalizations, and 5000 deaths yearly [5]. The Eastern Mediterranean region has the third-highest estimated burden of food-borne diseases per population, with more than 100 million people estimated to become ill with a food-borne disease every year. [4] According to the Ministry of Health data, there were 358 incidents of food poisoning reported in 2018 in Saudi Arabia [6].

The occurrence of foodborne illness depends on various factors. Food production, handling, and storage practices greatly influence the risk of foodborne illness, coupled with the personal hygiene practices of food consumers [7]. About half of the cases of food-borne illness are related to improper food storage or reheating practices, and the other half are related to issues with cross-contamination [8]. The risk of FBI is also influenced by factors such as gender, age, education, income level, and cultural factors [9]. Improper knowledge, attitudes, and practices towards food handling can lead to foodborne disease outbreaks. Food handlers at home are the main source of food poisoning in children [10]. Parents of young children carry the responsibility of providing safe meals to them. Hence, proper knowledge, attitudes, and practices are essential in maintaining food safety in the home. No studies about knowledge, attitudes, and practices of parents regarding food poisoning have been conducted in Saudi Arabia. This has caused an information gap for this important public health issue. This study aims to assess parents’ knowledge, attitudes, and practices regarding food poisoning in the Aseer region in southwest Saudi Arabia. It is expected that the findings of this study will enable policymakers and other stakeholders to set appropriate, evidence-based priorities in the area of food safety and to develop appropriate health education programs.

2. Methodology
2.1. Study Design, Procedure, and Participants

A descriptive cross-sectional study was conducted targeting all parents in the Aseer region of the southern part of Saudi Arabia. People 18 years and older with children living in the Aseer region were invited to participate in the survey. A total of 3500 eligible parents received the study survey, and 3011 parents completed the study questionnaire, with a response rate of 86%. Data were collected using an electronic questionnaire. The questionnaire was constructed after an intensive literature review and consultation with an expert. A panel of three experts from the medical college of King Khalid University reviewed the questionnaire to check its clarity and content validity. Tool reliability was assessed using a pilot study of 25 participants with a reliability coefficient (α-Cronbach’s) of 0.73. The tool covered the following data: parents’ age, gender, education level, income, and their children’s ages. Knowledge in food poisoning was assessed using 15 questions. For the knowledge items, each correct answer was given one point, and the total sum of the discrete scores of the different items was calculated. Parents with a score of less than 9 points (corresponding to 60% of the maximum score) were considered to have poor knowledge of food poisoning. Good knowledge was considered to correspond with a score of 10 points or more.

The parents’ attitudes were assessed using 15 questions, and the parents’ practices were assessed using 20 questions that covered feeding habits and hygiene. For parent attitudes, the composite mean score was calculated for all the items, and the participants with a mean score below 1.5 were considered to have a negative attitude. Those with a composite mean score between 1.6 to 2.4 points were considered to have a neutral attitude. A positive attitude was assigned to those with a composite mean score of 2.5 to 3 points [11]. Standard food hygiene practices were inquired about and recorded as being practiced “usually”, “sometimes”, or “never”, measured as a percentage. The online questionnaire was uploaded on social media platforms, and all eligible parents were invited to complete the questionnaire after the purpose and confidentiality of the data were explained.

This research was approved by the Research Ethics Committee of King Khalid University (HAPO-06-B-001) on 5 June 2020 with the approval number ECM#2020-0706.
2.2. Data Analysis

After the data were extracted, it was revised, coded, and fed to the statistical software IBM SPSS version 22 (IBM Inc. Armonk, NY, USA). All statistical analysis was done using two-tailed tests. A \( p \)-value of less than 0.05 was considered to be statistically significant. Cross tabulation was used to assess the distribution of awareness according to participants’ bio-demographic data. Relations were tested using the Pearson chi-square test. Multiple logistic regression was undertaken to identify the factors.

3. Results

The study included 3011 participants whose ages ranged from 18 to 65 years old, with a mean age of 28.9 \( \pm \) 10.4 years. The majority of the participants were females (81.8%), and 96.2% of the participants were Saudi. A total of 52.7% of the parents were university graduates, and 21.3% had an educational level below secondary school. Looking at the educational levels of the mothers only, 41.5% were university graduates, and 19.1% had an educational level below secondary school. About 55% of the mothers were housewives. A total of 81% of the participants were urban residents, and 37% had a monthly income of less than SR 10,000 (USD 2667). Almost 65.4% of the respondents had families of six people or more, and 23.2% of the participants only had one child. The mother was responsible for cooking in the home among 87.1% of the respondents, and 93.3% of the respondents had outdoor meals (Table 1).

Table 1. Bio-demographic data of study participants.

| Bio-Demographic Data | \( (n) \) | %     |
|----------------------|---------|-------|
| **Age in years**     |         |       |
| <30 years            | 1946    | 64.6% |
| >30 years            | 1065    | 35.4% |
| **Gender**           |         |       |
| Male                 | 547     | 18.2% |
| Female               | 2464    | 81.8% |
| **Nationality**      |         |       |
| Saudi                | 2898    | 96.2% |
| Non-Saudi            | 113     | 3.8%  |
| **Father’s education** | \( n = 548 \) |       |
| Illiterate           | 39      | 7.1%  |
| Primary              | 46      | 8.4%  |
| Intermediate         | 32      | 5.8%  |
| Secondary            | 100     | 18.2% |
| University           | 289     | 52.7% |
| Above university     | 52      | 9.5%  |
| **Mother’s education** | \( n = 2463 \) |       |
| Illiterate           | 84      | 3.4%  |
| Primary              | 146     | 6.0%  |
| Intermediate         | 240     | 9.7%  |
| Secondary            | 521     | 21.1% |
| University           | 1021    | 41.5% |
| Above university     | 451     | 18.3% |
| **Mother’s occupation** | \( n = 2463 \) |       |
| Governmental         | 948     | 38.5% |
| Private              | 162     | 6.6%  |
| Housewife            | 1353    | 54.9% |
| **Residence**        |         |       |
| Urban                | 2439    | 81.0% |
| Rural                | 572     | 19.0% |
Table 1. Cont.

| Monthly income       | (n) | %   |
|----------------------|-----|-----|
| <5000 SR             | 370 | 12.3% |
| 5000–10,000 SR       | 745 | 24.7% |
| 10,000–15,000 SR     | 680 | 22.6% |
| 15,000–20,000 SR     | 546 | 18.1% |
| >20,000 SR           | 670 | 22.3% |

| Total family size    |     |     |
|----------------------|-----|-----|
| 1–2                  | 99  | 3.3% |
| 3–5                  | 943 | 31.3% |
| 6+                   | 1969 | 65.4% |

| Number of children   |     |     |
|----------------------|-----|-----|
| 1                    | 698 | 23.2% |
| 2–3                  | 735 | 24.4% |
| 4–5                  | 830 | 27.6% |
| 6+                   | 748 | 24.8% |

| Person responsible for cooking at home |     |     |
|---------------------------------------|-----|-----|
| Mother                                | 2622 | 87.1% |
| Father                                | 32  | 1.1% |
| Housekeeper                           | 357 | 11.9% |

| Frequency of outdoor meals           |     |     |
|--------------------------------------|-----|-----|
| None                                 | 202 | 6.7% |
| 1–3/month                            | 1279 | 42.5% |
| 1–2/week                             | 953  | 31.7% |
| >2/week                              | 577  | 19.2% |

SR: Saudi Riyal.

Table 2 shows the parents’ knowledge regarding food poisoning. Around 85% of the respondents agreed that eating raw, unwashed vegetables is an extremely risky behavior that may lead to food poisoning, and 80.9% of respondents agreed that food processors who display unsanitary food practices can be a source of microbial contamination leading to food poisoning. A total of 79.6% of respondents reported that eating unwashed fruits is risky for food poisoning. A total of 74.6% of respondents know that food poisoning is caused by pathogenic microbes, and 74.1% of respondents agreed that eating raw or undercooked meat is very risky for food poisoning. Only 39% of respondents reported that pasteurized milk can be drunk directly without any risk of food poisoning, and 48.7% of respondents agreed on the absence of risk of food poisoning from eating cooked leftovers kept in the refrigerator for 2 to 3 days. Good knowledge regarding food poisoning was detected among 1527 (50.7%) participants.

Table 3 illustrates parents’ attitudes towards safe food consumption and food poisoning. Exactly 67.6% of the respondents disagreed that there is no risk of disease from eating unwashed vegetables and herbs picked directly from the plant, and the same proportion of respondents disagreed that there is no risk of disease from eating raw meat from young animals. A total of 58.3% of respondents disagreed that the rainwater collected in the tank is safe to drink without any treatment, while 56.9% disagreed that raw eggs are healthier and more nutritious than cooked ones. On the other side, 81.1% of respondents agreed that washing hands with soap and water before preparing food is essential to prevent food poisoning. A total of 79.1% of the participants agreed that handwashing with soap and water before eating is essential to prevent food poisoning, and 77.5% of respondents agreed that the thorough washing of vegetables and fruits with tap water is essential to prevent food poisoning. Overall, a positive attitude towards safe food consumption and food poisoning was detected among 1229 (40.8%) participants, while 250 (8.3%) had a negative attitude.
Table 2. Parents’ knowledge regarding food poisoning.

| Knowledge Items                                                                 | Yes (n) | %   | No (n) | %   | Don’t Know (n) | %   |
|--------------------------------------------------------------------------------|---------|------|--------|------|----------------|------|
| Pathogenic microbes cause food poisoning.                                      | 2245    | 74.6%| 130    | 4.3%| 636            | 21.1%|
| Some toxins that microbes produce that cause food poisoning are resistant to the heating temperature of food. | 1700    | 56.5%| 530    | 17.6% | 781            | 25.9%|
| Drinking raw milk is very risky for food poisoning.                           | 1600    | 53.1%| 496    | 16.5%| 915            | 30.4%|
| Eating raw eggs is very risky for food poisoning.                             | 1919    | 63.7%| 567    | 18.8%| 525            | 17.4%|
| Eating raw or undercooked meat is very risky for food poisoning.              | 2231    | 74.1%| 403    | 13.4%| 377            | 12.5%|
| Eating raw, unwashed vegetables is extremely risky for food poisoning.        | 2550    | 84.7%| 257    | 8.5% | 204            | 6.8% |
| Eating unwashed fruits is risky for food poisoning.                           | 2396    | 79.6%| 352    | 11.7%| 263            | 8.7% |
| Food processors who use unsanitary practices can be the source of microbial contamination of food that causes food poisoning | 2436    | 80.9%| 185    | 6.1% | 390            | 13.0%|
| Well-cooked food is free from microbes that cause food poisoning.             | 1805    | 59.9%| 742    | 24.6%| 464            | 15.4%|
| Eating uncooked cooked food, which is kept at room temperature for 12–24 h, is at high risk of causing food poisoning. | 1579    | 52.4%| 805    | 26.7%| 627            | 20.8%|
| Raw white cheese manufactured from raw milk has a high risk of food poisoning. | 1207    | 40.1%| 550    | 18.3%| 1254           | 41.6%|
| Pasteurized milk can be drunk directly without any risk of food poisoning.    | 1173    | 39.0%| 573    | 19.0%| 1265           | 42.0%|
| Keeping food at refrigerator temperature will slow microbial growth and beating, thus preventing food spoilage and food poisoning. | 2203    | 73.2%| 346    | 11.5%| 462            | 15.3%|
| Drinking surface water such as rivers, streams, and rainwater tanks without any treatment, such as boiling or adding chlorine, is at great risk of causing food poisoning. | 2092    | 69.5%| 447    | 14.8%| 472            | 15.7%|
| There is no risk of food poisoning from eating cooked leftovers kept in the refrigerator for 2–3 days. | 1466    | 48.7%| 1006   | 33.4%| 539            | 17.9%|

Regarding parents’ practices for preventing food poisoning (Table 4), 86.8% of the participants reported that they wash their hands with water and soap after handling raw, unwashed vegetables, 84.5% of the participants reported that they wash their hands with water and soap after using the toilet, 81.2% of the participants reported that they wash their hands with soap and water before eating meals, 70.8% of the participants reported that they wash fresh vegetables and fruits in tap water before eating, and 61.6% of the participants reported that they wash their hands with soap and water before preparing.
food. Only 20.1% of the respondents eat food such as meat, rice, and soup by hand from a large bowl shared by many people, 13.8% of the respondents eat food from a seemingly unclean restaurant or cafeteria, 11.9% of the respondents pick up vegetables or herbs from plants and eat them without washing, and 11% of the respondents eat undercooked eggs.

### Table 3. Parents’ attitudes towards safe food consumption.

| Attitude towards Safe Food Consumption                                                                 | Agree (n) | %   | Disagree (n) | %   | Don’t Know (n) | %   |
|----------------------------------------------------------------------------------------------------------|-----------|-----|--------------|-----|----------------|-----|
| Raw milk is healthier than pasteurized or boiled milk.                                                   | 922       | 30.6% | 980          | 32.5% | 1109           | 36.8% |
| There is no risk of disease from drinking raw goat or cow’s milk immediately after milking.             | 808       | 26.8% | 1617         | 53.7% | 586            | 19.5% |
| There is no risk of disease from drinking camel’s milk right after milking.                             | 1019      | 33.8% | 1318         | 43.8% | 674            | 22.4% |
| Raw eggs are healthier and more nutritious than cooked eggs.                                            | 606       | 20.1% | 1714         | 56.9% | 691            | 22.9% |
| There is no risk of disease from eating raw eggs.                                                      | 620       | 20.6% | 1728         | 57.4% | 663            | 22.0% |
| There is no risk of disease from eating the raw meat of young animals.                                 | 458       | 15.2% | 2034         | 67.6% | 519            | 17.2% |
| Wiping fruits and vegetables makes them safe to eat.                                                    | 965       | 32.0% | 1635         | 54.3% | 411            | 13.6% |
| There is no risk of disease from eating cooked food kept at room temperature for one day if covered.  | 1112      | 36.9% | 1401         | 46.5% | 498            | 16.5% |
| There is no risk of disease from eating unwashed vegetables and herbs picked directly from the plant.  | 576       | 19.1% | 2036         | 67.6% | 399            | 13.3% |
| If a child’s stool is free of pathogenic microbes, then he is not sick.                                | 566       | 18.8% | 1414         | 47.0% | 1031           | 34.2% |
| The rainwater collected in the tank is safe to drink without any treatment.                            | 640       | 21.3% | 1756         | 58.3% | 615            | 20.4% |
| Food processors without clinical symptoms can contaminate food with disease-causing microbes that cause food poisoning. | 1364   | 45.3% | 871          | 28.9% | 776            | 25.8% |
| Handwashing with soap and water before eating is essential to prevent food poisoning.                 | 2383      | 79.1% | 326          | 10.8% | 302            | 10.0% |
| Thorough washing of vegetables and fruits in tap water is essential to prevent food poisoning.         | 2335      | 77.5% | 349          | 11.6% | 327            | 10.9% |
| Washing hands with soap and water before preparing food is essential to prevent food poisoning.        | 2443      | 81.1% | 274          | 9.1%  | 294            | 9.8%  |
| **Overall attitude**                                                                                    |           |       |              |       |                |      |
| **Negative**                                                                                           | 250       | (8.3%)|              |       |                |      |
| **Neutral**                                                                                            | 1532      | (50.9%)|             |       |                |      |
| **Positive**                                                                                           | 1229      | (40.8%)|             |       |                |      |
Table 4. Parents’ practices regarding food poisoning.

| Practice Items                                                                 | Usually (n) | Usually (%) | Sometimes (n) | Sometimes (%) | Never (n) | Never (%) |
|--------------------------------------------------------------------------------|-------------|-------------|---------------|--------------|-----------|-----------|
| Do you wash fresh vegetables and fruits in tap water before eating?             | 2131        | 70.8%       | 794           | 26.4%        | 86        | 2.9%      |
| Do you wash your hands with soap and water before eating your meal?            | 2444        | 81.2%       | 469           | 15.6%        | 98        | 3.3%      |
| Do you wash your hands with soap and water before preparing food?              | 1855        | 61.6%       | 916           | 30.4%        | 240       | 8.0%      |
| Do you wash your hands with soap and water after handling raw, unwashed vegetables? | 2615       | 86.8%       | 288           | 9.6%         | 108       | 3.6%      |
| Do you wash your hands with soap and water after using the toilet?             | 2545        | 84.5%       | 338           | 11.2%        | 128       | 4.3%      |
| Do you wash your hands after touching animals?                                 | 544         | 18.1%       | 708           | 23.5%        | 1759      | 58.4%     |
| Do you eat fresh vegetables and fruits without washing?                        | 1407        | 46.7%       | 767           | 25.5%        | 837       | 27.8%     |
| Do you wipe fresh vegetables and fruits before you eat them?                   | 526         | 17.5%       | 768           | 25.5%        | 1717      | 57.0%     |
| When taking a field trip, do you pick up vegetables or herbs from plants and eat them without washing? | 359         | 11.9%       | 530           | 17.6%        | 2122      | 70.5%     |
| Do you eat raw eggs?                                                           | 505         | 16.8%       | 911           | 30.3%        | 1595      | 53.0%     |
| Do you eat undercooked eggs (soft yolk)?                                       | 331         | 11.0%       | 490           | 16.3%        | 2190      | 72.7%     |
| Do you eat raw meat?                                                           | 413         | 13.7%       | 719           | 23.9%        | 1879      | 62.4%     |
| Do you eat undercooked meat (inside red)?                                      | 447         | 14.8%       | 595           | 19.8%        | 1969      | 65.4%     |
| Do you drink raw cow or goat milk?                                             | 447         | 14.8%       | 593           | 19.7%        | 1971      | 65.5%     |
| Do you drink raw camel milk?                                                   | 432         | 14.3%       | 683           | 22.7%        | 1896      | 63.0%     |
| Would you eat raw white cheese prepared from pasteurized raw UN milk?         | 588         | 19.5%       | 1210          | 40.2%        | 1213      | 40.3%     |
| Do you eat food cooked at room temperature for more than 6 h without adequate heating? | 433        | 14.4%       | 977           | 32.4%        | 1601      | 53.2%     |
| Are you eating food from a seemingly unclean restaurant or cafeteria?         | 417         | 13.8%       | 628           | 20.9%        | 1966      | 65.3%     |
| Do you drink rainwater that is collected in tanks or surface streams without any treatment? | 1119     | 37.2%       | 1107          | 36.8%        | 785       | 26.1%     |
| Do you eat food, such as meat, rice, and soup, by hand from a large bowl shared by many people? | 605     | 20.1%       | 725           | 24.1%        | 1681      | 55.8%     |

Table 5 shows the distribution of parents’ knowledge regarding food poisoning by their bio-demographic data. Good knowledge was detected among 57.9% of the parents above the age of 30 years compared to 46.8% of those below the age of 30 years, with a statistical significance \((p = 0.001)\). A total of 60% of the male parents had a good knowledge level compared to 48.7% of the female parents \((p = 0.001)\). A total of 52.9% of the university graduate fathers had good knowledge compared to 38.5% of the illiterate fathers \((p = 0.003)\). Good knowledge was detected among 55.3% of the university graduate mothers compared to 45.2% of the illiterate mothers \((p = 0.001)\). Good knowledge was significantly higher.
amongst working mothers than housewives at 55.2% and 47.7%, respectively. A total of 51.8% of urban resident participants had a good knowledge level compared to 46% of the rural residents (p = 0.012). Exactly of 56% of the participants who had outdoor meals more than twice per week had good knowledge compared to 42.6% of those who did not (p = 0.007).

Table 5. Distribution of parents’ knowledge regarding food poisoning by their bio-demographic data.

| Bio-Demographic Data          | Knowledge Level | p-Value |
|------------------------------|-----------------|---------|
|                              | Poor (n) | %     | Good (n) | %     |
| Age in years                 |           |       |           |       |
| <30 years                    | 1036      | 53.2% | 910       | 46.8% |
| >30 years                    | 448       | 42.1% | 617       | 57.9% |
| Gender                       |           |       |           |       |
| Male                         | 219       | 40.0% | 328       | 60.0% |
| Female                       | 1265      | 51.3% | 1199      | 48.7% |
| Father’s education           |           |       |           |       |
| (n = 548) Illiterate         | 24        | 61.5% | 15        | 38.5% |
| Primary                      | 24        | 52.2% | 22        | 47.8% |
| Intermediate                 | 16        | 50.0% | 16        | 50.0% |
| Secondary                    | 44        | 44.0% | 46        | 56.0% |
| University                   | 136       | 47.1% | 153       | 52.9% |
| Above university             | 26        | 50.0% | 26        | 50.0% |
| Mother’s education           |           |       |           |       |
| (n = 2463) Illiterate        | 46        | 54.8% | 38        | 45.2% |
| Primary                      | 80        | 54.8% | 66        | 45.2% |
| Intermediate                 | 118       | 49.2% | 122       | 50.8% |
| Secondary                    | 281       | 53.9% | 240       | 46.1% |
| University                   | 457       | 44.7% | 564       | 55.3% |
| Above university             | 240       | 53.2% | 211       | 46.8% |
| Mother’s occupation          |           |       |           |       |
| (n = 2463) Governmental      | 425       | 44.8% | 523       | 55.2% |
| Private                      | 82        | 50.6% | 80        | 49.4% |
| Housewife                    | 708       | 52.3% | 645       | 47.7% |
| Residence                    |           |       |           |       |
| Urban                        | 1175      | 48.2% | 1264      | 51.8% |
| Rural                        | 309       | 54.0% | 263       | 46.0% |
| Total family size            |           |       |           |       |
| 1–2                          | 60        | 60.6% | 39        | 39.4% |
| 3–5                          | 469       | 49.7% | 474       | 50.3% |
| 6+                           | 955       | 48.5% | 1014      | 51.5% |
| Number of children           |           |       |           |       |
| 1                            | 317       | 45.4% | 381       | 54.6% |
| 2–3                          | 370       | 50.3% | 365       | 49.7% |
| 4–5                          | 425       | 51.2% | 405       | 48.8% |
| 6+                           | 372       | 49.7% | 376       | 50.3% |
| Person responsible for cooking at home | | | | |
| Mother                       | 1279      | 48.8% | 1343      | 51.2% |
| Father                       | 13        | 40.6% | 19        | 59.4% |
| Housekeeper                  | 192       | 53.8% | 165       | 46.2% |

Table 5. Distribution of parents’ knowledge regarding food poisoning by their bio-demographic data.
The regression model shown in Table 6 shows that age was associated with a higher knowledge level, which was 2% higher for every additional year (OR (odds ratio) = 1.02; 95% CI (confidence intervals): 1.02–1.03). Female parents had a 35% lower knowledge level than the male parents (OR = 0.65; 95% CI: 0.54–0.78). Higher education for the mother was associated with an increased knowledge level of about 9% (OR = 1.09; 95% CI: 1.01–1.17). Housewives had 11% less knowledge than working mothers (OR = 0.89; 95% CI: 0.82–0.97). Parents who had a housekeeper for cooking showed a 16% lower knowledge level than the parents who cook by themselves (OR = 0.84; 95% CI: 0.75–0.93). Parents who had more frequent outdoor meals showed a 13% higher knowledge level regarding food poisoning than parents who did not have frequent outdoor meals (OR = 1.13; 95% CI: 1.04–1.23).

### Table 5. Cont.

| Frequency of outdoor meals | Knowledge Level | p-Value |
|---------------------------|-----------------|---------|
| None                      | Poor (n=116)    | 57.4%   |
|                           | Good (n=86)     | 42.6%   |
| 1–3/month                 | Poor (n=643)    | 50.3%   |
|                           | Good (n=636)    | 49.7%   |
| 1–2/week                  | Poor (n=471)    | 49.4%   |
|                           | Good (n=482)    | 50.6%   |
| >2/week                   | Poor (n=254)    | 44.0%   |
|                           | Good (n=323)    | 56.0%   |

P: Pearson X2 test. *p < 0.05 (significant).

### Table 6. Multiple logistic regression model for determinants of parents’ knowledge regarding food poisoning.

| Factors                          | p-Value | OR  | 95% CI Lower | 95% CI Upper |
|----------------------------------|---------|-----|--------------|--------------|
| Age in years                     | 0.001 * | 1.02| 1.02         | 1.03         |
| Female vs. male parents          | 0.001 * | 0.65| 0.54         | 0.78         |
| High mother education            | 0.018 * | 1.09| 1.01         | 1.17         |
| (university vs. others)          |         |     |              |              |
| High father education            | 0.304   | 0.97| 0.90         | 1.03         |
| (university vs. others)          |         |     |              |              |
| Housewives vs. working mothers   | 0.009 * | 0.89| 0.82         | 0.97         |
| Rural vs. urban residence        | 0.183   | 0.88| 0.73         | 1.06         |
| Family size                      | 0.099   | 1.02| 1.00         | 1.05         |
| Number of children               | 0.086   | 0.98| 0.96         | 1.00         |
| Housekeeper cooking vs. parents  | 0.002 * | 0.84| 0.75         | 0.93         |
| Frequency of outdoor meals       | 0.004 * | 1.13| 1.04         | 1.23         |

OR: odds ratio; CI: confidence intervals. *p < 0.05 (significant).

### 4. Discussion

Proper food handling knowledge and practices can go a long way in avoiding foodborne illnesses. The results of the current study reveal important information on the knowledge, attitudes, and practices of parents regarding food poisoning. Most of the respondents were Saudi females and were the main person responsible for cooking at home. This reflects a cultural bias towards cooking and food handling by women in the Arab region [12,13].

Our study observed that about half of the participants had good knowledge regarding the causes, risk factors, and prevention of food poisoning. The other half had poor knowledge scores. An analysis of the responses to the core statements revealed that most of
the participants agreed that eating raw, unwashed vegetables is extremely risky in regard to food poisoning, food handlers can be a source of the microbial contamination of food, and eating unwashed fruits is risky for food poisoning. Regarding milk, more than 60% of the participants were unaware that pasteurized milk can be drunk directly without any risk of food poisoning, and almost half of the participants agreed that the risk of food poisoning can be avoided from eating cooked leftovers kept in the refrigerator for 2–3 days.

The knowledge scores of our study participants are similar to the knowledge scores of mothers in this region and other Asian and African countries, where it was reported that more than half of the respondents possess good knowledge of food poisoning [14–16]. However, lower knowledge levels were reported from the bordering country Yemen [17], which has similar religious and cultural milieu. The difference in findings between this study and studies in Yemen may be due to lower literacy levels and poor socio-economic conditions among the Yemeni population.

The study revealed that only 40% of the parents had a positive attitude towards safe food consumption and food poisoning. Almost half of the parents believed the rainwater collected in a tank is safe to drink without any treatment and raw eggs are healthier and more nutritious than cooked eggs. A good proportion of the respondents had an inappropriate attitude towards raw milk consumption, whether it be goat milk, cow milk, or camel milk, and a third believed that raw milk is healthier than pasteurized or boiled milk. A similar attitude towards the consumption of milk directly from the udder was also observed. The microbial contamination of milk and dairy products constitutes an important health risk for the consumers. Despite the latest reports implicating the practice of consuming raw milk as the most frequent source of exposure among patients with brucellosis, such practices and attitudes are still prevalent in the Middle East and North Africa, as reflected in the findings of recent studies [18,19]. Traditional beliefs play an important role in influencing food-related attitudes and practices. An example of this influence is the belief that fresh local produce is healthier and more beneficial, as well as the misconception that the nutrients in milk are destroyed when the milk is boiled [18]. These beliefs reflect lingering cultural influences in the study population, which was largely nomadic and agrarian until a few decades back, and food practices such as raw milk consumption were common. Interestingly, new trends of health food in developed countries also promote these attitudes and practices [20,21]. Focusing on the parents’ practices regarding food poisoning, three areas of concern were investigated: washing practices, eating raw foods, and storing and consuming food. We found satisfactory practices related to washing hands before and after food handling and consumption. The majority of the participants reported that they wash their hands with soap and water after handling raw, unwashed vegetables, after using the toilet, and before eating food. A good number of the participants also reported that they wash fresh vegetables and fruits in tap water before eating them. However, the practice of washing hands with soap and water before preparing food was not as common. The consumption of any form of raw food originating from an animal (i.e., milk, eggs, and meat) was only reported by a few participants. Other unhygienic practices, for example, eating foods such as meat, rice, and soup by hand from a large bowl shared by many people and eating food from a seemingly unclean restaurant or cafeteria, were also negligible.

Appropriate food handling practices reported in our study are a result of the Islamic influence on hygiene practices [22]. A recently published systematic review from Malaysia reported good levels of knowledge, attitudes, and practices among different food handler groups in Malaysia, thus supporting this notion [23]. Findings on food handling practices from our study contrast with findings reported from other Asian countries such as India and Nepal [24,25]. These dissimilarities reflect the differences in socioeconomic status, culture, and rural habitat. The study found that older age, being male, having a university-level or higher education, the working status of the mother, urban living, and frequently eating outside had a significant association with good knowledge regarding food hygiene and food poisoning. Several studies have reported that a higher age and being male
was more positively associated with food hygiene knowledge. However, most of these findings were taken from professional food handlers [26,27]. Regarding educational level, studies specifically for mothers have also shown a positive association with educational level and knowledge regarding food hygiene and food poisoning [28]. These findings are in accordance with the findings from a study in Palestine where it was reported that those with a high level of education had higher knowledge scores than those with a lower level of education. It was also found that those who lived in a city or a village reported higher scores than those living in camps [12]. It is evident that a higher education level leads to higher knowledge levels. Social media is popular in the Arab world and has a penetration rate reaching almost 80% in Saudi Arabia [29]. Research in Saudi Arabia has recommended using social media to impart better health education to the population, particularly among females [30]. The relationship between urban living and better knowledge may reflect on improved access to information via social media and other mass media.

Despite satisfactory findings regarding food handling practices, the knowledge and attitudes of the parents in our study are worrisome. Considering that 30% of deaths related to food poisoning occur in children below five years of age [4] and that parents are the main people responsible for providing safe food for children, the study findings have important implications. These findings serve as a baseline of information for program planners and policymakers in Saudi Arabia and support the strengthening of health education initiatives for parents and other food handlers.

**Strength and Limitation**

The key strength of this study is that it is the first study in this region that focuses on the knowledge, attitudes, and practices of parents regarding food poisoning. The large sample size of this study is its strength, as the results can be generalized to the Saudi population. The study’s major limitation is that the data were collected via an online survey, and the practice was not observable and only as reported by respondents. Hence, social desirability bias cannot be ruled out. Due to the cross-sectional design of the study, the causal factors of knowledge, attitudes, and practices related to food poisoning cannot be identified.

5. Conclusions

This study provided much-needed information regarding the knowledge, attitudes, and practices related to food poisoning among parents in the Aseer region of Saudi Arabia. Although most of the respondents reported satisfactory practices, gaps were identified in knowledge and attitudes. This suggests a need for further research focused on observed food handling practices. A mixed-method research approach targeting the main food handlers in the family and community could identify the gaps and associated factors. To prevent food poisoning, it is necessary to improve the knowledge, attitudes, and practices of food handlers. Thus, it is imperative to devise strategies for designing awareness programs about food poisoning and safe food handling for all food handlers in the community.

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