Jordan Journal of Nursing Research,
DOI: https://doi.org/10.14525/JJNR.2026.18

Jordan Journal of Nursing Research

https://jjnr.just.edu.jo/jjnr

Knowledge, Attitudes and Practices Related to Food Poisoning among University Students in Jordan

Abeer A. Alzayyat, RN, MSN [1*]

1 *Department of Medical Allied Sciences, Al-Balqa Applied University, Zarqa University College, Zarqa, Jordan.*
** Corresponding Author. Email: abeer.zayyat@bau.edu.jo.*

ARTICLE INFO

Article History:
Received: November 12, 2025
Accepted: March 28, 2026

ABSTRACT

Background: Food poisoning is a significant health problem that affects many groups, including university students. ***Purpose*:** The main purpose of the study was to evaluate the knowledge, attitudes, and practices (KAP) of Jordanian university students on food poisoning. ***Methods*:** This study used **a** descriptive cross-sectional correlational approach, and collected data from 360 undergraduate Jordanian university students. The researcher used a self-report questionnaire on KAP toward food poisoning for data collection. ***Results*:** The mean knowledge score was 45 out of 60, the mean attitude score was 39 out of 60, and the mean practice score was 66 out of 80. The results showed that there were statistically significant differences in participants' knowledge scores according to gender ($t = -2.31$, $p = 0.02$) and history of food poisoning ($t = 1.99$, $p = 0.04$), indicating that these factors were associated with variations in knowledge levels. Specifically, female participants ($M = 46.53$; $SD = 7.11$) and those with a history of having food poisoning ($M = 47.24$; $SD = 7.26$) reported statistically higher degrees of knowledge. Similarly, the results illustrated that there were statistically significant differences in the attitude scores of the participation in relation to their gender ($t = -3.83$; $p = 0.001$) and participation in food poisoning courses ($t = 2.08$; $p = 0.04$). Particularly, female participants ($M = 40.77$; $SD = 10.35$) and those who attended food poisoning courses ($M = 41.32$; $SD = 10.28$) reported statistically higher attitude scores. ***Conclusion*:** The study demonstrated that Jordanian university students perceived high levels of KAP. Moreover, the study illustrated that students' demographics, such as gender and history of food poisoning, had impacts on their KAP scores. University students may get benefit from this study by increasing their awareness about those areas of knowledge deficits, poor attitudes, and malpractices concerning food safety. ***Implications for Nursing*:** Nurses can utilize the study findings in order to design and implement proper caring measures for those university students at risk for developing foodborne disorders.

Keywords: Food poisoning, University students, Knowledge, Attitudes, Practices, Jordan.

What does this paper add?

1. While the issues of foodborne illnesses and proper food handling have been addressed in the previous Jordanian literature, those initiatives lack the depth and comprehensive assessment required for building lasting understanding.
2. This study highlighted that Jordanian university students have adequate knowledge, positive attitudes, and hygienic practices concerning food poisoning.
3. This study also concentrated on the role of demographic variables and students' academic characteristics in their experiences with food poisoning.

Introduction

Food poisoning can be described as a pathological condition resulting from ingestion of water or food that is contaminated with chemicals, parasites, bacteria, or viruses and/or their poisons (Mshelia et al., 2022). The major causes of food contamination are improper storage, production or handling of the food (Afrin et al., 2024). One of the closely related concepts to food poisoning is food safety. The Centers for Disease Control and Prevention (CDC) defined food safety as those practices that may decrease the incidence of food poisoning. A recent systematic review by Liguori et al. (2022) reported that major tasks of food safety might incorporate prompt refrigeration of the cooked food, using safe temperatures to cook the food, separating raw foods in addition to hand washing and surface cleaning. These routines should be adhered to guarantee the prevention of potential harms to consumers.

A descriptive study in Saudi Arabia revealed that inadequate knowledge and practices regarding food safety may increase the risk of foodborne illness transmission, especially among college students (Halwani, 2023). An epidemiological report by the World Health Organization (2023) indicated that the incidences of food-associated diseases amount to about 600 million cases annually. Of these incidences, 400,000 individuals required hospitalization, and more than 4500 deaths have been documented in the United States (Halwani, 2023). Furthermore, most recently, Alnemari et al. (2024) reported that there is a significant increase in the number of individuals who suffered from foodborne disease outbreaks internationally. To specify, the global estimate of foodborne illnesses is about 600 million individuals. Additionally, about 10 % of the individuals consumed contaminated food which resulted in 400,000 deaths annually.

Concerning regional statistics, reports showed that Africa and Southeast Asia are the top regions of food poisoning cases per population, followed by the Eastern Mediterranean region. To illustrate, the Eastern Mediterranean region has about 100 million cases of people suffering from foodborne illnesses annually. Furthermore, the estimated number of deaths in this region is 37,500 individuals each year. The most common foodborne illnesses were diarrhea, typhoid fever, and hepatitis.

Recent official statistics in Jordan indicate a significant decline in cases of food poisoning, driven by stricter health controls and awareness programs. National reports indicated that Jordan recorded a 5% decrease in food poisoning cases during 2024. Historically, Jordan recorded approximately 15,000 cases of salmonella infection in 2003-2004 linked to poultry products, prompting a comprehensive update of safety procedures. Reports indicated that younger age groups (under 30 years old) were the most affected in mass poisoning incidents, which calls for awareness programs directed to schools and universities.

One of the significant food consumer groups is the young adults. Unfortunately, in a cross-sectional study conducted in Bangladesh, Islam et al. (2024) showed that young adults are vulnerable to foodborne illnesses because of their inadequate knowledge about food safety and improper food practices. University students, as a subset group of young adults, have been included in many food-safety studies, because they play significant roles as both future food producers and food consumers. Çol et al. (2024) in their experimental study on a sample of university students from Turkey indicated that the health of university students could be jeopardized due to their high-risk practices, negative attitudes, and low level of knowledge on healthy food styles. Moreover, a recent online survey on university students in Romania illustrated that more than a half of the Romanian students had insufficient knowledge of food safety. Similarly, the condition of the university students in the eastern part of the world is not better. To illustrate, a systematic review of Malaysian published studies about KAP of university students toward food poisoning reported that only 30 % of the included studies (i.e., 3 out of 10) showed high levels of knowledge related to food safety among their participants.

In relation to the Middle East and North Africa (MENA) region, little data is available about food safety among university students (Ajlouni et al., 2023). Qutob et al. (2025) conducted a cross-sectional study to evaluate KAP of Saudi university students on food poisoning. In relation to the practice domain, the results showed that about 60 % of the Saudi students did not wash their hands before handling the food. This indicates that the Saudi students did not adhere to the basic recommended practices on food safety.

The Jordanian literature examined the issue of food safety among university students. It has been shown that students in Jordan exhibited generally low levels of knowledge and negative attitudes concerning food

safety. For instance, in a cross-sectional study that involved 461 Jordanian university students, the findings revealed that the participants had inadequate food storage knowledge and some common malpractices which lead to food poisoning, such as reliance on feel-touch tests rather than thermometers (Alsakarneh et al., 2024). However, those initiatives lack the depth and comprehensive assessment required for building lasting understanding. This study could help in addressing this gap by comprehensively examining KAP and the role of demographics among university students in Jordan. Moreover, unlike those studies in the western parts of the world that concentrated on the risk of home-cooked meals, this study focused on the recognized food safety education within the higher education institutions in Jordan. From a different perspective though, while former studies in the Gulf Cooperation Council countries emphasized that students used formal food safety knowledge sources, the present study highlighted the impact of informal food safety sources used by Jordanian university students.

It is important to indicate that there are several factors that make university students vulnerable to foodborne illnesses. These factors might include inadequate awareness of students toward the safe practices of food handling, the risk of cross-contamination in non-official restaurants, poor temperature control, limited knowledge of safe food practices, heavy dependence on street food, living away from family, and high-risk eating behaviors, such as consuming fast food that may not be cooked in a good way or using street food/vending. These factors collectively make the transition of food pathogens, such as salmonella, easier, which aids in the development of foodborne illnesses.

Concentrating on this topic among Jordanian university students may provide empirical data for clinicians about the magnitude of the food poisoning problem among Jordanian youth. Additionally, investigating knowledge of university students concerning food safety and identifying those factors that contribute to maladaptive food practices could help in decreasing the incidence of food borne diseases among this sensitive group. This information could be utilized to design health education campaigns that aim to promote the awareness of university students and enhance their attitudes and practices regarding handling food. Ultimately, this may sustain the overall well-being of university students through fostering positive attitudes and healthy behaviors that lead to avoiding food contamination.

Study Aim and Research Questions

The main purpose of this study was to evaluate the KAP of university students in Jordan on food poisoning and food safety. The following research questions guided the present study:

1- What are the levels of KAP of Jordanian university students toward food poisoning?
2- What are the differences of KAP based on students' sociodemographic details?
3- What are the predictors of the students' KAP toward food poisoning?

Methodology

Research Design

This study used a descriptive cross-sectional correlational approach to fulfill the research aim. This design intends to investigate the relationship between two or more variables (Fain, 2024). This is congruent with the aim of this study, which examined the predictors of students' KAP associated with food poisoning. Data collection was carried out during the second semester of 2024/2025 academic year.

Study Setting

This study was conducted at four universities located in the middle region of Jordan (i.e., Amman & Zarqa cities)**.** Those universities were chosen, because they are located in large Jordanian cities and their students represent diverse socioeconomic backgrounds. The students' classes were the data collection site, because it was easier to access the students during their lectures, as most of the students attended their classes.

The selected universities were two public and two private institutions that are located in urban areas of Jordan in Amman and Zarqa. These universities encompass about 100,000 students who reside in different regions of Jordan. Moreover, the chosen universities offered a wide range of study majors for students, such as humanistic and scientific specialties, engineering, and health sciences. Although the selected universities offered three levels of education (i.e., undergraduates, master's, and doctorates), this study focused on undergraduate students.

Population and Sampling

The target population was all Jordanian university students, and the accessible population was Jordanian students who studied in the selected universities. The students were included if they meet the following eligibility criteria: (1) Being an adult (at least 18 years old), (2) Able to read and understand Arabic, (3) Register at any course at the selected universities during the data collection time, (4) Are physically and mentally able to participate in the study (i.e., do not have severe physical conditions or mental health illnesses that deter them from taking part in the study).

The researcher used a multistage cluster sampling approach to select the eligible students. To determine the appropriate sample size for the one-way ANOVA in this study, we assumed a medium effect size of 0.25, a power of 0.80, and an alpha level of 0.05; the required sample size was calculated to be approximately 200 participants (Browner, 2009). However, to overcome the problem of incomplete questionnaires, 360 students were approached as a precaution to serve as the study sample.

Instrumentation

In this study, the researcher used two types of self-report questionnaires. The first questionnaire is about the students' demographics. These demographics incorporate age, grade point average, monthly income, gender, marital status, major, university year, food poisoning courses, history of food poisoning, and the source of the student's information about food poisoning. The second questionnaire is about KAP toward food poisoning that was designed by Sharif and Al-Malki (2010). The original authors of the tool tested the questionnaire on Saudi university students and found that the questionnaire is suitable for Arabian contexts. The questionnaire is composed of three subscales: knowledge, attitudes, and practices. The total number of items is 50, which is divided into the three subscales as follows: knowledge (15 items), attitudes (15 items) and practices (20 items). The three subscales used a five-point Likert scale as follows; for the knowledge and attitude subscales, the responses ranged from strongly agree to strongly disagree. On the other hand, for the practice subscale, the responses ranged from always to never.

In relation to scoring, the response for each item in the questionnaire has a score that ranged from 0 to 4 points. For the knowledge subscale, the score for all the 15 items ranged from strongly agree (4 points) to strongly disagree (0 points). For the attitude subscale, the first 11 items have a reversed score that ranged from strongly agree (0 point) to strongly disagree (4 points), but the items 12–15 have a score that ranged from strongly agree (4 points) to strongly disagree (0 points). Lastly, in relation to the practice subscale, the first 6 items have a score that ranged from always (4 points) to never (0 point). Conversely, items 7-20 have a reversed score that ranged from always (0 points) to never (4 points). The cut-off points of the questionnaire for each item are scores 3 and 4 which are regarded as a positive response (answering right) and scores of less than 3, which are regarded as a negative response (answering wrong). For the knowledge subscale, a wrong answer is labeled as ''no knowledge" and a right answer is labeled as ''having knowledge". For the attitude subscale, a right or wrong answer is labeled as ''positive or negative attitude," and for the practice subscale, it is labeled as ''hygienic or unhygienic practice". The psychometric properties of the questionnaire have been tested in the original study. The findings revealed that the questionnaire had a Cronbach's alpha of 0.85 for the whole subscale, which indicates good internal consistency, test-retest of a two week interval showed good stability (ICC was 0.83); the scale had a content validity index of 0.93, illustrating high degrees of agreement among experts in relation to representativeness, clarity and relevance; the tool had a positive correlation (r = 0.75) with food safety attitude and practice questionnaire supporting convergent validity, and a negative correlation (r = - 0.80) with General Nutrition Knowledge Questionnaire, supporting discriminant validity.

Data Collection Procedure

In this study, data collection was fulfilled based on the principles of a multistage cluster sampling approach. Initially, the researcher divided the study population into distinct groups or clusters. The clusters were the Jordanian universities that were located in Amman and Zarqa. After obtaining the required approval, the researcher obtained a list of those universities from the Jordanian Ministry of Higher Education and Scientific Research. The researcher chose 4 universities from this list randomly. Then, a subset of elements within each selected cluster is randomly sampled. These subsets were the students' classes. To achieve that, the researcher contacted the admission and registration

office at each selected university to obtain the list of all classes that were offered for undergraduate university students during the second semester of 2024/2025 academic year. One class was selected from this list randomly. The random number generator was used for randomly selecting the classes. The researcher assigned a unique ID for every class at the selected universities, generated random numbers through Research Randomizer software, and selected the matched classes. Although choosing only one class from each university may not adequately represent the entire student population at that institution, the researcher applied this method, because it is considered pragmatic, and it could help in cross-institutional comparison. Moreover, this approach helped the researcher overcome the potential logistical constraints within each university. After that, data was collected from a random sample of students within each selected cluster or class as follows. It is important to mention that if a class declined participation, the researcher replaced it using the same random selection process from the remaining classes in the university pool instead of depending on the convenience method of sampling.

The researcher approached the teachers/lecturers of the selected classes and briefed the study. The researcher negotiated with the lecturers an appropriate plan for data collection during their lectures, Students' rosters at each of the selected classes were obtained. A total of 90 students were selected randomly from each class using the students' rosters. The lecturers guided the researcher in inviting the selected students, introduced the researcher to them, and then left. Students who expressed interest in participating were provided with a cover letter, an informed consent form to sign, and the questionnaire. During the data collection process, the researcher was available to address any concerns raised by the participants. Lastly, the researcher collected the filled questionnaires and kept them in a secured envelope. Other tasks undertaken for data protection involved storing the filled questionnaires in a locked cabinet, creating password-protected files after entering the data into the researcher's personnel computer. No one except the researcher had access to the participants' data. Although there are different published recommendations for the data retention period, the researcher will retain the collected data for two years.

Ethical Considerations

Ethical principles of nursing research were adhered to and maintained throughout the course of this study. At first, the researcher obtained ethical approvals from the Ministry of Higher Education and Scientific Research, as well as from the participating universities as the study proposal was revised by Institutional Review Boards (IRB). The main approving body was Al-Balqa' Applied University (IRB number 49/3/2025/2026). The participants were fully informed about the purpose of this study and their commitment in relation to the data collection procedure by using a covering letter. Participation was voluntary, and the participants signed an informed consent before filling out the study questionnaire. The participants' responses were anonymized, and privacy will be granted in the study. Additionally, the collected data was stored in a secure, access-controlled file on the investigator's personal computer, ensuring that only the researcher can access it, with no possibility of use by others. Finally, the study tools were used after obtaining the original author's approval.

Data Analysis

The researcher used Statistical Package for Social Sciences (SPSS) for data analysis purposes. The researcher conducted a full review, which includes data screening, data cleaning, coding for categorical data, and managing the outlier values. Both descriptive and inferential measures were employed. Initially, descriptive measures, including measures of central tendency and dispersion, were used to describe the participants' demographics. Concerning the first research question, descriptive measures (as the mean and standard deviation) were utilized to describe the level of students' KAP. In relation to the second research question, inferential measures (including t-test and ANOVA) were used to verify the differences in students' KAP based on demographic characteristics and academic characteristics. Regarding the last research question, a multiple regression analysis was conducted by including demographic characteristics and academic characteristics as potential predictors for the students' KAP. Statistical significance level (i.e., alpha) was set at 0.05.

Results

Characteristics of the Study Sample

The total number of participants is 360 undergraduate Jordanian university students. According to the study

results, the participants' age ranged from 18 to 24 years (M = 20.43; SD = 1.46). Monthly income ranged from 150 to 900 Jordanian Dinars (M = 505.05; SD = 197.02). The students' Grade Point Average ranged from 50 to 90 points (M = 70.43; SD = 8.26). The results showed that most of the participants were females (n = 255, 70.8 %), single (n = 342, 95 %), first year students (n = 190, 52.8 %), studied in health sciences faculties (n = 158, 43.9 %), did not participate in any previous courses about food poisoning (n = 263, 73.1%), nor they had any history of being affected by food poisoning or foodborne illnesses (n = 263, 73.1%). The participants' major source of information about food poisoning was the internet and TV (n = 147, 40.8%). Table 1 summarizes the participants' demographics and academic characteristics.

Table 1. Socio-demographics and academic characteristics of the sample (N=360)

Variable	Frequency (Percentage)
Gender	
Male	105 (29.2)
Female	255 (70.8)
Marital Status	
Single	342 (95)
Married	15 (4.2)
Divorced	3 (0.8)
Major	
Humanistic	34 (9.4)
Scientific faculties	110 (30.6)
Engineering	6 (1.7)
Health sciences	158 (43.9)
Nutrition	52 (14.4)
University year	
First year	190 (52.8)
Second year	103 (28.6)
Third year	41 (11.4)
Fourth year	26 (7.2)
Food poisoning courses	97 (26.9)
Yes	263 (73.1)
No	
History of food poisoning	97 (26.9)
Yes	263 (73.1)
No	
Source of Information	
Health care staff	92 (25.6)
Internet and TV	147 (40.8)
Family or friends	59 (16.4)
Other sources	62 (17.2)

Knowledge Scores about Food Poisoning

The participants' knowledge scores ranged from 23 to 60 (M = 45.49; SD = 7.53). Item analysis of the knowledge subscale (as presented in Table 2) shows that the highest reported items were item 1 "Food poisoning is caused by pathogenic microbes" (94 % of the participants having knowledge), item 8 "Food handlers with unhygienic practice could be the source of microbial contamination of the food which causes food poisoning" (90% having knowledge) and item 6 "Eating raw unwashed vegetables is highly risky for food poisoning" (88 % having knowledge).

On the other hand, the lowest reported items were item 11 "Raw white cheese processed from raw milk has a high risk of food poisoning" (56 % having knowledge), item 2 "Some toxins produced by microbes and causing food poisoning are resistant to heating temperature of food" (59% having knowledge), and item 15 "There is no risk of food poisoning from eating leftover cooked food kept in the refrigerator for 2-3 days" (68 % having knowledge).

Attitude Scores Toward Food Poisoning

In this study, the participants had attitude scores that range from 16 to 57 (M = 39.45; SD = 10.41). Table 2 presents information concerning item analysis of the attitude subscale. Based on the study results, about 89 % of the participants had a positive attitude concerning item 15 "Washing hands with soap and water before preparing food is necessary to prevent food poisoning. Similarly, 86 % of the participants responded in a positive way to item 13 "Washing hands with soap and water prior to eating food is necessary to prevent food poisoning". Item 14 "Thorough washing of vegetables and fruits in tap water is necessary to prevent food poisoning" was also acknowledged positively by 85 % of the participants.

Conversely, the following three items were recognized negatively by more than a half of the participants; 59 % for item 3 "There is no risk of disease from drinking the milk of she camel right after milking", 64 % for item 4 "Baby feces is free from pathogenic microbes if he/she is not sick, and 67% for item 8 "There is no risk of disease from eating cooked food kept at room temperature for one day if covered".

Practice Scores Associated with Food Poisoning

The degrees of the participants' practices ranged

from 18 to 80 (M = 66.35; SD = 15.38). Item analysis results showed that highest reported hygienic practices of participants were item 5 “Do you wash your hands with soap and water after using the toilet?” (96 %), item 6 “Do you wash your hands after contact with animals?” (94 %), and item 2 “Do you wash your hands with soap and water before eating your meal?” (94 %).

On the other hand, the most dominant unhygienic practices of the participants were item 17 “Do you eat cooked food left at room temperature for over 6 hours without sufficient heating?” (41 %), item 20 “Do you eat food, like meat and rice and soup, by hand from a big bowl shared by several people?” (37 %), and item 8 “Do you just wipe fresh vegetables and fruits before you eat them?” (34 %). These results are summarized in Table 2.

Table 2. Item analysis of the knowledge, attitude, and practice subscales (N=360)

	Knowledge subscale		
Number	**Item**	**Having knowledge n (%)**	**No knowledge n (%)**
1	Food poisoning is caused by pathogenic microbes	337 (93.6 %)	23 (6.4 %)
2	Some toxins produced by microbes and causing food poisoning are resistant to heating temperature of food	212 (58.9 %)	148 (41.1 %)
3	Drinking raw milk is highly risky for food poisoning	283 (78.6 %)	77 (21.4 %)
4	Eating raw eggs is highly risky for food poisoning	255 (70.8 %)	105 (29.2%)
5	Eating raw or half - cooked meat is highly risky for food poisoning	313(86.9 %)	47 (13.1 %)
6	Eating raw unwashed vegetables is highly risky for food poisoning	317 (88.1 %)	43 (11.9 %)
7	Eating unwashed and not pealed fruits is highly risky for food poisoning	306 (85 %)	54 (15%)
8	Food handlers with unhygienic practices could be the source of microbial contamination of food which causes food poisoning	323 (89.7 %)	37 (10.3 %)
9	Well cooked food is free from microbes which cause food poisoning	268 (74.4 %)	92 (25.6 %)
10	Eating uncovered leftover cooked food, kept at room temperature for 12-24 hours, is at high risk to cause food poisoning	275 (76.4 %)	85 (23.6 %)
11	Raw white cheese processed from raw milk has a high risk of food poisoning	200 (55.6 %)	160 (44.4 %)
12	Pasteurized milk can be drunk directly with no risk of food poisoning.	224 (62.2 %)	136 (37.8 %)
13	Keeping food at refrigerator temperature will slow down the microbial growth and multiplication, thus preventing food spoilage and food poisoning	301 (83.6 %)	59 (16.4 %)
14	Drinking surface water like rivers, streams and rain water reservoirs without any treatment as boiling or adding chlorine, is at high risk to cause food poisoning	284 (78.9 %)	76 (21.1 %)
15	There is no risk of food poisoning from eating leftover cooked food kept in the refrigerator for 2-3 days.	246 (68.3 %)	114 (31.7 %)
	Attitude subscale		
Number	**Item**	**Positive attitude n (%)**	**Negative attitude n (%)**
1	Raw milk is more healthy and nutritious than pasteurized or boiled milk	180 (50 %)	180 (50 %)
2	There is no risk of disease from drinking raw goat or cow milk right after milking	184 (51.1 %)	176 (48.9 %)
3	There is no risk of disease from drinking the milk of she camel right after milking	148 (41.1 %)	212 (58.9 %)
4	Raw eggs are more healthy and nutritious than cooked ones	187 (51.9 %)	173 (48.1 %)
5	There is no risk of disease from drinking raw eggs	183 (50.8 %)	177 (49.2 %)

6	There is no risk of disease from eating raw meat of young animals	227 (63.1 %)	133 (36.9 %)
7	Wiping vegetables or fruits make them safe to be eaten	233 (64.7 %)	127 (35.3 %)
8	There is no risk of disease from eating cooked food kept at room temperature for one day if covered	120 (33.3 %)	240 (66.7 %)
9	There is no risk of disease from eating unwashed vegetables and herbs picked up directly from the plant	236 (65.6 %)	124 (34.4 %)
10	Baby feces is free from pathogenic microbes if he/she is not sick	130 (36.1 %)	230 (63.9 %)
11	Rain water collected in a reservoir is safe to drink without any treatment	177 (49.2 %)	183 (50.8 %)
12	Food handlers without clinical symptoms can contaminate food with pathogenic microbes which cause food poisoning	248 (68.9 %)	112 (31.1 %)
13	Washing hands with soap and water prior to eating food is necessary to prevent food poisoning	308 (85.6 %)	52 (14.4 %)
14	Thorough washing of vegetables and fruits in tap water is necessary to prevent food poisoning	307 (85.3 %)	53 (14.7 %)
15	Washing hands with soap and water before preparing food is necessary to prevent food poisoning	322 (89.4 %)	38 (10.6 %)
	Practice subscale		
Number	**Item**	**Hygienic practice n (%)**	**Unhygienic practice n (%)**
1	Do you wash fresh vegetables and fruits in tap water before eating?	336 (93.3 %)	24 (6.7 %)
2	Do you wash your hands with soap and water before eating your meal?	337 (93.6 %)	23 (6.4 %)
3	Do you wash your hands with water and soap before preparing food?	335 (93.1 %)	25 (6.9 %)
4	Do you wash your hands with water and soap after handling raw unwashed vegetables?	306 (85 %)	54 (15 %)
5	Do you wash your hands with soap and water after using the toilet?	344 (95.6 %)	16 (4.4 %)
6	Do you wash your hands after contact with animals?	339 (94.2 %)	21 (5.8 %)
7	Do you eat fresh vegetables and fruits without washing?	245 (68.1 %)	115 (31.9 %)
8	Do you just wipe fresh vegetables and fruits before you eat them?	237 (65.8 %)	123 (34.2 %)
9	When you make a field trip, do you pick up vegetables or herbs from the plants and eat them without washing?	247 (68.6 %)	113 (31.4 %)
10	Do you eat raw eggs?	303 (84.2 %)	57 (15.8 %)
11	Do you eat uncooked eggs (Egg yolk is soft)?	257 (71.4 %)	103 (28.6 %)
12	Do you eat raw meat?	312 (86.7 %)	48 (13.3 %)
13	Do you eat half-cooked eggs (Egg yolk is soft)?	303 (84.2 %)	57 (15.8 %)
14	Do you drink raw cow or goat milk?	299 (83.1 %)	61 (16.9 %)
15	Do you drink raw milk of she camel?	288 (80 %)	72 (20 %)
16	Do you eat raw white cheese prepared from raw un-pasteurized milk?	259 (71.9 %)	101 (28.1 %)
17	Do you eat cooked food left at room temperature for over 6 hours without sufficient heating?	211 (58.6 %)	149 (41.4 %)
18	Do you eat food from a restaurant/cafeteria that looks not clean?	303 (84.2 %)	57 (15.8 %)
19	Do you drink from rain water collected in a reservoir or surface stream water without any treatment?	291 (80.8 %)	69 (19.2 %)
20	Do you eat food, like meat and rice and soup, by hand from a big bowl shared by several people?	228 (63.3 %)	132 (36.7 %)

Differences in Students' Knowledge Scores

It is important to indicate that in this study, multiple pairwise comparisons (several t-tests & ANOVAs) were conducted, which increases the risk of Type-I error. To overcome this issue, the researcher applied a correction for multiple testing (Bonferroni). The initial significance

level (alpha =0.05) was divided by the number of comparisons (n) for each time of the conducted test, and a new threshold (e.g., 0.05/n) was used. To test the differences in knowledge scores between the dichotomous study groups (including gender, food poisoning courses and history of food poisoning). Independent sample t test was used. To test the normality assumption, Shapiro-Wilk test was utilized, and the results were not significant (P< 0.05), indicating that normality was achieved and verified. Independent sample t test analysis showed that there are statistically significant differences in the knowledge scores of the participants in relation to their gender (t = - 2.31; p = 0.02) and history of food poisoning (t = 1.99; p = 0.04). Specifically, female participants reported statistically higher degrees of knowledge (*M* = 46.53; *SD* = 7.11) than their male counterparts (*M* = 44.52; *SD* = 8.34). Similarly, participants with history of having food poisoning showed statistically higher degrees of knowledge (*M* = 47.24; *SD* = 7.26) than those who did not have history of food poisoning (*M* = 45.47; *SD* = 7.49).

From a different perspective, though, a one-way ANOVA test was used to verify the differences between the categorical groups of the participants (such as marital status and study major). The normality assumption was verified through Shapiro-Wilk test. One-way ANOVA analysis showed that there are statistically significant differences in the knowledge scores of the participants based on their study major or attended faculty (F = 4.99; p = 0.001). The post hoc analysis (i.e, Bonferroni) revealed that those participants who majored in nutrition sciences have statistically higher degrees of knowledge concerning food safety (*M* = 48.34; *SD* = 5.86) in comparison to participants who attended other faculties. These results are detailed in Table 3.

Table 3. Differences in knowledge scores by sociodemographic and academic characteristics of the students (N=360)

Variables	Mean	SD	t/F	P-value
Gender			- 2.31	0.02*
Male	44.52	8.34		
Female	46.53	7.11		
Marital Status				
Single	45.89	7.55	0.25	0.78
Married	47.27	7.57		
Divorced	45.33	5.69		
Major				
Humanistic	44.24	6.83		
Scientific faculties	48.00	7.79	4.99	0.001*
Engineering	44.51	8.94		
Health sciences	46.13	7.58		
Nutrition	48.34	5.86		
University year			0.87	0.46
First year	45.45	7.67		
Second year	46.23	7.90		
Third year	47.44	6.63		
Fourth year	46.08	6.22		
Food poisoning courses			1.49	0.14
Yes	46.92	7.03		
No	45.59	7.69		
History of food poisoning			1.99	0.04*
Yes	47.24	7.26		
No	45.47	7.59		
Source of Information			1.67	0.18
Health care staff	47.07	6.22		
Internet and TV	46.15	7.75		
Family or friends	45.17	8.92		
Other sources	44.53	7.53		

Differences in Students' Attitude Scores

Independent sample t-test analysis showed that there are statistically significant differences in the attitude scores of the participants in relation to their gender (t = - 3.83; p = 0.001) and participation in food poisoning courses (t=2.08; p=0.04). Particularly, female participants reported statistically higher degrees of attitude (*M*=40.77; *SD* = 10.35) than their counterpart male participants (*M* = 36.24; *SD* = 9.86). Likely, participants who attended food poisoning courses reported statistically higher degrees of attitude (*M* = 41.32; *SD* = 10.28) than their counterpart participants who did not attended such courses (*M* = 38.76; *SD* = 10.39).

On the other hand, one-way ANOVA analysis showed that there are statistically significant differences in the attitude scores of the participants based on their study major or attended faculty (F = 2.44; p = 0.04), university year (F = 3.78; p = 0.01), and source of information (F = 2.71; p = 0.04). To specify, the post hoc analysis (i.e., Bonferroni) revealed that students who attended nutrition majors have statistically higher degrees of attitude toward food safety (*M* = 42.71; *SD* = 8.70) in comparison to participants who attended other majors or faculties. Likely, participants who are in the fourth year of their study have statistically higher degrees of attitude toward food safety (*M* = 42.85; *SD* = 8.56) in comparison to participants who are in the other three years of their study. Lastly, students who depend on health care staff as a source of information about food poisoning reported statistically higher degrees of attitude toward food safety (*M* = 41.49; *SD* = 9.68) in comparison to participants who depend on other sources of information. These results are summarized in Table 4.

Table 4. Differences in attitude scores by sociodemographic and academic characteristics of the students (N=360)

Variables	Mean	SD	t/F	P-value
Gender			- 3.83	0.001*
Male	36.24	9.86		
Female	40.77	10.35		
Marital Status				
Single	39.35	10.49	0.43	0.65
Married	41.00	9.30		
Divorced	43.67	5.86		
Major				
Humanistic	39.15	10.44		
Scientific faculties	40.29	10.55	2.44	0.04*
Engineering	36.17	10.94		
Health sciences	37.98	10.60		
Nutrition	42.71	8.70		
University year			3.78	0.01*
First year	40.59	9.92		
Second year	37.18	11.26		
Third year	37.68	10.36		
Fourth year	42.85	8.56		
Food poisoning courses			2.08	0.04*
Yes	41.32	10.28		
No	38.76	10.39		
History of food poisoning			1.18	0.24
Yes	40.52	10.55		
No	39.06	10.34		
Source of Information			2.71	0.04*
Health care staff	41.49	9.68		
Internet and TV	39.19	10.91		
Family or friends	39.81	9.61		
Other sources	36.69	10.51		

Differences in Students' Practice Scores

Independent sample t-test analysis showed that there are statistically significant differences in the practice scores of the participants in relation to their gender (t = - 4.66; p = 0.001). The results showed that female participants reported statistically higher degrees of practice (*M* = 68.85; *SD* = 14.20) than their male counterparts (*M* = 60.29; *SD* = 16.49). Similarly, one-way ANOVA analysis showed that there are statistically significant differences in the practice scores of the participants based on university year (F = 6.80; p = 0.001). Post hoc analysis (i.e., Bonferroni) revealed that participants who are in the fourth year of their study have statistically higher degrees of practice toward food safety (*M* = 69.52; *SD* = 12.59) in comparison to participants who are in the other three years of their study. These results are summarized in Table 5.

Table 5. Differences in practice scores by sociodemographic and academic characteristics of the students (N=360)

Variables	Mean	SD	t/F	P-value
Gender			- 4.66	0.001*
Male	60.29	16.49		
Female	68.85	14.20		
Marital Status				
Single	66.38	15.32	0.04	0.96
Married	66.20	18.25		
Divorced	64.00	10.15		
Major				
Humanistic	68.91	12.43		
Scientific faculties	68.26	14.20	2.07	0.08
Engineering	62.67	15.40		
Health sciences	63.87	17.50		
Nutrition	68.60	11.42		
University year			6.80	0.001*
First year	61.40	12.56		
Second year	64.29	18.66		
Third year	66.35	16.64		
Fourth year	69.52	12.59		
Food poisoning courses			1.03	0.31
Yes	67.72	14.27		
No	65.85	15.77		
History of food poisoning			- 1.25	0.21
Yes	64.69	16.32		
No	66.97	15.01		
Source of Information			2.16	0.09
Health care staff	67.88	15.99		
Internet and TV	66.17	15.28		
Family or friends	68.63	11.51		
Other sources	62.35	17.36		

Discussion

This study seeks to explore Jordanian university students' KAP concerning food poisoning. In this part at the study, the researcher highlights the most important results in this study. Moreover, the researcher compares those results with available results in previous related studies. It is important to note that the researcher added some personal reflections to explain the identified results in this study. This part also incorporates implications of the study findings for nursing practice and university students and teachers. In order to connect the content of the discussion to the previously presented study content, the researcher organized this part into subheadings using titles that match the research questions.

Levels of KAP of Jordanian University Students toward Food Poisoning

Rather than viewing knowledge, attitudes, and practices independently, the findings reveal important interactions among these three domains that reflect how food safety behaviors among students are shaped, not only by formal knowledge, but also by cultural norms, experiential learning, and habitual practices. Our descriptive study showed that university students in Jordan demonstrated a moderate level of knowledge in relation to food safety. This finding is consistent with previous related studies in the local and international contexts. For example, in the Saudi Arabian context, Alnemari et al. (2024) revealed that Saudi university students had a similar level of knowledge about food safety. Conversely, better levels of knowledge were documented in other studies, which could be attributed to the variations in the study design, study setting, study period, questionnaire format, and sociodemographic characteristics.

Although students demonstrated a moderate overall level of knowledge, item analysis revealed critical misconceptions related to toxin resistance to heat, safety of refrigerated leftovers, raw white cheese, and pasteurized milk. These misconceptions are particularly important, because they relate to common daily food behaviors in Jordanian society. At the same time, students showed very high levels of hygienic practices**,** especially in handwashing and washing fruits and vegetables. This apparent contradiction indicates a knowledge–practice gap**,** where students perform appropriate hygienic behaviors without fully understanding the microbiological rationale behind them. Similarly, Afrin et al. (2024) found that university students in Bangladesh had some misconceptions about food safety and malpractices, such as improper storing practices of stored raw meat and fish on the top shelf of the refrigerator.

This pattern can be explained through the KAP theoretical perspective, where practices are often shaped by learned habits and cultural upbringing rather than formal scientific knowledge. In Jordanian and Islamic cultural contexts, cleanliness and hand hygiene are deeply embedded social norms taught from early childhood. Consequently, students maintain good hygienic practices even when their scientific understanding of foodborne pathogens is incomplete. This explains why high practice scores coexisted with only moderate knowledge levels.

Similarly, the attitude findings revealed a mixture of positive and negative beliefs. Students strongly endorsed attitudes related to hand hygiene and food washing, but a considerable proportion still believed in traditional misconceptions, such as the safety of raw milk, raw eggs, or food kept at room temperature if covered. This coexistence of positive hygienic attitudes with traditional food beliefs highlights how cultural food perceptions may persist despite higher education exposure. These beliefs directly explain the unhygienic practices observed in items related to leftover food, wiping vegetables instead of washing, and eating from shared bowls. In contrast to our results, Minh (2024) found that university students in Vietnam had a favorable attitude concerning food positioning. The differences between our results and those of Minh (2024) could be attributed to methodological variations.

Integrating the three domains shows that students' food safety behaviors are primarily driven by cultural hygiene norms and experiential learning, moderately supported by knowledge, and partially influenced by traditional food beliefs. This interpretation directly answers the first research question by clarifying not only the levels of KAP, but also how these levels interact in shaping behaviors.

Influence of Selected Students' Characteristics on Knowledge, Attitude, and Practice Scores

According to the study results, female students were more likely to have higher knowledge degrees, positive attitudes, and hygienic practices than male students. Previous international and local studies on university students supported this finding (Ali et al., 2023; Alsakarneh et al., 2024; Gebre et al., 2023). For instance, in a previous Jordanian study (Alsakarneh et al., 2024), the results indicated that female students exhibited better degrees of knowledge than their male counterparts. Moreover, the results reported that female students had higher scores in relation to the cross-contamination practices and food microbiology. This superiority of females in knowledge, attitudes and practices could exist because of several sociocultural, gender-based roles and parental factors. In the Jordanian society, females are expected to have the responsibility to prepare food for other household members. Therefore, those females are expected to be knowledgeable about proper food preparation principles

and following hygienic food practices. Additionally, literature indicated that food safety awareness is transmitted across generations especially from the educated mothers to their female children. Thus, females usually have more awareness of food safety procedures than males.

From a different perspective though, the present study results highlighted the influence of the students' specialty on their perceived degrees of knowledge and attitudes. Specifically, the results showed that students enrolled in a nutrition major were more likely to perceive higher knowledge degrees and more positive attitudes than students in other majors. These findings align with the findings of Gökçeel and Akoğlu (2022) who found that Turkish university students who majored in food engineering tend to have better scores in the knowledge scale of food safety than students from other disciplines. The rationale behind these findings is that students who enroll in a nutrition major usually have specialized coursework about food safety that increases their awareness level. Moreover, those students have hands-on training on various standardized food preparation procedures, thus making them more familiar with hygienic food practices.

Lastly, this study illustrated that fourth-year Jordanian university students have more positive attitudes and higher hygienic food practices than students of the first three years. In contrast to these findings, a previous Jordanian study (Osaili et al., 2021) found that there was no association between university year and overall score of the students' KAP. Using different sampling techniques and employing different measures for investigating the students' KAP toward food safety could possibly lead to the variation in the reported findings between our study and those findings of Osaili et al. (2021). High scores for the fourth-year students in the present study might have happened, because those students were exposed to food safety education (either as obligatory or elective courses) through their university journey. Furthermore, it is important to consider the maturation issue, as senior or fourth-year students tend to be more mature and behave more professionally than junior students of other levels.

Implications for Nursing

The present study has significant implications for the nursing practice, education and research, university students, and university teachers. The study may contribute to the evidence based practices of nurses dealing with food poisoning cases. To illustrate, nurses can utilize the study findings in order to design and implement proper caring measures for university students at higher risk for developing foodborne disorders. Moreover, nursing curricula need to be updated to reflect the latest knowledge available on food safety issues, particularly among youth or university students. This study offers significant findings for nursing researchers who are interested in studying this issue. Replication of this study using a more diverse and larger sample is highly recommended.

University students may benefit from this study by increasing their awareness about those areas of knowledge deficits, poor attitudes, and malpractices concerning food safety. Additionally, this study may assist vulnerable university students with low degrees of KAP to recognize themselves initially and to seek help from the profession staff. Therefore, this will decrease the unfavorable incidence of food poisoning. Lastly, university teachers should place more concentration on the high-risk group among university students for having food poisoning. University teachers alongside the health care staff should collaborate to design health education programs, based on the findings of this study, to increase the knowledge base of university students and improve their attitudes toward food safety. Hands-on training sessions need to be included in the college students' curricula to help them master hygienic food practices.

Limitations

While this study provides significant findings for different stakeholders, the results should be interpreted carefully in light of the following limitations. Initially, regardless the fact that this study was conducted on students in large universities in Jordan, the findings cannot be generalized to all areas of Jordan, as these selected universities are located only in the middle part of Jordan. Furthermore, collecting the data on students' KAP using a well-structured self-report questionnaire could provide objective data about the students' responses. However, the deep motivations of those students to be engaged in hygienic food safety practices might be overlooked in the present study. Future research could overcome this limitation by incorporating qualitative data collection methods, such as interviews. Furthermore, the self-administered KAP

questionnaires, especially when completed in the presence of peers and after a teacher's introduction, may make the students vulnerable to social desirability bias. Forthcoming research could address this issue by building trust with the participants, fostering honest reporting, and using indirect questioning (e.g., third-person scenarios). Finally, in relation to the study design, no causal inferences can be made from cross-sectional data. Therefore, the researcher might not be able to investigate the influencing factors that contribute to the students' experiences of food poisoning and food safety. Experimental studies may be needed to be carried out to find out the potential causes of students' knowledge deficits, negative attitudes, and improper food practices.

Conclusion

The incidence of foodborne illnesses is alarming among university students internationally. This study investigated KAP of the Arabian Jordanian university students. The results underscore that Jordanian students have a cultural background that contributed to their high scores in knowledge, attitudes, and practices related to food safety. This study also clarified the role of demographic variables and students' academic characteristics in their experiences of food poisoning. This study is one of the initial and important studies that examined these variables among university students in the Arab world generally, and in Jordan particularly. More research is needed to investigate the predictors of students' KAP toward food safety.

Acknowledgements

The author dedicates this academic work for the Jordanian students who inspired her to conduct this study.

Conflict of Interests

The author declares that she has no conflict of interests.

Funding or Sources of Financial Support

This research paper is not funded by any funding source.

REFERENCES

Afrin, S., Salma, N., Yeasmin, S., Promy, S.T., Salam, S., & Ali, M.K.M. (2024). Perceptions and perspectives towards safe food handling and its practices: A case study at Jahangirnagar University. *Journal of Health, Population and Nutrition, 43*(1), 225.

Ajlouni, B., Al-Nabulsi, A., Issa, S. N., Farha, R.A., Wafa'a Ta'an, R., Saleh, S.A., ... & Mukattash, T. (2023). Evaluating nutrition-related knowledge, attitudes, and practices for the prevention of breast cancer among women in Jordan. *Jordan Journal of Nursing Research, 2*, 289-298.

Ali, M.T., Mahmud, S., Mohsin, M., Mian, A.U., Islam, A., & Ahmed, F.F. (2023). Knowledge, attitudes, and practices toward food safety among students in Bangladesh: A cross-sectional web-based study. *Heliyon, 9*(4).

Alnemari, H., Alotaibi, S., Hassan, M.E., Hussain, M., & Alhazmi, A. (2024). Knowledge, attitudes, and practices regarding food poisoning among health sciences university students, Dammam, Saudi Arabia. *Journal of the Saudi Society for Food and Nutrition (JSSFN), 17*(1).

Alsakarneh, N., Hammouh, F., & Sayd, A.A.K.B. (2024). Food safety knowledge and handling practices among Jordanian university students. *Mutah Journal of Natural, Applied and Health Sciences, 39*(1).

Browner, W. S. (2009). *Designing clinical research* (3rd ed.). Lippincott Williams & Wilkins.

Çol, B.K., Başaran, A.G., & Köse, B.G. (2024). The impact of health promotion training on university students' health perceptions, healthy lifestyle behaviors, and risky behaviors. *Frontiers in Psychology*, *15*, 1407233.

Fain, J. (2024). *Reading, understanding, and applying nursing research*. F.A. Davis.

Gebre, G.G., Legesse, T., & Fikadu, A.A. (2023). Food safety knowledge, attitudes, and practice among male and female food handlers: Evidence from fruit and vegetable producers in Ethiopia. *Heliyon*, *9*(6).

Gökçeel, E., & Akoğlu, A. (2022). Evaluation of university students' knowledge, attitudes, and practices on food safety in Bolu, Turkey. *Food and Health*, *8*(4), 321-333.

Halwani, M.A. (2023). A Study to assess basic food safety knowledge among university students. *Food and Nutrition Sciences, 14*(6), 526-541.

Islam, S., Tanjia, N., Mitra, A.K., Hossain, A., Jasika, M.T., Suhi, S.S., & Hossain, S.J. (2024). Inadequate food safety knowledge and hygiene practices among

street food vendors in Dhaka, Bangladesh. *Scientific Reports*, *14*(1), 17349.

Liguori, J., Trübswasser, U., Pradeilles, R., Le Port, A., Landais, E., Talsma, E.F., …, & Holdsworth, M. (2022). How do food safety concerns affect consumer behaviors and diets in low-and middle-income countries? A systematic review. *Global Food Security*, *32*, 100606.

Minh, D. C. (2024). Knowledge, attitudes, and practices related to food poisoning prevention among Vietnamese medical students: Results of an online survey. *Journal of Public Health and Development*, *22*(2), 226-238.

Mshelia, A.B., Osman, M., & Binti Misni, N. (2022). A cross-sectional study design to determine the prevalence of knowledge, attitudes, and the preventive practices of food poisoning and its factors among post-graduate students in a public university in Selangor, Malaysia. *PLoS One*, *17*(1), e0262313.

Osaili, T.M., Al-Nabulsi, A.A., & Taybeh, A. O. (2021). Food safety knowledge, attitudes, and practices among Jordanian universities' students during the COVID-19 pandemic. *Frontiers in Public Health*, *9*, 729816.

Qutob, R.A., Alaryni, A., Alghamdi, A., Alotay, A.A., Alhajery, M.A., AlHussaini, K.I., …, & Alshalan, L.Z. (2025). Knowledge, attitudes and practices of university students on food poisoning: A cross-sectional study in Saudi Arabia. *Journal of Pioneering Medical Sciences*, *14*, 55-62.

Sharif, L., & Al-Malki, T. (2010). Knowledge, attitudes and practices of Taif University students on food poisoning. *Food Control*, *21*(1), 55-60.

World Health Organization. (2023). *Estimating the burden of foodborne diseases*. https://www.who.int/activities/estimating-the-burden-of-foodborne-diseases