

## Food Safety Knowledge, Attitude and Self-Reported Practices among Medical Students at Ain Shams University, Egypt

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### Abstract

**Background:** Foodborne diseases are a growing public health problem. The study of food safety knowledge and practice among university students is crucial as they are usually involved in food preparation for themselves and they are also the future food handlers for other household members. **Objective:** To estimate the knowledge, attitude and self-reported practice of food safety among medical students and to identify the relation of food safety knowledge on attitude and practice. **Method:** A cross sectional study was conducted at the Faculty of Medicine, Ain Shams University using a validated, anonymous self-administrated questionnaire that included several sections; sociodemographic data, food safety knowledge, attitude and questions related to food safety practice. **Results:** The questionnaire was completed by 244 medical students from the six faculty grades, 47% were males and 52.9% females, mean age in years  $\pm$  SD was  $21.9 \pm 1.7$ . An insufficient level of food safety knowledge was found among students. Correct answers for the six food safety knowledge questions were selected by less than 50% of studied students. By gender, females had significantly higher food safety knowledge, attitude and practice mean scores ( $t = -3.01$   $p = 0.003$ -  $t = -2.5$   $p = 0.013$  -  $t = -3.03$   $p = 0.003$ ) respectively. Knowledge score correlation with attitude and practice scores showed no statistical significance ( $r = 0.04$   $p = 0.45$  and  $r = 0.11$   $p = 0.07$ ) respectively. Students with more positive food safety attitude reported safer food practices ( $r = 0.28$   $p < 0.001$ ). **Conclusion:** The insufficient level of food safety knowledge in this study highlighted the need to develop continued education on food safety targeting university students.

**Keywords:** Food safety, Food borne illness, university students

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### Introduction

Globally food borne diseases are a growing public health problem with high toll on morbidity and mortality.<sup>1</sup> Annually, millions of people suffer from food-borne diseases and illnesses resulting from the consumption of contaminated food.<sup>2</sup> This leads to loss of productivity, diminished quality of life as well as imposing high economic burden.<sup>3</sup> Food safety is defined as the degree of confidence that food will not cause harm to anyone who consumes

it. This occurs through handling, preparing and storing food in a way to optimally reduce the risk of individuals becoming sick from foodborne illnesses.<sup>3</sup> Although it is problematic to accurately estimate the incidence of food-borne diseases worldwide, It has been estimated that around 2 million people die each year from diarrheal diseases, mainly due to contaminated food and water.<sup>4</sup> Food borne outbreaks are mainly due to many factors

as food storage (time and temperature), contaminated equipment, lack of personal hygiene, unsafe food and water sources and improper cooking.<sup>5</sup> According to Lee et al, 2017, more than 50% of the total food poisoning cases were attributed to improper food handling. Recent studies have shown that around 50 to 87% of foodborne outbreaks occur due to wrong home practices.<sup>6</sup> In US improper domestic food handling was responsible for 9 to 15% of cases between 1998 and 2008.<sup>7-8</sup> Food safety at home might affect not only the home occupants but may extend to a wider community. Currently in many countries, home kitchen may also be used for small home-based business that prepare and cater food for the community outside of the home. An important issue is that these catering activities are usually unregulated, not under supervision of any authority for kitchens and people involved may not have been trained in food safety.<sup>9</sup> Food safety knowledge increases with age and practice. Females have higher scores than males.<sup>10</sup> In a study assessing the level of food safety knowledge among Jordanian female students staying in dorms, around one third of the participants (33.9%) answered correctly more than 50% of the questionnaire.<sup>11</sup>

It is crucial to study food safety knowledge and practice among university students as they are usually involved in food preparation for themselves. In addition, they are the future food handlers for household members as children, pregnant women and elderly. Research on food safety understanding and practice in Egypt is scarce. Understanding food safety knowledge, attitude and practice is a critical step to develop a well-tailored education program. This study aims to identify the knowledge, attitude and self-reported practice of food safety among medical students at Ain Shams University

in Cairo, as well as to identify the relation of knowledge of food safety on attitude and practice among the studied medical students.

## Method

*Study design:* A cross sectional study was carried out. The study was conducted from April 2017 until June 2017. The sample consisted of 195 undergraduate students enrolled from different grades of Faculty of Medicine at Ain Shams University located in Cairo, Egypt.

A sample of 195 medical students was estimated at 95% CI, using Epi-Info 7 taking a prevalence of knowledge among youth was 53%<sup>11</sup> with standard deviation of 7%. The questionnaire was distributed to 300 students, the completion was anonymous and voluntary. Out of this number 244 were completed and included in the analysis (response rate 81.3%).

*Study tool:* Data was collected using a validated, anonymous self-administrated questionnaire. The used questionnaire was adapted from Majowicz et al.2016.<sup>12</sup> The questionnaire included several sections: The first part included demographic data as age, gender, grade, residence and self-preparation of meals. The second part consisted of six questions on food safety knowledge. The answers were graded by assigning one point for the correct answer and 0 point for the wrong answer. The total score of food safety knowledge for each student was calculated by summation of the correct answers. Higher scores denote higher knowledge. The third part included four questions on attitude towards food safety using a 5-Likert-scale format. The answers ranged from zero for strongly disagree to (4) for strongly agree. The fourth part included four questions related to food safety practice during food preparation. The practice questions were assigned the following scores: 'never', 1

point, 'rarely', 2 points, 'sometimes', 3 points, 'usually', 4 points and 'always', 5 points. The questionnaire was peer reviewed and a pilot study was carried out on 10 students for wording clarity, understandability and time needed to fill it. The results of the pilot study were not included in the final analysis.

#### Data Analysis

Statistical analysis was performed using IBM SPSS version 22 (Statistical Package for Social Sciences) with a p value less than 0.05 being considered statistically significant. Quantitative data, such as age, were presented as means and standard deviations. The independent t-test was used to compare two groups. Qualitative data were presented as counts and percentages. The Chi square test was used to verify association between different categorical variables.

#### Ethical consideration

The protocol of the study was submitted to the Ethical Review Committee at the Faculty of Medicine, Ain Sham University prior to the study. It was an exempted research as an anonymous questionnaire was used. A verbal informed consent was obtained from each participant after the explanation of the study and assuring that participation is voluntary. The confidentiality of data was also assured.

#### Results

A total of 244 medical students completed the questionnaire, about 47% males and 52.9% females, mean age in years  $\pm$  SD (21.9 $\pm$  1.7). All 6 grades were presented in the study sample. Out of the studied sample about 54% were staying with their family and the majority (95.9%) said that they didn't work during academic year. (Table 1). Nearly one third (31%). of the study participants cooked food or meals from basic ingredients a few times a week.

There was a statistically significant difference between males and females ( $\chi^2 = 14.7$  Table 1. Characteristics of studied medical students

Variable	Frequency (N=244)	Percent
<b>Age in years</b>		
Mean $\pm$ SD		21.9 $\pm$ 1.7
<b>Gender</b>		
Male	115	47.1
Female	129	52.9
<b>Grade</b>		
1.0	24	9.8
2.0	21	8.6
3.0	31	12.7
4.0	97	39.8
5.0	31	12.7
6.0	40	16.4
<b>Working</b>		
No	234	95.9
Yes	10	4.1
<b>Residency</b>		
Living with family	132	54.1
Living away from family	112	45.9
<b>How often do you cook food or meals from basic ingredients?</b>		
At least once a day	52	21.3
A few times a week	76	31.1
A few times a month	56	23.0
A few times a year	30	12.3
Never	30	12.3

$p=0.005$ ), 30% of female students compared to 11% of males cooked at least once per day. Also, there was a statistically significant difference between those who lived with family and those who lived in the hostel (18.9% compared to 27.7% respectively)  $\chi^2= 10.2$   $p=0.03$ . (Data not shown). Concerning the knowledge about food safety 49.6% of the study participants correctly selected that the most important way to prevent food poisoning was "keep foods refrigerated

until it's time to cook or serve them". On that "leftovers should be the other hand, 29.9% correctly selected

**Table 2. Frequency of food safety correct knowledge among the studied medical students**

Knowledge	Frequency	Percent
<b>Which of the following is considered the most important way to prevent food poisoning?</b>		
Keep foods refrigerated until it's time to cook or serve them	121	49.6
<b>How long should leftovers be stored in the refrigerator?</b>		
3 to 4 days	73	29.9
<b>The best way to keep from getting food poisoning from fresh fruits and vegetables is to Wash them with</b>		
Cool running water	96	39.3
<b>Which is the most hygienic way to wash your hands</b>		
Apply sanitizer, run water, rub hands together for 20 sec., rinse hands, dry hands, rub on an antiseptic hand lotion	79	32.4
<b>If you have a sore on the back of your hand, should you prepare food for other people</b>		
Yes, if you bandage the sore and wear a glove	86	35.2
<b>Which should not be done when storing raw meat, fish, or poultry in the refrigerator</b>		
put it in the coldest place in the refrigerator	82	33.6
Scale passing (%)	50	
Knowledge score	2.2 ± 1.3	

**Table 3. Food safety attitude questions among the studied medical students**

Attitude	Disagree N (%)	Neutral N (%)	Agree N (%)
<b>I like learning about how to keep my foods safe to eat</b>	0.0 (0.0)	11 (4.5)	233 (95.5)
<b>I am concerned about getting food poisoning</b>	11 (4.5)	61 (25.0)	172 (70.5)
<b>Confident about cooking safe and healthy meals</b>	18 (7.4)	52 (21.3)	174 (71.3)
<b>Being able to cook safe, healthy meals is an important life skill</b>	12 (4.9)	19 (7.8)	213 (87.3)

stored in the refrigerator 3 to 4 days". Only 39.3% reported that "the best way to prevent food poisoning from fresh fruits and vegetables was to wash them with cool running water". Nearly one third (32.4%) selected that "the most hygienic way to wash hands is to apply sanitizer, run water, rub hands together for 20 sec., rinse hands, dry hands, rub on an antiseptic hand lotion". Concerning knowledge about what should be done if they have a sore on their hand 35% reported that they "should bandage the sore and wear a glove" females had better knowledge and the difference was statistically significant

(27.8% among males compared to 41.9% among females)  $\chi^2 = 10.3$   $p=0.036$ ). One third (33.6%) of the study participants reported correctly that "when storing raw meat, fish, or poultry it should not be put in the coldest place in the refrigerator". Passing percentage for the six knowledge questions was 50%, knowledge score (range 0-6) mean ± SD were 2.2 ± 1.3 (Table 2). Concerning attitude towards food safety the majority (95.5%) of studied students agreed that "they like learning about how to keep foods safe to eat". While 70.5% agreed that "they were concerned about getting food poisoning"

and 71.3% agreed that “they were confident to cook safe, healthy meals for self and family”, 7.4% disagreed. Most of the study participants (87.3%) agreed that

“being able to cook safe, healthy meals is an important life skill” (Table 3). Studied students

**Table 4. Descriptive table of food safety self-reported practice questions among the studied medical students**

Practice	Never/ Rarely N (%)	Sometimes N (%)	Usually/ Always N (%)
<b>I plan, or help plan, the meals in my household</b>	44 (18.0)	56 (23.0)	144 (59.0)
<b>Before preparing or handling food, I wash my hands with soap and warm running water</b>	5 (2.0)	38 (15.6)	201 (82.4)
<b>I wash my hands with soap and warm running water after working with raw meat or chicken.</b>	6 (2.5)	23 (9.4)	215 (88.1)
<b>I keep raw meat and chicken away from ready-to-eat foods like raw vegetables</b>	8 (3.3)	43 (17.6)	193 (79.1)

**Table 5. relation between knowledge, attitude, practice scores with gender**

Gender	N	Mean Knowledge score $\pm$ S.D.	Sig.
Male	115	1.9 $\pm$ 1.2	t=-3.01
Female	129	2.4 $\pm$ 1.3	p= 0.003
Mean attitude score $\pm$ SD			
Male	115	6.9 $\pm$ 1.1	t=-2.5
Female	129	7.2 $\pm$ 1	p= 0.01
Mean practice score $\pm$ SD			
Male	115	6.6 $\pm$ 1.3	t=-3.03
Female	129	7.1 $\pm$ 1.1	p= 0.003

reported “involvement in planning or helping to plan the meals in their households”, 59.0% usually/always and 18.0% rarely or never involved. Most of the students 82.4% reported that they usually / always “before preparing or handling food, wash hands with soap and warm running water” while 17.6% selected sometimes/never. Similarly, 88.1% of respondents reported that “they wash hands with soap and warm running water after working with raw meat or chicken” while 2.5% selected sometimes/never for

the same situation. The majority of respondents (79.1%) reported that they usually / always “keep raw meat and chicken away from ready-to-eat foods like raw vegetables”, 17.6% and 3.3% selected sometimes and rarely/ never respectively (Table 4). By gender females had higher knowledge, attitude and practice mean scores as regards the food safety and the difference was statistically significant (t= -3.01 p=0.003- t= -2.5 p=0.013 - t= -3.03p=0.003 respectively) (Table 5). Concerning the association between passing score ( $\geq 50\%$ ) of food safety knowledge questions and different characteristics of studied medical students, more females (56.6%) had passing knowledge score compared to males (43.4%) with a marginally significant association (p=0.05). Faculty grade was significantly associated (p=0.023) with food safety passing score; 55.0% of 6<sup>th</sup> year students passed the safety knowledge score compared to only 37.5% of first year students. On the other hand, age and living with or away from family showed no significant association (Table 6)

**Table 6. Relation of food safety knowledge and characteristics of studied medical students**

	Total knowledge score		Sig
	Fail Mean $\pm$ SD	Passed Mean $\pm$ SD	
Age	21.8 $\pm$ 1.7	22.1 $\pm$ 1.7	t=1.5 p=0.14
	Total knowledge score		Sig.
	Failed No. (%)	Passed No. (%)	
<b>Gender</b>			
Male	79 (68.7)	36 (31.3)	x <sup>2</sup> = 3.8 p=0.05
Female	73 (56.6)	56 (43.4)	
<b>Grade</b>			
1.0	15(62.5)	9 (37.5)	x <sup>2</sup> = 13.1 p=0.023
2.0	12 (57.1)	9 (42.9)	
3.0	25 (80.6)	6 (19.4)	
4.0	58 (59.8)	39 (40.2)	
5.0	24 (77.4)	7 (22.6)	
6.0	18 (45.0)	22 (55.0)	
<b>Residency</b>			
Living with family	80 (60.6)	52 (39.4)	x <sup>2</sup> = 0.4 p=0.3
Living away from family	72(64.3)	40 (35.7)	

As regards the relation between grades and knowledge score there was statistical difference showing higher score with higher grades  $f = 2.56$   $p = 0.028$ , while there was non-significant difference with attitude, and practice scores (Data not shown). Knowledge score correlation with attitude and practice scores showed no statistical significance ( $r = 0.04$   $p = 0.45$  and  $r = 0.11$   $p = 0.07$  respectively). Correlation between attitude score and practice score showed a statistically significant difference ( $r = 0.28$   $p = 0.000$ ) (Table 7).

## Discussion

Although the public is increasingly concerned about food-related risks, the rise in food born disease cases suggests that people still consume, store and prepare food using improper, unhealthy and unsafe

ways.<sup>13</sup> Recent studies have shown that around 50 to 87% of foodborne outbreaks occur due to wrong home practices.<sup>6</sup> The current study showed an insufficient level of food safety knowledge among medical students with a mean  $\pm$  SD of 2.2 $\pm$ 1.3. Correct answers for the six food safety knowledge questions were selected by less than 50% of studied medical students; this agrees with many studies reporting low level of food safety knowledge among young adults and adolescents.<sup>15-16</sup> In the present study, students were least knowledgeable on the correct duration of keeping leftovers refrigerated as well as the most hygienic way to wash hands. The current study results revealed a statistically significant highest proportion of students scoring ( $\geq 50\%$ ) on food safety knowledge score among senior students (Sixth year). This finding is similar to the results of Osaili et al., 2011 carried out among Jordanian college female students as well as another study carried out in Saudi Arabia among school students.<sup>11,17</sup>

**Table 7. Correlation between age and studied medical students scores of food safety knowledge, attitude and practice**

		Attitude score	Practice score	age
<b>Knowledge</b>	r <sub>p</sub>	0.048	0.115	0.113
	P value	0.458	0.073	0.078
	N	244	244	244
<b>Attitude</b>	r <sub>p</sub>		0.283**	0.008
	P value	--	0.000	0.895
	N		244	244
<b>Practice</b>	r <sub>p</sub>			0.124
	P value	--	--	0.053
	N			244

In the present study females had significantly higher knowledge, attitude and practice mean scores. Similarly, concerning knowledge about the correct action to be done if they have a sore on their hand 35% of studied students reported that they "should bandage the sore and wear a glove". Females had better

knowledge and the difference was statistically significant (27.8% among males compared to 41.9% among females)  $\chi^2 = 10.3$   $p=0.036$ ). These findings agree with many studies showing that females have significantly higher food safety knowledge, attitude and practice.<sup>11,15,16,17</sup>

The current study findings show that female students are more informed about food safety than male students. This may be due to the fact that females are more interested in food preparation and cooking especially in our country. Similarly, in the present study, senior students were more informed; this is probably because they studied microbiology, public health and internal medicine and these curricula increased significantly their food safety level of knowledge. Knowledge score correlation with attitude and practice scores showed no statistical significance ( $r=0.04$   $p=0.45$  and  $r=0.11$   $p=0.07$  respectively). This disagrees with Sanlier, 2009 study revealing a significant correlation between food safety knowledge and practice scores.<sup>2</sup> On the other hand, the current study finding agrees with USDA-FSIS, (2002) report, showing that consumers good knowledge level on food safety may not always result in safe food practices.<sup>18</sup> However, in the present study, a statistically significant positive correlation between attitude score and practice score was shown ( $r=0.28$   $p=0.000$ ) as students with more positive food safety attitude reported safer food practices.

The findings of the current study highlighted the need to develop continued consumer education on different aspects of food safety (storing, preparation and handling). This education should start from early childhood years. Target population for food safety education are not only food handlers, but all consumers of all age categories especially males, as most of food safety related morbidities are due to

domestic unsafe food practices and can be easily prevented.

#### *Limitation of the study*

As the study population consisted of medical students, the results cannot be generalized to all university students or to all ages. In addition, the practice responses were self-reported, which may lead to bias.

## References

1. Linscott, A.J. (2011). Foodborn illness. *Clinical Microbiology Newsletter*, 33, 41-45.
2. Sanlier, N. (2009). The knowledge and practice of food safety by young and adult consumers. *Food Control*, 20, 538-542.
3. Byrd-Bredbenner C, Berning J, Martin-Biggers J & Quick V (2013). Food safety in home kitchens: a synthesis of the literature. *Int J Environ Res Public Health*. 2013 Sep 2;10(9):4060-85. doi: 10.3390/ijerph10094060. PubMed PMID: 24002725; PubMedCentral PMCID: PMC3799528.
4. WHO. (2007). Food safety and foodborne illness. Fact sheet No. 237, available from <http://www.who.int/mediacentre/factsheets/fs237/en/index.html> (Last accessed December 2018).
5. Lynch M, Painter J, Woodruff R & Braden C (2006). Centers for Disease Control and Prevention. Surveillance for foodborne-disease outbreaks--United States, 1998-2002. *MMWR Surveill Summ*. 2006 Nov 10;55(10):1-42. PubMed PMID: 17093388.
6. Redmond EC, Griffith CJ (2003). Consumer food handling in the home: a review of food safety studies. *J Food Prot*. 2003 Jan;66(1):130-61. Review. PubMed PMID:12540194.
7. Centers for Disease Control and Prevention. Number of Reported Foodborne Disease Outbreaks and Outbreak-Associated Illnesses, by Etiology and Place Where Food Was Eaten—United States, 2008. Available online: [http://www.cdc.gov/outbreaknet/pdf/2008M\\_MWR-Table3.pdf](http://www.cdc.gov/outbreaknet/pdf/2008M_MWR-Table3.pdf). (last accessed December 2018)

8. Centers for Disease Control and Prevention. Surveillance for Foodborne Disease Outbreaks— United States, 1998–2008. Morbidity and Mortality Weekly Report. Available online: <http://www.cdc.gov/mmwr/pdf/ss/ss6202.pdf> (last accessed December 2018)
9. Scott E. (2003). Food safety and foodborne disease in 21st century homes. *The Canadian journal of infectious diseases = Journal canadien des maladies infectieuses*, 14(5), 277-80.
10. Byrd-Bredbenner, C., Wheatley, V., Schaffner, D., Bruhn, C., Blalock, L., & Maurer, J. (2007). Development of food safety psychosocial questionnaires for young adults. *Journal of Food Science Education*, 6, 30–37.
11. Tareq M. Osaili, Bayan A. Obeidat, Dima O. Abu Jamous, Hiba A. Bawadi (2011), Food safety knowledge and practices among college female students in north of Jordan, *Food Control*, Volume 22, Issue 2, 2011, 269-276.
12. Hassan, H.F., Dimassi, H. (2014). Food safety and handling knowledge and practices of Lebanese university students. *Food Control* 40 (2014) 127-133.
13. Majowicz SE, Diplock KJ, Leatherdale ST, Bredin CT, Rebellato S, Hammond D, Jones-Bitton A, Dubin JA (2016). Food safety knowledge, attitudes and self-reported practices among Ontario high school students. *Can J Public Health*. 2016 Mar 16;106(8):e520-6. doi: 10.17269/cjph.106.5213. PubMed PMID: 26986914.
14. McCarthy, M., M. Brennan, A. L. Kelly, C. Ritson, M. de Boer and N. Thompson. (2007) 'Who is at Risk and What do they Know? Segmenting a Population on their Food Safety Knowledge', *Food Quality and Preference* 18(2): 205–17.
15. Garayoa R, Córdoba M, García-Jalón I, Sanchez-Villegas A, Vitas AI. (2005). Relationship between consumer food safety knowledge and reported behavior among students from health sciences in one region of Spain. *J Food Prot*. 2005 Dec;68(12):2631-6. PubMed PMID: 16355835.
16. Sharif, L., & Al-Malki, T. (2010). Knowledge, attitude and practice of Taif University students on food poisoning. *Food Control*, 21, 55-60.
17. Almansour M, Sami W, Al-Rashedy OS, Alsaab RS, Alfayez AS, Almarri NR. (2016) Knowledge, attitude, and practice (KAP) of food hygiene among schools students in Majmaah city, Saudi Arabia. *J Pak Med Assoc*. 2016 Apr;66(4):442-6.
18. USDA-FSIS (2002): Pathogen Reduction: Hazard Analysis and Critical Control Point (PR/ HACCP) Rule and Evaluation Final Report: Changes in Consumer Knowledge, Behavior, and Confidence Since the 1996 PR/HACCP Final Rule. United