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Food Safety Perception and Practices among University Students in Jordan

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Food-borne illnesses represent a major public health problem. Published research on food safety among university students shows that this group has limited knowledge in this field. The study assessed eating behavior and Food safety knowledge and practice among university students in Jordan. This cross-sectional study was based on a questionnaire that was completed by 1, 161 students from three major universities in Jordan. The mean number of times per week in which students ate or bought food from restaurants was 3.69 ± 3.0 SD. The most common factors that students considered when easting in a restaurant were hygiene (82.7%), followed by the price (9.0%), and closeness to living place (7.7%). Only 51.5% of participants reported that the restaurant workers always/often wear gloves when preparing their meals. Overall, 53.7% (n = 637) of students reported having at least one symptom after eating food in a restaurant, however only 4.1% of our sample reported these incidences to the authorities. Significant differences in food safety knowledge and practices exist between students. There is a need to increase university students' knowledge on food safety and to improve their awareness of the importance of reporting food poisoning symptoms.

Ke ywords: Food poisoning, University, students, Jordan.

Foodborne illnesses represent a major global health challenge that affects millions of people annually with increased mortality and morbidity[1]. It also increases the costs of healthcare settings investigations and treatment leading to a great economic burden. Furthermore, it results in unwanted increase in the sick leaves and food industry losses[2, 3].

Food can be a transmission vehicle for many bacterial organisms such as clostridium perfringens, listeria monocytogenes, salmonella and campylobacter. Food can also transmit viruses and parasites leading to symptoms that can be mild and self-limiting but can also be life-threatening[4, 5].

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Foods which are considered risky in transmitting infections include are many, such as raw or undercooked meat or poultry, foods that contain raw or undercooked eggs, unwashed fresh vegetables including salads, luncheon meats that have not been reheated and unpasteurized milk. The wide range of the risky foods puts the consumers at increased risk of foodborne infections[3, 6].

Each year, foodborne illnesses are responsible for more than 325,000 admissions and 5,000 deaths in the USA[7], while in England and Wales, they cause around 1.3 million food poisoning cases, 21,000 admissions and 500 deaths every year[8]. In Jordan, salmonella in shawarma from local restaurants caused a total of 1,600 hospitalizations and one death in 2006 and 2007 [9].

A study on food safety in Jordan was based on the analysis of 1,028 samples of various types of ready to eat (RTE) products (550 chicken and 478 beef products). These samples were collected from both large and small restaurants in all 12 Jordan governorates from April through August 2009. The samples were tested for salmonella, *Listeria monocytogenes*, and *E. coli* O157:H7. The overall prevalence of salmonella serovars in chicken or beef products was 0.5%, with 0.8 and 0.2% in RTE chicken and RTE beef, respectively. The overall prevalence of L. monocytogenes in RTE chicken and beef products was 2%, with 2.7 and 1.5% in RTE chicken and RTE beef products, respectively[9].

The diarrheal episodes caused by Shigella and Salmonella infections were considered underreported in Jordan. For each case of laboratory-confirmed Shigella or Salmonella infection, it was estimated that there are about 273 infected persons in the community[10].

Nutritional health and food safety of university students can improve their social and educational performance and learning efficacy[11]. Published research on food safety handling and practices among university students shows that this group has limited knowledge about these practices[12, 13]. There is only one published study in this field in Jordan on college students. This study showed very poor knowledge on food safety[14]. Therefore, studying the knowledge of university students in Jordan on food safety and the influencing factors would be helpful in reducing the foodborne illnesses and the consequent health, social and educational losses. This can be achieved by launching the appropriate awareness workshops and educational courses. In order to achieve this and to provide a basis for food safety research amongst university students in Jordan, we proposed this cross-sectional study on food safety practices and behaviors among university students in Jordan.

MATERIALS AND METHODS

Study Design

This cross-sectional study was conducted in three of the largest Jordanian public universities located in the three administrative regions of Jordan: Mutah University (MU) (South), the University of Jordan (UJ) (Middle) and the Jordan University of Science and Technology (JUST) (North). The questionnaire consisted of two sections. The first section asked for socio-demographic data. The second section asked for the student's place of residence during term time, frequency per week and reasons for eating food from restaurants, student's assessment of this food and, finally, hygiene habits that the students apply or notice during eating in restaurants. This section also looked for common symptoms related to food poisoning during the last year. It examined the frequency of these symptoms, foods associated with them and hospitalization due to these symptoms.

Ten copies of the final version of questionnaire were on students in each of the participating universities and the questionnaire was found adequate for the students population in Jordan.

This study was approved by the Scientific and the Ethics Committees of the Faculty of Medicine at Mutah University.

Sample Size

We based our sample size calculations on the most up-to-date figures published by Ministry of Higher Education which covered the number of students at Jordanian universities for the academic year of 2012/2013. In the year, the total number of undergraduate students attending public universities in Jordan was 185,617 [15] and the number of undergraduate students in the

participating universities (71,477) constituted more than one third (38.5%) of them. The number of undergraduate students at MU, the UJ and JUST were 16,826; 32,912; and 21,739, respectively. Using the Kish formula[16] for sample size estimation at a 95% significance level and a 5% error margin, the representative sample sizes in these universities were 376, 380 and 378, respectively.

Sample Collection

Data collection took place during the second semester of the academic year 2013/2014 by trained research assistants. Students studying health-related specialties were included in this study and their results were compared with results of students from other specialties.

We excluded first year students because they had not spent enough time in the university as well as post-graduate students because we assume that they have different study schedules and different eating habit than undergraduate students. A stratified random sampling technique was used for data collection in which each university was stratified by faculty and therefore the numbers of collected questionnaire proportional to the number of students in each faculty. Data collection took place at different weekdays and day times. Each student received a questionnaire and the study objectives were explained to him. Any questions that the students had were answered and then they were asked to fill the questionnaire without discussing it with their colleagues. Completing the questionnaire took between 5-10 minutes.

Statistical Methods

Data was entered into an SPSS data base and analysis was carried out using SPSS software version 18.0 (SPSS; Chicago, IL, USA). Descriptive statistics were obtained and reported as necessary. Multinomial logistic regression was used to build prediction models to the answers of the following questions:

1. Which is safer in terms of food hygiene?
   (1) Restaurants food (2) Home-prepared food (3) No difference
2. Do you feel safe, in terms of food hygiene, when eating at restaurants?
   (1) Always/often (2) Sometimes/seldom (3) Never
3. Which is the most important factor that you take into consideration when choosing a restaurant to eat from?
   (1) Hygiene (2) Others (price and closeness to place of living)
4. Do you wash hands at restaurants before eating?
   (1) Always/often (2) Sometimes/seldom (3) Never
5. During the last year, did you have any food poisoning symptoms after eating food from a restaurant? (Yes, no)
6. If yes, did you file a complaint against the restaurant form which you bought the food? (Yes, no)

A stepwise selection method was used to select the best predictors of the above questions. Stepwise selection criteria were utilized for model selection. Selection parameters were 0.15 for alpha to enter and 0.2 for alpha to remove. The candidate predictors used were:

a) Gender (Male, female)
b) Nationality (Jordanian, non-Jordanian)
c) Age
d) Socioeconomic Index (SEI) with possible categories of Low, Medium, and High. SEI is an indication of the socioeconomic status of study participants and it was identified for each participant based on the place where parents reside (City, town, village), the average monthly family income (Jordanian Dinar) (<500, 500-999, 1,000-1,499, 1,500-2,000, >2,000), father's educational level (Illiterate, elementary or secondary, high school, diploma, bachelor degree, masters or PhD), and mother's educational level (Illiterate, elementary or secondary, high school, diploma, bachelor degree, masters or PhD).
e) Academic year (Second, third, fourth, fifth, sixth or more)
f) Faculty type (Scientific, humanities)
g) Studying a health-related specialty (Yes, no)
h) Housing during the university semester (With parents, residence inside campus, residence outside campus)

RESULTS

Sociodemographic data

The number of students who returned completely filled questionnaire was 1,161 (mean

age 20.8 ± 2.0 years) (range 17-40 years) and females constituted 60.4% of them (n = 716). The numbers of students from MU, the UJ, and JUST were 400 (33.7%), 394 (33.2%), and 393 (33.1%), respectively. The majority of students were Jordanians (91.9%) (n = 1084) and studied in scientific faculties (62.7%). The number of students who studied in health-related specialties was 270 (22.7%). Regarding the academic year, second-year students constituted almost half of our sample (49.0%) (n = 569). The number of students who were in third-, fourth-, fifth-, and sixth-year were 314 (27%), 183 (15.8%), 85 (7.3%), and 10 (0.9%), respectively. In regards to the socioeconomic status of study participants, 35.1% had a high SEI, 32.7% had a medium SEI and the rest (32.2%) had a low SEI.

Table 1. The mean number of times for each symptom that students report after having eaten food from restaurants during the last year

Symptom	Percentage	Most commonly eaten food	Mean number of times ± SD
Nausea	72.9%	Chicken shawarma (18.8%)	3.63 ± 7.2(n = 226)
Vomiting	43.2%	Chicken shawarma and beef/lamb meat shawarma (13.9%)	2.51 ± 2.8(n = 170)
Chills	43.1%	Chicken shawarma (17%)	2.92 ± 2.8(n = 119)
Diarrhea without blood or mucus	37.8%	Beef/lamb meat shawarma (20.5%)	2.48 ± 2.4(n = 126)
Fever	35.7%	Chicken shawarma (21.9%)	3.91 ± 10.0(n = 106)
Diarrhea with blood or mucus	9.2%	Chicken shawarma or cooked beef or lamb meat (16.7%)	2.91 ± 3.2(n = 23)

Table 2. Most commonly reported symptoms with each food

Food	Most common associated symptom
Beef/lamb meat shawarma	Diarrhea without blood or mucus
Burger	Nausea
Chicken shawarma	Nausea
Cooked beef or lamb meat	Nausea
Cooked chicken	Nausea
Falafel	Vomiting + Nausea
Grilled chicken	Nausea
Grilled Kebabs	Nausea
Grilled lamb meat	Nausea
Homos	Nausea
Other foods	Nausea
Roasted chicken	Nausea
Salads	Nausea
Salami	Nausea
Strained yogurt (Labneh)	Fever
Yogurt	Nausea

Food safety knowledge and practices

During term time, the majority of students (74.4%) reported that they lived with their parents (n = 873), 18.3% (n = 215) reported that they lived in rented residencies outside university campus, while only 7.3% (n = 86) reported that they lived in university accommodation. The mean number of times per week in which students ate or bought food from restaurants was 3.69 ± 3.0 SD (n = 1097) and with 63.6% (698) of students doing that at least three times per week. The most common frequency was three times per week (n = 258). The most commonly reported reason for eating in or

Table 3. Reporting the incidence of food poisoning

Did you report the incidence? (n=621) (%yes)	4.1% (n = 49)
Were you admitted to hospital because of any of the symptoms? (n = 437) (%yes)	8.7% (n = 103)
Were you told by the doctor that this symptom(s) are the result of food poisoning (n = 103)	82.5% (n = 85)
Mean number of times admitted to hospital (n = 75)	2.29 ± 1.7 SD (range 1-8)
Total number days admitted to hospital	3.55 ± 3.8 SD (range 1-18)

Table 4. Parameter estimates of the multinomial logistic regression model for predicting the answers of "Feel safe regarding food hygiene when eating at restaurants?". Reference answer is "Never"

			Coefficient	Significance
Feel safe regarding food hygiene when eating at restaurants: (1)Always/often (2) Sometimes/seldom (3) Never	Always/often	Intercept	3.916	0.000
		Age	-0.123	0.003
		Medical faculty=No	-0.507	0.038
		Medical faculty=Yes	0	
		Nationality=Jordanian	-0.108	0.756
		Nationality=Non-Jordanian	0	
		Living during term time=with parents	0.383	0.106
		Living during term time=inside campus	0.137	0.730
		Living during term time=outside campus	0	
	Sometimes/seldom	Intercept	2.768	0.006
		Age	-0.124	0.004
		Medical faculty=No	-0.613	0.015
		Medical faculty=Yes	0	
		Nationality=Jordanian	0.718	0.089
		Nationality=Non-Jordanian	0	
		Living during term time=with parents	0.602	0.018
		Living during term time=inside campus	0.586	0.153
		Living during term time=outside campus	0	
	Pseudo R-Square		0.035	
	P-value		0.000	

Table 5. Parameter estimates of the multinomial logistic regression model for predicting the answers of "Do you wash hands at restaurants before eating?". Reference answer is "Never"

			Coefficient	Significance
Do you wash hands at restaurants before eating (1) Always/often (2) Sometimes/seldom (3) Never	Always/often	Intercept	4.085	0.000
		Medical faculty=No	-0.592	0.223
		Medical faculty=Yes	0	
		Sex=Male	-1.045	0.003
		Sex=Female	0	
		Faculty type=scientific	-0.122	0.745
		Faculty type=humanities	0	
	Sometimes/seldom	Intercept	2.392	0.000
		Medical faculty=No	-0.300	0.554
		Medical faculty=Yes	0	
		Sex=Male	-1.063	0.004
		Sex=Female	0	
		Faculty type=scientific	0.333	0.400
		Faculty type=humanities	0	
	Pseudo R-Square		0.017	
	P-value		0.007	

buying food from restaurant was being late in the university (62.4%), followed by the desire to enjoy some time (46.2%), having no time or not knowing how to cook (36.7%), and living away from their families (20.2%). When asked about their opinion whether home or restaurants food is safer in terms of food hygiene, the majority of students thought that home food is the safest (94.1%), while 2.3% thought that there is no difference and only 2.2% thought that restaurants food is the safest. Moreover, less than half of students (47.4%) reported that they always/often feel safe in terms of food hygiene when they eat in restaurants outside of the university campus. On the other hand, 37% and 15.0% of students responded with sometimes/seldom and never, respectively. When asked to arrange three points (price, closeness to living place, and hygiene) that they take into consideration when eating in a restaurant, the most commonly reported point was hygiene (82.7%), followed by the price (9.0%), and closeness to living place (7.7%).

Reasons for students to eat or buy food from restaurants regarding of the frequency showed that being late in University lectures is the main factor (62.4%), followed by enjoying time (46.2%). Interestingly having no time to cook was reported only by 24.2% of the sample. Other reported reasons were "living away from parents" (20.2%), "not knowing how to cook" 12.5%

Regarding hygiene practices in inside the restaurant, 74% (872) of the participants reported washing their hands always/often before eating in the restaurants, 16.3%reported that they do so "sometimes", while 9.7% of them reported seldom/never washing their hands before eating in restaurants. Only 51.5% of participants reported that the restaurant works always/often wear gloves when preparing their meals. 30.1% of students reported that the workers do that sometimes, while 18.5% of the participants reported that workers seldom/never wear gloves. However, 44.5% of students reported that the restaurant worker seldom/never adheres to the correct use of gloves (e.g., they handle money while using the gloves).

Episodes of food poisoning

Students were asked whether they had during the last year any of six symptoms after eating food from restaurants. Overall, 53.7% (n = 637) of students reported having at least one symptom after eating food in a restaurant. Two, three, four, five, and six symptoms were reported by 15.9%, 10.8%, 5.9%, 3.2%, and 1.2% of students, respectively. Table 1 shows the mean number of times for each symptom that students report after having eaten food from restaurants during the last year. Among students who reported having at least one symptom after eating food from a restaurant, nausea was the most commonly reported symptom (72.9%), followed by vomiting (43.2%), and chills (43.1%). Interestingly, the most commonly reported eaten food for each of the six symptoms was shawarma (whether chicken or beef/lamb meat shawarma). "Cooked beef or lamb meat" was reported with chicken shawarma as the most commonly eaten food by students who had the symptom of "diarrhea with mucus or blood". The mean number of times reported for each symptom ranged from 2.48-3.92, with chills having the highest frequency and "diarrhea without blood or mucus" having the lowest frequency. Table 2 shows the most commonly reported symptom with each food.

Table 3 shows results related to reporting the incidence of food poisoning. Only 4.1% of students reported the incidence of having symptoms suggestive of food poisoning. 8.7% of the total sample reported being admitted because of symptoms suggestive of food poisoning; 82.5% of them were told by the doctor that their symptoms were due to food poisoning.

Figure 1 shows the most common foods that students reported avoiding eating or buying them from restaurants. Among 16 suggested foods, the most commonly avoided foods were salami (48.0%), cooked beef or lamb meat (45.5%), and grilled lamb meat (41.0%). Beef/lamb meat shawarma and chicken shawarma were reported by 39.5% and 13.8% of students, respectively.

Predictive factors

Table 4 shows parameters estimates for the questions of "Do you feel safe regarding food hygiene when eating at a restaurant?" with the answer "never" set as the reference answer. The probability of answer "never" to this question was increased with older age of the students, studying at a health-related faculty, parental residence in villages, and housing outside of campus during semester time.

Parameter estimates for the question of "Which is the most important point that you take

into consideration when choosing a restaurant?" with the answers "closeness to place of living/ price" set as the reference answer. Gender was selected as the only significant predictor (P<0.001). Male students had a higher probability of choosing hygiene as the most important point that they take into consideration when choosing a restaurant (P<0.001).

Table 5 shows parameter estimates for question "Do you wash hands at restaurants before eating?" with the reference answer set to "Never". The students who were more likely to wash their hands at restaurants were the students studying health-related specialties, students with parental residence in cities or towns, and female students.

The parameter estimates of the question "Which is safer in terms food hygiene?" with the reference answer set to "No difference" are shown in supplementary table (Table 1-S). Significant predictors of answering that home-prepared food is safer than restaurants food were having a higher father's educational level, male Gender, being non-Jordanian, and having a low monthly family income (<500 JD).

Response of students regarding filing complaints can be predicted by their parents' residence, family income and their mothers' educational level. Parameter estimates are shown in supplementary table (Table 2-S). Students whose parents live in cities have a significantly higher probability of filing complaints than those whose parents live in towns or villages. Students with family income of 999 Jordanian Dinar or less are less likely to file complaints. Students whose mothers have only high school education are the least likely to file complaints.

DISCUSSION

This cross sectional study provided an insight to the different eating behaviors and food safety practices among university students from Jordan. To the authors' best knowledge, this is the first study to be carried out in on university students in Jordan. Therefore, the results of this study could represent the baselines for further research and planning for educational courses and awareness campaigns among university students to a reduce the foodborne threats.

The study revealed that the majority of students believe that home-prepared food is safer and cleaner than the food prepared in restaurants (94.1%), and they do not feel safe eating in restaurants outside university campus. This is similar to what was found by Sun et al. (2014) where home food was selected as the safest food by the university students involved in that study[17]. Actually, this attitude is justifiable since proper hygienic food handling and preparation is usually better followed at homes compared to crowded and commercial restaurants. This is also supported by the fact that nearly 80% of the reported foodborne outbreaks in the USA were from commercial or institutional food sources[18].

The study showed that selection of restaurants by the students was prioritized by level of hygiene, which was followed by price then closeness to the place of residence in a minority of the students. This trend of selection the food to eat is similar to reported in the Chinese study, where healthy food was the major criteria, followed by price, brand and appearance[17]. About three quarters of the students reported that they always wash their hands before eating in restaurants. This more than reported in USA and Turkish studies[19, 20]. A study from Spain revealed that that 13.5% only of Spanish university students washed their hands with soap and water before and during food preparation and 38.6% used safe methods[21]. Therefore, the overall food safety awareness and behaviour in terms of hygiene and hand washing seems to be reasonable in our sample when compared with results from other countries.

However, taking into consideration how important this practice to break the chain of foodborne illnesses, more education is needed to increase the awareness food safety practices among students. This is supported by the fact that more than half of the students who ate in restaurants suffered from at least one symptom suggestive of foodborne illness such as nausea, vomiting and chills. This is much higher than reported figures from a study on international university students in one of the US universities where 28% of respondents self-reported they have been sick because of foodborne illness within the past year in the United States; 10% have sought medical attention[22]. In the current study, about 8.7% of the students reported that were admitted

to hospital and the majority of them were told by the doctor that they had food poisoning.

The commonest food associated with all symptoms was shawarma, but interestingly shawarma was shown to be one of the least foods avoided by students. Eating shawarma might lead to gastrointestinal infections and the sources of this infection are many from many sources such as unhygienic food handling, meat contamination, and the use of the raw egg mayonnaise which is used in preparing this food[23]. This is consistent with study from Sudan where mayonnaise and chicken had high prevalence of high prevalence of different bacteria due to poor handling and food safety measures[24]. It is also consistent with results from Jordan shown a high prevalence of salmonella, *Listeria monocytogenes*, and *E. coli* O157:H7 in ready to eat meat products with higher prevalence in chicken more than lamb meat. Eating shawarma despite being the commonest food to cause gastrointestinal symptoms is probably because shawarma is a popular fast food here in Jordan which is cheap, quickly prepared and many restaurants offer it throughout the country. Other foods associated with symptoms of foodborne illnesses were Beef/lamb meat shawarma Cooked beef or lamb meat Grilled meats and interestingly the falafel.

Our results show that around half of the study participants experienced at least one episode of food poisoning symptoms during the previous year, however only 4.1% of our sample reported the incidence of having symptoms suggestive of food poisoning to the authorities. Similar low figures of reporting suspected food poisoning incidence are also reported in study on international students at a U.S university[22] and in other studies from China[17], Thailand or reports from other asian countries[25, 26]. Probable explanations might be fear of reporting a restaurant or lack of knowledge on existence of complaint pathways. Therefore, proper education and increasing the awareness among the students about the existing complaint pathways and roles of local health authorities is highly recommended.

Students from advanced study years, high family income and high family educational level and students studying health-related specialties preferred eating in homes and revealed that they do not feel safe eating in restaurants. Our results are consistent with those from Lebanon and the USA. Difference in knowledge was detected by gender and by academic year in knowledge and food handling in Lebanese study[13]. Results from the USA show that male respondents and whites consumed more risky foods compared with female respondents and nonwhites, respectively[27]. Educational level was shown to affect the food safety knowledge among students as previously reported[17]. Additionally, students studying health-related specialties were the highest category of students to practice hand washing before eating in restaurants and to select restaurants based on hygiene rather than price and closeness to residency. They were also the least to have symptoms of foodborne illnesses. Such food safety knowledge among students studying health-related specialties was previously reported and could be justified by the fact that health students have a better opportunity to gain knowledge about food safety and nutritional habits due to their field of study compared to students studying non health-related specialties [17, 28, 29]. Our results are consistent with outcomes of the study on female college students in the north of Jordan. Interestingly, both studies have highlighted the role of parents' education on food practices of students. The study on college students showed that a higher percentage of students who had mothers with educational level more 12 years (38.6%) passed the food safety knowledge questions compared with students who had mothers with less education (33.9%) ($P > 0.05$), while our study showed that students of second group are less likely to report complaints on food poisoning when compared with students from the former group[14].

In conclusion, this study showed that significant differences in food safety knowledge and practices exist between students. There is a high rate of episodes of symptoms suggestive of food poisoning, but with very low rates of reporting these incidences to authorities. There is a need to increase university students' knowledge on food safety and to improve their awareness of the importance of reporting food poisoning symptoms. Our results and previous published reports can be used as the baseline for future training programs on food safety knowledge and practices among university students. The appropriate food safety

knowledge and practices can also be indirectly spread through university students to a broader population, including families and friends, and even reaching to the majority of the community population.

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