

Awareness of Food Safety among 1874 Secondary Students in Tripoli city, Libya

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ABSTRACT

What distinguishes secondary students is that they are in adolescence and this age group is known for its tendency for non-compliance and out of the ordinary. Thus, they are more prone to foodborne diseases. This study aimed to assess food safety knowledge and practices among secondary students at twelve public secondary schools in all six municipalities in Tripoli city, Libya. A cross-sectional survey was carried out among 1874 students in which 55.2% of the respondents were females and 44.8% were males. The majority of the respondents (71.5%) were between the age of 16 and 17 years. Data were analyzed by the SPSS. The findings revealed that 83.4% and 87.5% of students have good knowledge and a moderate level of practices of food safety, respectively. The findings also revealed that only 7.8 % of students reported that they "always" wash their hands before eating breakfast in school. It was observed that there was a significant association between food safety knowledge scores and students' municipality and a significant association between food safety practices scores and students' municipality, and mothers' education level of secondary school students ($P < 0.05$). In conclusion, there was a weakness of some important knowledge points and practices of food safety. Therefore, an effective and continuous education program for these teenagers is necessary. Also, the authorities should provide appropriate facilities at schools that enable students to wash their hands.

Keywords: Food Safety, Knowledge, Practices, Secondary, Students, Libya.

INTRODUCTION

Food safety is referred to as a scientific discipline describing the handling, preparation, and storage of food in ways that prevent foodborne illness (Mridha, 2013). People can become infected with 200 diseases as a result of consuming food or drink contaminated with bacteria, viruses, parasites, or chemical compounds that can lead to diarrhea or even various types of cancer (Grace, 2015 and WHO, 2019). Importantly, diarrhea killed 230,000 people

and sickens 550 million every year (WHO, 2019). Furthermore, foodborne diseases are a significant threat to people's health as well as to social development in all countries of the world through a negative impact on the countries' economy (Havelaar *et al.*, 2007, WHO, 2019). Also, the incidence of foodborne illnesses is attributed to practices related to hand hygiene, temperature-time treatment in cooking, and food storage conditions as well as cross-contamination (Ababio & Lovatt, 2015). Globally, the number of cases of food-borne illnesses is increasing

yearly (Lin *et al.*, 1998, Mead *et al.*, 1999). Interestingly, foodborne diseases may increase in developing countries, due to increased consumption of unsafe food due to the lack of effective food safety systems that monitor and control food from farm to table (Grace, 2015).

Unsafe food safety practices are prevalent among all age groups, especially young people, and this makes them more prone to foodborne diseases (Byrd-Bredbenner *et al.*, 2007a, Byrd-Bredbenner *et al.*, 2013). Several studies were conducted to assess students' level of knowledge of food safety and concluded the need to raise their awareness because they are consumers of food, and mostly, they will be responsible not only for the safety of their food but for their families' food in the future (Turnbull-Fortune & Badrie, 2014; Almansour *et al.*, 2016). Interestingly, some students may graduate from school without learning even basic food safety principles (Lange, 2017).

Poor food practices that begin in early childhood may continue and may be difficult to alter in adulthood (Wills *et al.*, 2005). Thus, schools are the optimal places for developing knowledge and strength safe food habits (Sidebottom, 1995, Haaple & Probart, 2004). Incidence of food poisoning among school children is due to unsafe food practices such as improper storage, abuse temperature, poor personal hygiene in canteens, hostels kitchens, and prepared food as part of the supplementary food program (Lin *et al.*, 1998). In schools, students consume available food in canteens during school hours. Therefore, a great responsibility rests with the school officials. They should provide safe food products that meet the nutritional requirements of these students, as well as state policies that should play an important role in promoting healthy eating within schools. (Moy *et al.*, 2006; Yabanci & Sanlier, 2007).

The studies that assess food safety knowledge are necessary to an integrated and effective program for food safety education, and also they are essential for responsible authorities to put food safety policies. To develop an integrated and effective educational program for a specific group in society is by identifying its unsafe eating habits and then addressing them by the focus on them in the educational program (Byrd-Bredbenner *et al.*, 2007b).

Although the studies assessing the level of awareness of food safety are limited in developing countries. However, these studies showed that food safety is a priority for individuals in these countries just as it is in developed countries (Grace, 2015). Confirming this, in Libya, there are no previous local studies on food safety knowledge and practices for secondary school students. Therefore, this study aimed to evaluate the secondary students' knowledge and practices of food safety, to explore the association between certain demographic characteristics of the students with their food safety knowledge and practices, and to determine the correlation between scores of knowledge and practices of the students.

Materials and Methods

Study Participants: A cross-sectional study was designed and implemented to measure food safety knowledge and practices among students at twelve public secondary schools in all six municipalities in Tripoli city, the State of Libya during the year 2018. Two schools from each municipality (Ain Zara, Abusleem, Tripoli Center, Hai Al-Andalus, Suk Alguma, and Tajura), one was a females' school and the other was for males' school. They were randomly selected. Approval of the director of the Secondary Education Administration was taken. Data was collected from 1874 students aged from 14 to >19 years. Those not willing to participate in the study were excluded. The researcher visited the schools and presented the questionnaire forms to students in the classroom who had an activities class and briefly explained to them the purpose of the survey and the questions were clarified in the presence of their teacher. The teacher's role was to encourage the students to fill out the questionnaire. The forms were collected after the students reported that they completed the filling questionnaires.

Questionnaire: The questionnaire questions were adapted from those used by Norazmir *et al.*, 2012, Almansour *et al.*, 2016, Stratev *et al.*, 2017. The questions were in the Arabic language. The questionnaire contained three parts. The first

part consisted of questions on certain demographic characteristics which included gender, age, municipality, and mothers' education level. The second part consisted of 23 questions on food safety knowledge. Finally, the third part consisted of 13 questions on food safety practices. In the knowledge part, answers were graded by giving 1 point for the correct answer and 0 points for the incorrect answer. Scores scale of this part range from 0 to 23. The range scores from 0 to 11 represent the poor level of knowledge of food safety while from 12 to 19 is the good level and scores from 20 to 23 represent the excellent level. In the part of the practices, answers were graded by giving 1, 2, 3, and 4 points for "rarely", "sometimes", "often", and "always", respectively. The scores scale of this part range from 13 to 52. Scores from 13 to 26 represent a low level of food safety practices and from 27 to 43 is a moderate level while scores from 44 to 52 consider a high level.

Validity and Reliability of the Questionnaire: Two professors in the field of food science and technology verified the validity and confidence of the questions of the questionnaire and almost all the proposed notes were involved.

Data Analysis: Data acquired through the survey were coded, entered into an excel table. The SPSS (Statistical Package for Social Sciences), version 22 was used for data analysis. Both descriptive and inferential statistical tools were employed to analyze the data. For summarizing demographic characteristics, knowledge, and practices of the respondents, descriptive statistics (mean, standard deviation, and frequencies) were used and the chi-square test (X^2) was applied to determine the relationship between the dependent and independent variables. Bivariate correlation coefficient analysis was used to determine the correlation between food safety knowledge scores and food safety practices scores. A p-value < 0.05 were considered statistically significant.

Results and Discussion

Demographic characteristics of the sample: The demographic characteristics of the students' sample are

listed in Table 1. Of the 1874 responding students 1034 (55.2%) were females and 840 (44.8%) were males. The majority of the respondents (71.5%) were between the age of 16 and 17 years. The percentage distribution of the students in the municipalities was varied. The highest percentage of respondents was from Abusleem (25.4%) and the lowest percentage was from Ain Zara (9.01%). Regarding the level of education of students' mothers, 40.0% received a university education, while only 3.0% of them received no education.

Table 1: Demographic characteristics of the students' sample (N=1874).

Characteristic	Numbers	Percentage of the sample (%)
Gender		
Male	840	44.8
Female	1034	55.2
Age group		
14-15	129	6.9
16-17	1340	71.5
18-19	380	20.3
>19	25	1.3
Municipality		
Ain Zara	169	9.01
Abusleem	476	25.4
Tripoli Center	340	18.14
Hai Al-Andulas	230	12.3
Suk Alguma	321	17.12
Tajura	338	18.03
Mothers' education level		
Uneducated	54	3.0
Basic education	264	14.1
Secondary education	631	33.6
University education	750	40.0
High education	175	9.3

Food Safety Knowledge of the students' sample:

Figure 1. illustrates the food safety knowledge levels of the secondary students. The majority of respondents (83.4%) have a good level of food safety knowledge with a score ranging between 12-19 followed by 13.9% of them have a poor level of food safety knowledge who scored between 0-11 while only 2.7% of them scored between 20-23 which is an excellent level of food safety knowledge. Similar results were obtained in Malaysia, where a high percentage of students (88.7%) have a good level and 11% of them have an excellent level while only 0.3% of them have a poor level (Norazmir *et al.*, 2012). Also, similar results were obtained in Nigeria, by Lamidi (2016), and Ilesanmi (2017) who found that 75.8% and 86.0% of students have a good level of food safety knowledge while 24.4% and 14.0% have a poor level of food safety knowledge, respectively.



Figure1: Food safety knowledge level among the students' sample (N=1874)

The mean of the food safety knowledge scores of the respondents was calculated to be 14.4 ± 2.71 which falls in the scores range of good (12-19). In Similar studies, the obtained means were lower than obtained in this study such as in a study conducted by Norazmir *et al.* (2012) who found that the mean of the food safety knowledge scores of Malaysian students was 12.12 ± 1.900 for males and 12.28 ± 1.925 for females out of the total score 21. Also, Almansour *et al.* (2016) found that the mean knowledge level of Saudi students was 5.9 out of the total score of 10 ($59.48 \pm 11.04\%$). As well, Lamidi (2016) found that the mean knowledge level of Nigerian students was $5.50 \pm$

1.482 out of the total score of 10. While in other similar studies the obtained means were higher than obtained in this study such as in a study carried out by Ilesanmi (2017) who found that the mean of the food safety knowledge scores of the Nigerian students was 6.44 ± 1.657 from the total score of 10. Also, in Pennsylvania, the mean of food safety knowledge scores among middle school students was 7.2 ± 1.6 of a maximum of 10 points (Haapala and Probart 2004).

Table 2 reports the results of respondents' knowledge of food safety. Eighty-four percent of them knew that food poisoning is caused by pathogenic microorganisms. In a similar study in Saudi Arabia, the percentage of students (69.1%) that knew the correct answer to the same question was lower (Almansour *et al.*, 2016). The majority of the respondents (91.4%) were aware that food poisoning can cause serious illnesses that end in the hospital and sometimes lead to death. A lower percentage of Saudi students gave correct answers to the same question (70.7%) in a study conducted by (Almansour *et al.*, 2016). Over 68% of respondents gave the right answer to a question that the numbers of pathogenic bacteria rapidly multiply at room temperature. The result was higher than that obtained in a similar study in Saudi Arabia where 56.3% of students were aware of the previous fact (Almansour *et al.*, 2016). Eighty-six percent of respondents realized that landing flies on the food makes it harmful. In a similar study, a lower percentage of Saudi students (59.3%) knew the correct answer to the previous question (Almansour *et al.*, 2016). The majority of the respondent (91.6%) were knowledgeable that after coughing or sneezing, they should always wash their hands. A similar result was obtained by Norazmir *et al.* (2012) who reported that 92.0% of Malaysian students were aware of the importance of handwashing after coughing or sneezing. Approximately, half of the respondents (50.8%) correctly answered that to determine the safety of milk, you should taste it first rather than look at its expiry date only. In similar studies, the percentage of Malaysian and Nigerian students who gave the correct answer to the previous question was higher than that obtained in this study which was 62.4% and 70.2%, respectively (Norazmir *et al.*, 2012, Lamidi, 2016). While

only 15.5% of students correctly answered the same question in another study in Nigeria (Ilesanmi, 2017). Swollen cans usually contain spoiled food (Landry *et al.*, 2001). Over eighty-six percent (86.8%) were aware that eating canned food from a swollen can is harmful to health and may lead to death. More than half of the sample (59.7%) knew that raw chicken, fish, and red meat are not placed in the same place in the refrigerator. The obtained result was in the line with finding obtained by Norazmir *et al.* (2012) who found that 52.1 % of Malaysian students gave correct answers to a similar question. While the result was contrary to that obtained by Lamidi (2016) and Ilesanmi (2017) who found that only 42.1% and 42.6% of Nigerian students gave correct answers to a similar question, respectively. A large percentage of the sample (78.0%) gave the correct answers on that hand washing under running water only will be enough to remove the bacteria before touching the food. A similar finding was obtained by Norazmir *et al.* (2012) who found that 78.2% of Malaysian students gave correct answers to a similar question. While this is in contrast to similar studies conducted by Lamidi (2016) and Ilesanmi (2017) which reported that a low percentage of Nigerian students knew the correct answer which was 48.9% and 45.4%, respectively. Also, a high percentage of the respondents (83.0%) aware that food poisoning from fruits and vegetables can be avoided by washing them under running water. This finding was comparable to a study conducted in Malaysia that reported that 82.2% of students' answers were correct (Norazmir *et al.*, 2012). Less than half of the

respondents (48.5%) knew that food poisoning can be avoided by cleaning the kitchen sink drain every week. In a similar study, a little higher percentage of Malaysian students (55.4%) gave correct answers to a similar question (Norazmir *et al.*, 2012). A very small percentage of respondents (31.5%) were knowledgeable that salmonella bacteria can cause food poisoning. In contrast, a higher percentage was obtained in a study conducted by Norazmir *et al.* (2012). They reported that 56.6% of Malaysian students gave correct answers to the previous question. The percentage of respondents who knew that foods that cause poisoning included leftover chicken eaten cold, food is exposed without cover, rice left overnight in the kitchen and chocolate cake left overnight in the kitchen were 23.0, 76.0, 65.0, and 46.7, respectively. In a similar study, Malaysian students gave correct answers to previous questions with different percentages of 55.4, 20.6, 33.3, and 41.6%, respectively (Norazmir *et al.*, 2012). Additionally, 26.0%, 39.2%, 73.0%, 60.5%, 70.0%, 46.0 %, and 49.0 % of the sample were knowledgeable about foods that increase the risk of food poisoning that included a slice of melon, half-boiled eggs, unpasteurized milk, raw seafood or undercooked seafood, undercooked chicken and red meat, dry food stored in the cabinet near the oven and canned vegetables consumed without pre-heating, respectively. Also in a similar study, Malaysian students answered correctly on previous questions with different percentages 4.5, 10.3, 74.7, 73.4, 77.4, 45.1, and 73.9, respectively (Norazmir *et al.*, 2012).

Table 2: Food safety knowledge among students' sample (N =1874).

Question	Correct Answer N(%)			Incorrect Answer N(%)			No response N(%)
	Females	Males	Total	Females	males	Total	
Food poisoning is caused by pathogenic microorganisms.	880 (47.0)	695 (37.0)	1575 (84.0)	133 (7.1)	125 (6.7)	258 (13.8)	41 (2.2)
Food poisoning can cause serious illnesses that end in the hospital and sometimes	939 (50.1)	774 (41.3)	1713 (91.4)	82 (4.4)	61 (3.2)	143 (7.6)	18 (1.0)

lead to death.							
The numbers of pathogenic bacteria rapidly multiply at room temperature.	714 (38.1)	573 (30.6)	1287 (68.7)	292 (15.6)	248 (13.2)	540 (28.8)	47 (2.5)
Landing flies on the food makes it harmful.	919 (49.0)	696 (37.0)	1615 (86.0)	109 (6.0)	139 (7.0)	248 (13.0)	11 (1.0)
After coughing or sneezing, you should always wash your hands.	964 (51.4)	753 (40.2)	1717 (91.6)	63 (3.40)	79 (4.20)	142 (7.60)	15 (0.80)
To determine the safety of milk, you should taste it first rather than look at its expiry date only.	521 (27.8)	431 (23.0)	952 (50.8)	496 (26.5)	398 (21.2)	894 (47.7)	28 (1.5)
Eating canned food from a swollen can is harmful to health and may lead to death.	926 (49.4)	701 (37.4)	1627 (86.8)	93 (5.0)	126 (6.7)	219 (11.7)	28 (1.5)
Raw chicken, fish, and red meat are not placed in the same place in the refrigerator.	630 (33.6)	488 (26.0)	1118 (59.7)	388 (20.7)	339 (18.1)	727 (38.8)	29 (1.5)
Hand washing under running water only will be enough to remove the bacteria before touching the food.	881 (47.0)	585 (31.0)	1466 (78.0)	147 (8.0)	249 (13.0)	396 (21.0)	12 (1.0)
Food poisoning from fruits and vegetables can be avoided by washing them under running water.	830 (44.3)	726 (38.7)	1556 (83.0)	195 (10.4)	107 (5.70)	302 (16.1)	16 (0.9)
Food poisoning can be avoided by cleaning the kitchen sink drain every week.	462 (24.7)	446 (23.8)	908 (48.5)	549 (29.3)	372 (19.9)	921 (49.1)	45 (2.4)
Salmonella bacteria can cause food poisoning.	289 (15.4)	302 (16.1)	591 (31.5)	711 (37.9)	461 (24.6)	1172 (62.5)	111 (6.0)
Do the following foods cause poisoning?							
Leftover chicken has been eaten cold.	224 (12.0)	215 (11.0)	439 (23.0)	799 (43.0)	611 (33.0)	1410 (76.0)	25 (1.0)
Food is exposed without cover.	794 (42.0)	636 (34.0)	1430 (76.0)	232 (12.4)	198 (10.6)	430 (23.0)	14 (1.0)
Rice was left overnight in the	704	514	1218	313	310	623	33

kitchen.	(37.6)	(27.4)	(65.0)	(16.7)	(16.5)	(33.0)	(2.0)
The chocolate cake was left overnight in the kitchen.	436 (23.3)	440 (23.4)	876 (46.7)	579 (30.9)	376 (20.1)	955 (51.0)	43 (2.3)
Do the following foods increase the risk of food poisoning?							
A slice of melon.	278 (15.0)	201 (11.0)	479 (26.0)	733 (39.0)	619 (33.0)	1352 (72.0)	43 (2.0)
Half-boiled eggs.	423 (22.6)	312 (16.6)	735 (39.2)	595 (31.8)	512 (27.3)	1107 (59.1)	32 (1.7)
Unpasteurized milk.	797 (42.5)	572 (30.5)	1369 (73.0)	218 (11.6)	253 (13.5)	471 (25.0)	34 (2.0)
Raw seafood or undercooked seafood.	642 (34.3)	492 (26.2)	1134 (60.5)	379 (20.2)	330 (17.6)	709 (37.8)	31 (1.7)
Undercooked chicken and red meat.	723 (38.5)	591 (31.5)	1314 (70.0)	291 (15.5)	235 (12.5)	526 (28.0)	34 (2.0)
Dry food is stored in the cabinet near the oven.	462 (24.7)	403 (21.5)	865 (46.0)	551 (29.4)	415 (22.1)	966 (52.0)	43 (2.0)
Canned vegetables consumed without pre-heating.	464 (24.8)	445 (23.7)	909 (49.0)	544 (29.0)	381 (20.0)	925 (49.0)	40 (2.0)

N = number of total respondents

Association between demographic characteristics of sample and food safety knowledge level of the students: Table 3 presents the association between certain demographic characteristics of the respondents and the food safety knowledge level. Using the Chi-square test (X^2), a significant association was found only between the students' municipality and food safety knowledge scores ($p < 0.05$). While no significant association was found between other characteristics considered in this study and food safety knowledge scores ($p > 0.05$). This finding was comparable to a study conducted by Ilesanmi (2017) that

reported no significant association was found between food safety knowledge scores and age ($p = 0.319$), gender ($p = 0.789$), and mothers' educational level of the Nigerian students ($p = 0.836$). Also, Stratev et al. (2017) in Bulgaria reported that age ($p > 0.05$) and gender ($p > 0.05$) had no effect on knowledge of food safety among students of the Veterinary College. As well, Dehghan et al. (2017) found no effect of gender on knowledge of health and food safety of students of Tabriz University of Medical Sciences in Iran ($p = 0.520$).

Table 3: The association between demographic characteristics of the students' sample and food safety knowledge level (N =1874).

Variable	Total knowledge scores			P-value
	Poor 0-11	Good 12-19	Excellent 20-23	
Gender				0.0996
Female	140	873	21	
Male	121	689	30	

Age				
14-15	18	106	5	0.5815
16-17	189	1119	32	
18-19	52	316	12	
≥19	2	21	2	
Municipality				
Ain Zara	27	140	2	0.0000
Abusleem	46	410	20	
Tripoli Center	44	290	6	
Hai Al-Andalus	29	186	15	
Suk Alguma	65	251	5	
Tajura	50	285	3	
Mothers' education level				
Uneducated	5	47	2	0.4253
Basic education	38	220	6	
Secondary education	98	513	20	
University education	100	635	15	
High education	20	147	8	

Food Safety Practices of the students' sample: Figure 2. shows the food safety practices levels of secondary students. The majority of respondents (87.5 %) have a moderate level of food safety practices with scores between 27-43 followed by 9.8% of them have a high level of food safety practices who scored between 44-52 while only 2.7% of them have a low level of food safety practices with scores between 13-26. This result was contrary to that obtained in a similar study conducted by Norazmir *et al.* (2012) in Malaysia who found that a high percentage of students (71.9%) have a high level and 28.1% of them have a moderate level of food safety practices. While, in Nigeria, 65.8%, and 97.7% of students have a high level while 34.2% and 2.3% have a poor level of food safety practices in two studies conducted by Lamidi (2016), and Ilesanmi (2017), respectively. The mean of the food safety practices scores of the respondents was calculated to be 37.29 ± 3.54 of the total score 52 which falls in the scores range of the moderate (27-43). The obtained result was in the line with finding obtained by Norazmir *et al.* (2012) who found the mean of the food safety practices scores of Malaysian

students was 31.15 ± 3.316 from the total score of 40. Also, in another study, Ilesanmi (2017) found the mean of the food safety practices score of the Nigerian students was similar to that obtained in this study which was 30.10 ± 5.159 from the total score of 40. In contrast, a lower mean of practices level of Saudi students was obtained by Almansour *et al.* (2016) which was $62.5 \pm 10.79\%$ out of the total 64. Also, this finding was in contrast to a study conducted by, Lamidi (2016) who reported that the mean of practices level of the Nigerian students was 21.41 ± 9.295 from the total score of 40.

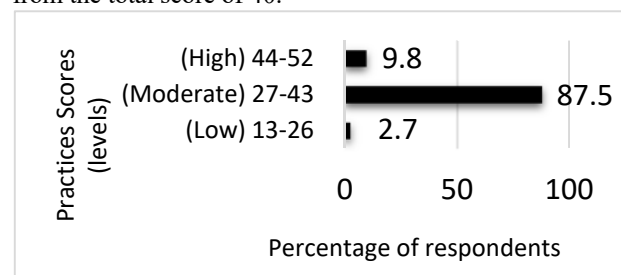


Figure 2. Food safety practices level among the students' sample (N=1874)

Table 4 reveals the results of the food safety practices of the students' sample. More than half of respondents (57.5%) reported that they “always” ensure buying clean and fresh food. In a similar study, a higher percentage of females and males of the Malaysian students' (71.6% and 66.3%) “always” ensure purchasing food that is clean and in fresh condition (Norazmir *et al.*, 2012). Also, a higher percentage of Nigerian students, 80% and 73.6% reported that they “always” ensure purchasing food that is clean and in the fresh condition in two studies conducted by Lamidi (2016) and Ilesanmi (2017), respectively. The majority of respondents (90.0%) indicated that they “always” wash their hands with water and soap after using the bath (urinating or defecating). Similarly, a high percentage of Saudi students (88.3%) answered correctly the question “do you wash your hand with water and soap after using the bathroom (urination)?”. Also, 90.8% of them correctly answered the same question but after defecation (Almansour *et al.*, 2016). Less than half of respondents (41.0%) mentioned that they “always” do not prolong their fingernails. Also, the percentage of Saudi students who answered correctly on the question “do you allow your fingernails to grow?” was not high (54.4%) (Almansour *et al.*, 2016). More than 61.0% of respondents indicated that they “always” wash their hands before food preparation and eating at home. In contrast, higher percentages were obtained in other studies, such as in a study conducted by Norazmir *et al.* (2012) who found 80.7% and 64.4% of females and males of the Malaysian students, respectively, “always” wash their hands before preparing and eating food at the home. Also, two studies conducted by Lamidi (2016) and Ilesanmi (2017), reported that 70.1% and 64.5% of Nigerian students, respectively, “always” do the previous practice. Only 7.8 % of respondents mentioned that they “always” wash their hands before eating breakfast in school. In contrast, Norazmir *et al.* (2012) reported that 65.0% and 67.3 % of females and males of Malaysian students “always” wash their hands before eating food in the school canteen/restaurant. Also, Lamidi (2016) and Ilesanmi (2017) found that 42.5% and 28.7% of Nigerian students indicated that they “always” do the previous

practice. It is worthy to mention that in eleven schools involved in this study there were no suitable facilities for students to wash their hands because of the absence of conservation works in recent years. In contrast, UNICEF (2017) reported that 95% of Libyan schools have handwashing facilities and only 5% of the schools had handwashing facilities in disrepair. More than 39.0 % of respondents mentioned that they “always” check the expiry date on food packages before buying. In similar studies, higher percentages were obtained such as in Malaysia where 58.9% of females and 56.4% of males of students “always” check the expiry date on the food packages before purchase (Norazmir *et al.*, 2012). Also in Nigeria, two studies conducted by Lamidi (2016) and Ilesanmi (2017) found that 50.0% and 44.2% of students “always” do the previous practice, respectively.

Raw eggs are one of the most common reasons for foodborne salmonellosis outbreaks (Howard *et al.*, 2012). There are concerns about washing eggs because the cuticle layer of the egg may damage during or after the washing process that covering pores and preventing microbes from entering the inside the egg (Leleu *et al.*, 2011). As most of the eggs on the Libyan market are dirty and unwashed. It is natural for the consumer to expect that washing eggs are important for the safety of eggs and the prevention of diseases caused by it, especially if the eggs were obtained from the market or directly from farms and were not clean (Koppel *et al.*, 2014). More than 50% of respondents indicated that they “always” wash fresh eggs just before cooking them. Also, a low percentage of them (30.1%) reported that they “always” do not eat raw eggs without cooking and foods made from raw eggs. The results were in line with findings from other similar studies like in Malaysia only 25.4% and 15.3% of female and male students indicated they “always” do not eat raw eggs without cooking and foods made from raw eggs (Norazmir *et al.*, 2012). Also, in two studies conducted in Nigeria by Lamidi (2016), and Ilesanmi (2017) 42.6% and 43.7% of students reported that they do “always” previous practice, respectively. More than 65.0 % of respondents indicated that they “always” put the perishable food in the

refrigerator as soon as they buy them. In contrast, Similar studies showed a lower percentage of students “always” do the previous practice as in Malaysia which was 51.8% and 38.6% of females and males, respectively (Norazmir *et al.* (2012). Also in Nigeria, it was reported that 58.7% and 57.6% of students in two studies carried out by Lamidi (2016) and Ilesanmi (2017) “always” do the previous practice, respectively. A low percentage of respondents (27.0%) reported that they do not taste foods to know if they are safe or not. The results were contrary to findings from other similar studies like in Malaysia, which indicated that 27.9% of females and 28.2% of male students reported that they “always” taste food to see if it is safe or not (Norazmir *et al.* 2012). Similarly, Lamidi (2016) and Ilesanmi (2017) found that 28.1% and 21.1% reported that they “always” taste food to see if it is safe or not, respectively. Low than half of the sample (32.6%) reported that they “always” dry their hands after washing them with a paper towel or tissue. Similar results were found by Norazmir *et al.* (2012), Lamidi (2016), and Ilesanmi (2017) they reported that 31.0% of females and 37.1% of males, 43.2% and 31.5% of students indicated they “always” dry

their hands with a paper towel or tissue after washing it, respectively. Sixty-three of respondents indicated that they “always” eat well-done meat and they do not eat rare meat. Higher percentages were found by similar studies like in Malaysia, 75.1% of females and 68.8% males of students reported that they “always” eat meat after well cooked, they do not consume rare meat (Norazmir *et al.*, 2012). Also, in Nigeria, 84.1% and 86.0% of students reported they “always” do the previous practice in two studies conducted by Lamidi (2016) and Ilesanmi (2017), respectively. As well, in Arabia Saudi, 78.6% of students answered correctly a similar question was do you eat half-cooked meat (inside is pink)? (Almansour *et al.*, 2016). A low percentage of respondents (23.0%) reported that they “always” prefer to reheat leftovers by using a microwave oven. Similar results were found by Norazmir *et al.* (2012) who reported that 27.4% of females and 28.7% of males of students indicated they “always” for leftovers, prefer to reheat it by using a microwave oven. Also, Lamidi (2016) and Ilesanmi (2017) found similar results, they reported that 35.5% and 34.3% of students “always” do the previous practice.

Table 4. Food safety practices among students' sample (N =1874)

Practices	Rarely N (%)		Sometimes N (%)		Often N (%)		Always N (%)		No response N (%)
	Females	Males	Females	Males	Females	Males	Females	Males	
I always ensure buying clean and fresh food.	34 (2.0)	21 (1.0)	168 (9.0)	122 (6.5)	242 (13.0)	193 (10.0)	583 (31.1)	494 (26.4)	17 (1.0)
Total	55 (3.0)		290 (15.5)		435 (23.0)		1077 (57.5)		
I wash my hands with water and soap after using the bath (urinating or defecating).	10 (0.5)	10 (0.5)	27 (1.4)	21 (1.1)	54 (2.9)	45 (2.4)	934 (49.8)	754 (40.2)	19 (1.0)
Total	20 (1.0)		48 (3.0)		99 (5.0)		1688 (90.0)		
I do not prolong my nails.	110 (6.0)	79 (4.0)	214 (11.4)	81 (4.3)	411 (22.0)	200 (10.6)	290 (15.5)	475 (25.0)	14 (0.7)
Total	189 (10.0)		295 (15.7)		611 (32.6)		765 (41.0)		
I wash my hands before food preparation and eating at home.	42 (2.0)	53 (3.0)	117 (6.0)	143 (7.6)	160 (8.5)	183 (9.8)	703 (37.5)	446 (23.8)	27 (1.4)
Total	95 (5.0)		260 (14.0)		343 (18.3)		1149 (61.3)		

I wash my hands before eating in school.	709 (37.8)	444 (23.7)	170 (9.1)	158 (8.4)	95 (5.0)	121 (6.5)	50 (2.7)	96 (4.8)	31 (1.7)
Total	1153 (61.5)		328 (17.5)		216 (11.5)		146 (7.8)		
I check the expiry date on food packages before buying.	101 (5.4)	139 (7.4)	229 (12.22)	265 (14.14)	202 (10.8)	173 (9.2)	484 (25.8)	255 (13.6)	26 (1.4)
Total	240 (12.8)		494 (26.4)		375 (20.0)		739 (39.4)		
I wash fresh eggs just before cooking them.	127 (6.8)	219 (11.7)	137 (7.3)	100 (5.3)	116 (6.2)	109 (5.8)	637 (34.0)	402 (21.5)	27 (1.0)
Total	346 (19.0)		237 (13.0)		225 (12.0)		1039 (55.0)		
I do not eat raw eggs without cooking and foods made from raw eggs.	225 (12.0)	252 (13.4)	364 (19.4)	261 (13.9)	79 (4.2)	106 (5.7)	353 (18.8)	211 (11.3)	23 (1.2)
Total	477 (25.45)		625 (33.35)		185 (9.9)		564 (30.1)		
I put the perishable food in the refrigerator as soon as I buy them.	95 (5.1)	101 (5.4)	104 (5.5)	80 (4.3)	115 (6.1)	131 (7.0)	708 (37.8)	512 (27.3)	28 (1.5)
Total	196 (10.5)		184 (9.8)		246 (13.1)		1220 (65.1)		
I do not taste foods to know if they are safe or not.	303 (16.0)	222 (12.0)	183 (10.0)	192 (10.0)	244 (13.0)	214 (11.0)	301 (16.0)	205 (11.0)	10 (1.0)
Total	525 (28.0)		375 (20.0)		458 (24.0)		506 (27.0)		
I dry my hands after washing them with a paper towel or tissue.	283 (15.1)	209 (11.2)	280 (15.0)	177 (9.4)	183 (9.8)	121 (6.4)	284 (15.2)	327 (17.4)	10 (0.5)
Total	492 (26.3)		457 (24.4)		304 (16.2)		611 (32.6)		
I eat well-done meat and I do not eat rare meat.	66 (4.0)	77 (4.0)	122 (7.0)	169 (9.0)	81 (4.0)	132 (7.0)	734 (39.0)	455 (24.0)	13 (1.0) 25 (1.0)*
Total	143 (8.0)		291 (16.0)		213 (11.0)		1189 (63.0)		
I prefer to reheat leftovers by using a microwave oven.	386 (20.6)	247 (13.2)	252 (13.4)	216 (11.5)	160 (8.5)	162 (8.6)	228 (12.2)	206 (11.0)	17 (1.0)
Total	633 (34.0)		468 (25.0)		322 (17.0)		434 (23.0)		

*They do not eat meat.

Association between demographic characteristics of sample and food safety practices level of the students:

The association between secondary students' sample demographic characteristics and the level of food safety practices is shown in table 5. Using an X^2 chi-square test, there was a significant association ($P < 0.05$) between the students' municipality and the mothers' education level and food safety practices scores while the association was insignificant ($P > 0.05$) between other characteristics considered in this study and the practices' scores. Similarly, age and gender did not affect food safety practices among

veterinary medicine students in Bulgaria (Stratev *et al.*, 2017). While this result is in contrast to a study conducted by Lamidi (2016) in Nigeria that found an insignificant association between mothers' educational level of the students and food safety practices scores and a significant association between age and gender and practices' scores. Also, in contrast to this study, Mohd Yusof *et al.* (2018) found a significant association between practices' scores and age among dietetic students in Malaysia.

Table 5: The association between demographic characteristics of students' sample and food safety practices level (N= 1874).

Variable	Total practices scores			P-value
	Low	Moderate	High	
Gender				
Female	20	918	96	0.0611
Male	30	723	87	
Age				
14-15	2	111	16	0.3884
16-17	34	1181	125	
18-19	12	327	41	
>19	2	22	1	
Municipality				
Ain Zara	1	141	27	0.0091
Abusleem	21	417	38	
Tripoli Center	9	302	29	
Hai Al-Andulas	6	196	28	
Suk Alguma	3	285	33	
Tajura	10	300	28	
Mothers' education level				
Uneducated	4	45	5	0.0012
Basic education	8	234	22	
Secondary education	21	555	55	
University education	9	669	72	
High education	8	138	29	

Correlation between safety food knowledge scores and food safety practice scores of the Secondary Students:

The correlation between scores of food safety knowledge and practices was determined. Although, Individuals with more knowledge about food hygiene used better food handling practices (Grayoa *et al*, 2005). However, the results of this study indicate an insignificantly small, positive linear relationship between the two variables ($r=$

0.096, $p > 0.05$). This result is in contrast to the result found by Ilesanmi (2017) which showed a significant small positive correlation between food safety knowledge and practices ($r= 0.134$, $p < 0.05$).

Conclusion

Overall, the findings of this study show the level of knowledge and practices was relatively good and moderate for the majority of secondary students, respectively. Also,

the findings of this study show there was a significant association between food safety knowledge scores and students' municipality. Moreover, a significant association was found between the students' municipality and mothers' education of the secondary students and food safety practices scores ($p < 0.05$). Interestingly, the outcome of the study shows that a very small percentage of students said that they always wash their hands before eating breakfast at school. Lastly, there was no significant correlation between food safety knowledge scores and food safety practices scores of the students.

Based on the results of this study, it seems that students of secondary schools need an effective program of competent authorities to address weaknesses in their knowledge and practices related to food safety. The program can include training courses by specialists in the food safety field or by inserting educational lessons on food safety into the studying plan. Also, soon, it can utilize brochures and educational posters that explain how to prevent foodborne diseases. Moreover, the authorities should pay attention to providing appropriate facilities that enable students to wash their hands at school.

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الوعي بسلامة الغذاء بين 1874 طالب ثانوي في مدينة طرابلس، ليبيا

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ملخص

ما يميز طلاب المرحلة الثانوية أنهم في مرحلة المراهقة، وهذه الفئة العمرية معروفة بميلها إلى عدم الالتزام والخروج عن المألوف. وبالتالي، فهم أكثر عرضة للأمراض المنقولة بالغذاء. هدفت هذه الدراسة إلى تقييم المعرفة والممارسات المتعلقة بسلامة الغذاء بين طلاب المرحلة الثانوية في اثنتي عشرة مدرسة ثانوية حكومية في جميع البلديات الست في مدينة طرابلس، ليبيا. تم إجراء مسح مقطعي على 1874 طالباً، 55.2% من المستجيبين كانوا إناث و 44.8% ذكور. غالبية المستجيبين للدراسة (71.5%) تراوحت أعمارهم بين 16 و 17 سنة. تم تحليل البيانات بواسطة البرنامج الإحصائي *SPSS*. كشفت النتائج أن 83.4% و 87.5% من الطلاب لديهم معرفة جيدة ومستوى معتدل من ممارسات سلامة الغذاء، على التوالي. وكشفت النتائج أيضاً أن 7.8% فقط من الطلاب أفادوا بأنهم "دائماً" يغسلون أيديهم قبل تناول وجبة الإفطار في المدرسة. لوحظ أن هناك ارتباط معنوي بين درجات المعرفة بسلامة الغذاء وبلدية الطلاب ($P < 0.05$) وكذلك ارتباط معنوي بين درجات ممارسات سلامة الغذاء وبلدية الطلاب ومستوى تعليم أمهات الطلبة ($P < 0.05$). في الختام، وجد ضعف في بعض نقاط المعرفة وممارسات سلامة الأغذية الهامة. فإنه من الضروري وجود برنامج تعليمي فعال ومستمر لهؤلاء المراهقين. كما يجب على السلطات توفير المرافق المناسبة في المدارس التي تمكن الطلاب من غسل أيديهم.

الكلمات الدالة: سلامة الغذاء، معرفة، ممارسات، ثانوي، طلاب، ليبيا