Safety Practices of Eggs and Poultry Meat Among Libyan Women

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Abstract:

Consumers' safe handling of eggs and poultry meat can prevent related foodborne diseases. This study aimed to assess the practices of egg and poultry meat safety among Libyan women. The electronic questionnaire was used. Based on survey data, 58% purchased eggs from a supermarket, and most participants (84%) reported that the eggs were displayed at room temperature. Sixty-nine percent of the participants did not eat salads containing eggs or mayonnaise. Only 10% of participants defrosted poultry meat in the refrigerator. Forty-nine percent of participants used a different cutting surface for each type of food. Most participants (82%) washed their hands with soap and water after handling the eggs or raw poultry meat. Fifty-seven percent of the participants washed eggs and poultry meat before cooking them. Only 41% of the participants knew about diseases caused by eggs and poultry meat. In conclusion, egg retailers should be educated about the proper display of eggs. Also, some consumers need to raise their awareness of some improper practices.

Keywords: Awareness, Eggs, Libya, Meat, Poultry, Safety, Women.

ممارسات سلامة البيض ولحوم الدواجن لدى النساء الليبيات

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الملخص:

إن التداول الآمن للبيض ولحوم الدواجن من قبل المستهلكين يمكن أن يمنع الأمراض المنقولة بالغذاء ذات الصلة. هدفت هذه الدراسة إلى تقييم ممارسات سلامة البيض ولحوم الدواجن بين النساء الليبيات. تم استخدام الاستبيان الالكتروني. بناءً على بيانات المسح، قام 58% بشراء البيض من السوق الممتاز، وأفاد معظم المشاركين (84%) أن البيض تم عرضه للبيع في درجة حرارة الغرفة. لم يتناول 69% من المشاركين السلطات التي تحتوي على البيض أو المايونيز. قام 10% فقط من المشاركين بفك التجميد عن لحوم الدواجن باستخدام الثلاجة. استخدم 49% من المشاركين في الدراسة سطح تقطيع مختلف لكل نوع من أنواع الغذاء. قام معظم المشاركين (82%) بغسل أيديهم بالماء والصابون بعد التعامل مع البيض أو لحوم الدواجن النيئة. قام 57% من المشاركين بغسل البيض ولحوم الدواجن قبل طهيها. بلغت نسبة المشاركين الذين يعرفون الأمراض التي يسببها البيض، ولحوم الدواجن 41% فقط. في الختام، يجب تثقيف تجار تجزئة البيض حول العرض الصحيح للبيض، كما يحتاج بعض المستهلكين إلى زيادة وعيهم ببعض الممارسات غير السليمة.

الكلمات المفتاحية: الوعي، بيض، دواجن، سلامة، لحوم، ليبيا، نساء.

1. Introduction:

Raising consumer awareness about food safety is the most important factor in preventing foodborne diseases (FBDs) (Abuhlega & Greesh, 2021). FBDs are illnesses caused by consuming contaminated food, water, or beverages (Syahrul et al., 2020). The contaminants include biological, chemical, and physical contaminants, as well as allergens. The food may contain one or more of the biological contaminants that include bacteria, parasites, viruses, fungi, and their products (WP et al., 2013). FBDs affect more than 91 million people in developing countries (WHO, 2015). That is due to poor hygiene, especially contamination of drinking water, contamination of food storage facilities, and a lack of awareness of food safety (Sanlier, 2009).

Eggs are recommended for breakfast to start the day with a high-quality protein source, which is indicated as 100% standard and has a biological value of 93.7% (Bertechini & Mazzuco, 2013). On the other side, eggs and poultry

meat may cause illness in humans due to contamination by pathogenic bacteria such as *Salmonella*, *Campylobacter* spp., *Escherichia coli* 0157:H7, *Listeria*, *Yersinia*, *Staphylococcus aureus*, *Clostridium perfringens*, *Clostridium botulinum*, and *Bacillus cereus* (Hafez and El-Adawy, 2019). *Salmonella* is also one of the most common causes of FBDs transmission (Galiş et al., 2013).

Efforts must be intensified to raise consumer awareness because it is the key to preventing FBD outbreaks, which occur in home kitchens, restaurants, and at social events (Stratev et al., 2017). Where the home causes FBDs through contaminated raw materials, a lack of awareness of food safety, improper handling and preparation of food in the kitchen, and eating raw or undercooked foods (Käferstein, 2003). Furthermore, numerous studies have shown that consumers lack sufficient knowledge about food safety in the kitchen to protect themselves from FBDs (Medeiros et al., 2001).

To prevent diseases transmitted through eggs and poultry meat, effective educational programs must be adopted for all individuals involved with the production of eggs and poultry meat along the production chain, and these programs must include the consumer (Hafez, 2003). Constantly and effectively educating consumers on the rules of food safety can help them (children, young adults, adults, and the elderly) know the ways to prevent health-related problems as well as change their bad eating habits (Sanlier, 2009).

Several studies carried out recently evaluated the awareness of different categories of the Libyan community, including university students, secondary and middle school students, and women, about food safety (Abuhlega et al., 2020; Abuhlega, 2020; Abuhlega & Greesh, 2021; and Abuhlega & Al turki, 2021). Additionally, one study assessed the knowledge of pregnant women about chemical contaminants in fish (Abuhlega & Maamar, 2020). However, there has been almost no previous study carried out to evaluate Libyan consumers' awareness of the safety of eggs and poultry meat. The purpose of this study was to investigate Libyan consumers' awareness of the safety of eggs and poultry meat, as well as the effect of the consumers' demographic characteristics on their awareness of the safety of eggs and poultry meat.

2. Materials and methods:

2.1 Research design:

The study was designed and conducted from August 2020 to February 2021 using an online questionnaire. The questionnaire contained questions about the safety practices of eggs and poultry meat. This study included 620 women from several cities in the state of Libya.

2.2 Questionnaire design and data collection:

The questions of the questionnaire used to carry out this survey were significantly based on a previous study (Koppel et al., 2014). The questionnaire was introduced in Arabic and reviewed by three experts in the field of food sciences to ensure the collection of relevant information and a unified understanding of the questions. Almost all the recommended observations by experts were taken. A preliminary study was also conducted by submitting questionnaire forms to 20 individuals to ensure the validity and reliability of the questionnaire. Their responses were not included in the final data of this study, and some questions were modified to facilitate their understanding. Participants filled out the questionnaires via a Qsurvey program. The questionnaire consisted of two parts: part 1: demographic characteristics (age, marital status, employment, family's monthly income, and education level); and part 2: eggs and poultry meat safety practices (15 questions).

2.3 Statistical analysis:

The data was analyzed by the Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics were conducted to determine the frequencies and percentages of all variables. A chi-square test (X^2) was used to find out the impact of age, marital status, employment, family's monthly income, and education level on the safety practices of eggs and poultry meat at a 95% confidence level.

3. Results and Discussion:

A total of 620 women responded to the survey. Participants' demographics are shown in Table (1). The majority of participants (63.7%) were in the 18–33 year age range, 28.7% were in the 34–49 year age range, and 7.6% were >49 years old. Also, results show that 50.5% of participants were single and 49.5% were married. More than half of the sample (54.8%) were employees, and 45.2% did not work. The distribution of the family's monthly income was uneven. About 63% of participants earn <1000 Libyan Dinar (LD), 31.8% earn 1000-3000 LD, and 4.8% earn >3000 LD. Regarding participants' education level, 90.5% received a university education or higher (M.Sc./Ph.D.), and 9.5% received education less than a university education.

Table (1): Demographic characteristics of the participants (n=620)

Variable	Number	Percentage (%)
Age (y)		
18-33	395	63.7
34-49	178	28.7
> 49	47	7.60
Marital status		
Single	313	50.5
Married	307	49.5
Employment		
Employee	340	54.8
Does not work	280	45.2
***Family's monthly income**		
<1000	393	63.4
1000-3000	197	31.8
>3000	30	4.80
Educational level		
Less than university	59	9.50
University education or **higher	561	90.5

* Libyan Dinar, ** M.Sc./Ph.D.

As shown in Table (2) 37.4% of the participants reported that they usually purchase eggs from the store. About 58% of the participants said they usually purchase eggs from the supermarket. While only 3.4% and 1.5% mentioned that they usually purchase eggs from the farmer and on the side of the road, respectively. That may refer to stores and supermarkets are the most available and easiest sources of eggs. This result was contrary to that obtained by Koppel et al. (2014), who found that 75.7, 74.2, and 63.0% of consumers from India, Korea, and Thailand, respectively, purchased eggs from stores. Also, the result was contrary to that obtained by Junqueira et al. (2022), who found that 77.1% of Portuguese consumers purchased eggs from stores. In the United States, a higher percentage of consumers (89.5%) purchased eggs from a grocery store (Kosa et al., 2015). Also in Table (2) the findings revealed that marital status, family's monthly income, and educational level of participants influenced where they usually purchased eggs from ($p<0.05$). The findings also revealed that age

and employment did not influence where the participants usually purchased eggs ($p>0.05$).

Table (2): Consumer purchase places for eggs. Where do you usually purchase eggs? (n= 620)

Variable	Store N/%	Supermarket N/%	Farmer N/%	From the side of the road N/%	P-value
Age (y)					
18-33	152/24.5	216/34.8	18/2.9	9/1.5	0.0605
34-49	62/10	113/18.2	3/0.5	0/0.0	
> 49	18/2.9	29/4.7	0/0.0	0/0.0	
Marital status					
Single	127/20.5	160/25.8	8/2.9	8/1.3	0.0032
Married	105/16.9	198/31.9	3/0.5	1/0.2	
Employment					
Employee	135/21.8	188/30.3	12/1.9	5/0.8	0.5977
Does not employee	97/15.6	170/27.4	9/1.5	4/0.6	
***Family's monthly income**					
<1000	147/23.7	223/36.0	15/2.4	8/1.3	0.0000
1000-3000	77/12.4	113/18.2	6/1.0	1/0.2	
>3000	22/3.5	0/0.0	8/1.3	0/0.0	
Educational Level					
Less than university	30/4.8	23/3.7	5/0.8	1/0.2	0.0069
University education or **higher	202/32.6	335/54.1	16/2.6	8/1.3	
Total	**232/37.4**	**358/57.7**	**21/3.4**	**9/1.5**	**-**

* Libyan Dinar, ** M.Sc./Ph.D.

The safety of eggs requires cold storage from production until preparation by consumers (Cardoso et al., 2021). As shown in Table (3) about 84% reported that the eggs are displayed at room temperature in the place where they usually buy the eggs. In line with this finding, 100% of Indian and 64% of Korean consumers reported that the eggs were displayed at room temperature. Only 10% and 6.3% of the participants reported that the eggs are displayed in the refrigerator and in the open air in the place where they usually buy the eggs, respectively. Although the Libyan standard for table eggs requires that the temperature of the direct display to the consumer not exceed 15°C (LNCSM, 2013), the results show that the competent authorities do not control and regulate eggs in selling places. Also, in Table (3) the results showed that there

was an influence of age and marital status on the question response regarding the way that eggs are displayed in the selling places ($p<0.05$). While the respondent's employment, family's monthly income, and educational level did not influence the response ($p>0.05$).

Table (3): Egg display. Where are the eggs usually displayed in the place where you buy them? (n=620)

Variable	Refrigerator	Room temperature	In the open air	P-value
Age (y)				
18-33	42/6.8	323/52.1	30/4.8	0.0000
34-49	18/2.9	152/24.5	8/1.3	
> 49	44/7.1	2/0.3	1/0.2	
Marital status				
Single	26/4.2	258/41.6	29/4.7	0.0045
Married	36/5.8	261/42.1	10/1.6	
Employment				
Employee	34/5.5	285/46.0	21/3.4	0.9917
Does not work	28/4.5	234/37.7	18/2.9	
***Family's monthly income**				
<1000	39/6.3	324/52.3	30/4.8	0.3764
1000-3000	20/3.2	168/27.1	9/1.5	
>3000	3/0.5	27/4.3	0/0.0	
Educational Level				
Less than university	6/1.0	49/7.9	4/0.6	0.9851
University education or **higher	56/9.0	470/75.8	35/5.6	
Total	**62/10.0**	**519/83.7**	**39/6.3**	-

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Improper handling of food in the home is responsible for many FBDs (Byrd-Bredbenner et al., 2013). Eggs and egg products were the cause of several outbreaks of salmonellosis at home (Cardoso et al., 2021). In Table (4) the results of this study showed that 80.8% of the participants reported that they usually store eggs in the refrigerator at home and 19.2% of them usually store eggs at room temperature. The obtained result was consistent with the findings of Lievonen et al. (2004), who discovered that 93% of consumers in Finland kept eggs in the refrigerator. Also, 91% of Australian consumers stored eggs in the refrigerator (Whiley et al., 2012). In addition, in the United States, 99% of consumers stored eggs in the refrigerator (Kosa et al., 2015). Also in Table (2)

the findings revealed that marital status and employment influenced where participants usually store eggs at home ($p<0.05$). While there was no influence of age, family's monthly income, and educational level on where the participants usually store eggs at home ($p>0.05$).

Table (4): Consumer behavior of storing eggs. Where do you usually store eggs at home?

Variable	Refrigerator	Room temperature	P-value
Age (y)			
18-33	320/51.6	75/12.1	0.9309
34-49	144/23.2	34/5.5	
> 49	37/6.0	10/1.6	
Marital status			
Single	239/38.5	74/11.9	0.0045
Married	262/42.3	45/7.3	
Employment			
Employee	263/42.4	77/12.4	0.0161
Does not work	238/38.4	42/6.8	
***Family's monthly income**			
<1000	311/50.2	82/13.2	0.2191
1000-3000	167/27.0	30/4.8	
>3000	23/3.7	7/1.1	
Educational Level			
Less than university	47/7.6	12/1.9	0.8143
University education or **higher	454/73.2	107/17.3	
Total	**501/80.8**	**119/19.2**	**-**

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There are concerns about washing eggs before storing them because the cuticle layer of the egg may be damaged during or after the washing process (Abuhlega, 2020). The cuticle layer covers pores and prevents microbes from entering the inside of the egg (Abuhlega, 2020). Table (5) shows that 74.2% of participants said that they don't wash eggs at home before storage. More than a quarter of the sample (25.8%) stated that they wash eggs before storing them, which could be because most eggs on the market are dirty. In line with this finding, the majority of Libyan students (55%) washed fresh eggs just before cooking them (Abuhlega, 2020). Also, the results depict that age, marital status, and educational level influence participants' behavior of washing eggs at home

before storage ($p<0.05$). While employment and the family's monthly income did not influence previous behavior ($p>0.05$).

Table (5): Consumer behavior when storing eggs. Do you wash eggs at home before storage?

Variable	Yes	No	P-value
Age (y)			
18-33	119/19.2	276/44.5	0.0033
34-49	30/4.8	148/23.9	
> 49	11/1.8	36/5.8	
Marital status			
Single	100/16.1	213/34.4	0.0004
Married	60/9.7	247/39.8	
Employment			
Employee	83/13.4	257/41.5	0.3818
Does not work	77/12.4	203/32.7	
***Family's monthly income**			
<1000	97/15.6	296/47.7	0.4077
1000-3000	57/9.2	140/22.6	
>3000	6/1.0	24/3.9	
Educational Level			
Less than university	22/3.5	37/6.0	0.0341
University education or **higher	138/22.3	423/68.2	
Total	**160/25.8**	**460/74.2**	**-**

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Appropriate handling of leftovers ensures the safety of consumers from FBDs (Koppel et al., 2016). The majority of participants (74.8%) said that they do not store leftover boiled eggs (Table 6). While 21.8% and 3.4% said that they usually store leftover boiled eggs in the refrigerator and at room temperature, respectively. On the contrary, in the United States, Colombia, Argentina, Estonia, Italy, Spain, and Russia, 49.6, 21.2, 47.0, 77.0, 59.1, 42.4, and 41.0% of consumers saved leftovers, respectively (Koppel et al., 2016). Also, unlike the current study, 37.4, 64.8, and 55.6% of Indian, Korean, and Thai consumers, respectively, stored cooked eggs in the shell in the refrigerator (Koppel et al., 2014). The results in Table (7) also show that age, marital status, employment, and family's monthly income influenced participants' behavior of storing leftover boiled eggs ($p<0.05$) while participants' education level did not influence the previous behavior ($p>0.05$).

Table (6): Consumer behavior of storing leftovers of boiled eggs in the shell. Where do you usually store leftovers of boiled eggs in the shell at home?

Variable	Refrigerator	Room temperature	I do not store leftovers of boiled eggs	P-value
Age (y)				
18-33	93/15	17/2.7	285/46	0.0000
34-49	35/5.6	2/0.3	141/22.7	
> 49	7/1.1	38/6.1	2/0.3	
Marital status				
Single	83/13.4	13/2.1	217/35	0.0061
Married	52/8.4	8/1.3	247/39.8	
Employment				
Employee	72/11.6	5/0.8	263/42.4	0.0115
Does not work	63/10.2	16/2.6	201/32.4	
***Family's monthly income**				
<1000	87/14.0	15/2.4	291/47.0	0.0000
1000-3000	44/7.1	148/23.9	5/0.8	
>3000	4/0.6	1/0.2	25/4.0	
Educational Level				
Less than university	15/2.4	2/0.3	42/6.8	0.9720
University education or **higher	120/19.3	19/3.1	422/68.1	
Total	**135/21.8**	**21/3.4**	**464/74.8**	**-**

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Most participants (95.8%) reported that they store poultry meat in the freezer, and only 4.2% store poultry meat in the refrigerator (Table 7). Food preservation by freezing produces high-quality, nutritious, and long-storage foods (James et al., 2015). In a similar study, a lower percentage (61%) of Belgian consumers stored poultry meat by freezing (Sampers et al., 2012). The results in Table (7) also show that the characteristics considered in this study did not influence participants' behavior toward storing cooked eggs ($p>0.05$).

Table (7): Consumer behavior of storing poultry meat. Where do you usually store poultry meat at home?

Variable	Refrigerator	Freezer	P-value
Age (y)			
18-33	17/2.7	378/61.0	0.6464
34-49	6/1.0	172/27.7	
> 49	3/0.5	44/7.1	
Marital status			
Single	14/2.3	299/48.2	0.7261
Married	12/1.9	295/47.6	
Employment			
Employee	14/2.3	326/52.6	0.9172
Does not work	12/1.9	268/43.2	
***Family's monthly income**			
<1000	13/2.1	380/61.3	0.3376
1000-3000	11/1.8	186/30.0	
>3000	2/0.3	28/4.5	
Educational Level			
Less than university	0/0.0	59/9.5	0.0911
University education or **higher	26/4.2	535/86.3	
Total	**26/4.2**	**594/95.8**	**-**

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Table (8) presents the handling behavior of consumers with salads containing eggs or mayonnaise. About a quarter of participants (26%) mentioned that they last time left the remaining salad containing eggs or mayonnaise ,at room temperature for less than an hour to less than two hours before they put it in the refrigerator or eat it later without putting it in the refrigerator. In contrast, in a similar study, 79% of American, 61% of Colombian, and 91% of Argentinean consumers would refrigerate freshly prepared salads that contained eggs or mayonnaise within 1 hour or less (Koppel et al., 2016). Interestingly, 68.9% of participants said they do not eat salads containing eggs or mayonnaise. That may be because eating fresh eggs is not a Libyan food habit. The results also show that only educational level affected the handling behavior for salads containing eggs or mayonnaise ($p<0.05$), while age, marital status, employment, and the family's monthly income did not affect the previous behavior ($p>0.05$).

Table (8): Consumer's handling behavior with salads containing eggs or mayonnaise. How long did you leave the remaining salad containing eggs or mayonnaise ,at room temperature last time before you put it in the refrigerator or eat it later without putting it in the refrigerator? Less than an hour to less than two hours (1), More than two hours to less than four hours (2), Four hours or more (3), I don't eat egg and poultry salads (4)

Variable	1	2	3	4	P-value
Age (y)					
18-33	107/17.3	13/2.1	8/1.3	267/43.1	0.6325
34-49	39/6.3	7/1.1	2/0.3	130/21.0	
> 49	15/2.4	2/0.3	0/0.0	30/4.8	
Marital status					
Single	91/14.7	12/1.9	5/0.8	205/33.1	0.3156
Married	70/11.3	10/1.6	5/0.8	222/35.8	
Employment					
Employee	94/15.2	15/2.4	6/1.0	225/36.3	0.3476
Does not work	67/10.8	7/1.1	4/0.6	202/32.6	
***Family's monthly income**					
<1000	100/16.1	15/2.4	6/1.0	272/43.9	0.1291
1000-3000	49/8.0	7/1.1	2/0.3	139/22.4	
>3000	12/1.9	0/0.0	2/0.3	16/2.6	
Educational Level					
Less than university	7/1.1	4/0.6	0/0.0	48/7.7	0.0239
University education or **higher	154/24.8	18/3.0	10/1.6	379/61.1	
Total	**161/26.0**	**22/3.5**	**10/1.6**	**427/68.9**	-

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Most surveyed consumers (90.0%) reported that they defrost poultry meat outside the refrigerator, Table (9) While (10%) of participants defrost poultry meat in the refrigerator. This finding suggests that Libyan consumers may be exposed to FPDs as a result of improper handling of poultry meat during preparation. In contrast, a lower percentage of Italian consumers (62.7%) defrosted poultry meat at room temperature (Langiano et al., 2012). Also, unlike the current study, a very low percentage of Ghanaian consumers (0.4%) defrosted poultry meat in the refrigerator (Ovai et al., 2022). The findings of the statistical analysis show that the characteristics considered in this study did not influence participants' behavior in defrosting poultry meat ($p>0.05$).

Table (9): Consumer behavior of defrosting poultry meat. Where do you defrost poultry meat?

Variable	Refrigerator	At room temperature	P-value
Age (y)			
18-33	33/5.3	362/58.4	0.1107
34-49	21/3.4	157/25.3	
> 49	8/1.3	39/6.3	
Marital status			
Single	27/4.4	286/46.1	0.2496
Married	35/5.6	272/43.9	
Employment			
Public employee	37/6.0	303/48.9	0.4197
Does not work	25/4.0	255/41.1	
***Family's monthly income**			
<1000	33/5.3	360/58.1	0.1055
1000-3000	27/4.4	170/27.4	
>3000	2/0.3	28/4.5	
Educational Level			
Less than university	3/0.5	56/9.0	0.4168
University education or **higher	59/9.5	502/81.0	
Total	**62/10.0**	**558/90.0**	**-**

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Consumers are the last link in the food chain, and their good food handling practices at home are very important in reducing the risk of FBDs (Abuhlega & Abduljalil, 2022). Table (10) shows consumer behavior related to the use of cutting boards. The results show a high percentage of women (81.7%) follow the right practices related to using the cutting surface. 49.0% and 32.7%, respectively, said they use different cutting surfaces for each type of food and use the same cutting surface (counter, plate, cutting board) and wash it between uses. In contrast, 78.7% of Italian consumers used the same chopping board to prepare raw and cooked foods (Langiano et al., 2012). Also, 31%, 24%, and 30% of Korean, Indian, and Thai respondents, respectively, used the same cutting board for different foods, such as meats and vegetables, and either did nothing or only wiped the cutting board between different foods (Koppel et al., 2014). The findings of the statistical analysis show that all demographic characteristics considered in this study did not influence the consumers' behavior related to the use of cutting boards ($p>0.05$).

Table (10): Consumer behavior related to the use of cutting boards. When you are cutting various types of food such as meat, vegetables, eggs, and bread, do you usually use. Available options included: The same cutting surface (counter, plate, cutting board) and wipe or wash it at the end (1); The same cutting surface (counter, plate, cutting board) and wipe it between uses (2); The same cutting surface (counter, plate, cutting board) and wash it between uses (3); A different cutting surface for each type of food (4); Do not use a cutting surface (5)

Variable	1 n/%	2 n/%	3 n/%	4 n/%	P-value
Age (y)					
18-33	45/7.3	19/3.1	130/21.0	191/30.8	0.7003
34-49	18/2.9	7/1.1	63/10.1	85/13.7	
> 49	6/1.0	3/0.5	10/1.6	28/4.5	
Marital status					
Single	37/5.9	14/2.3	107/17.3	145/23.4	0.5175
Married	32/5.2	15/2.4	96/15.5	159/25.6	
Employment					
Employee	38/6.1	15/2.4	114/18.4	164/26.5	0.9719
Does not work	31/5.0	14/2.3	89/14.4	140/22.6	
***Family's monthly income**					
<1000	46/7.4	19/3.1	131/21.1	188/30.3	0.7714
1000-3000	20/3.2	9/1.5	60/9.7	104/16.8	
>3000	3/0.5	1/0.2	12/1.9	12/1.9	
Educational Level					
Less than university	10/1.6	5/0.8	21/3.4	21/3.4	0.1462
University education or **higher	59/9.5	24/3.9	182/29.4	283/45.6	
Total	**69/11.1**	**29/4.7**	**203/32.7**	**304/49.0**	-

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Table (11) shows what the participants typically do immediately after handling raw poultry meat or eggs. The majority of participants in this study (82.3%) reported that they usually wash their hands with soap and water. Hand washing after handling raw poultry meat or eggs may be due to inherited habits rather than awareness of the bacterial load on poultry meat and eggs. This result is in line with the result obtained by Ovai et al. (2022), where 89.6% of Ghanaian consumers washed their hands with soap and water before and after handling poultry meat. In contrast, a lower percentage of Australian consumers

(38.7%) washed their hands after handling eggs (Whiley et al., 2017). Also, a lower percentage of Romanian and Portuguese consumers (73.9%) washed their hands after touching raw meat or eggs (Mihalache et al., 2022). The results in Table (11) also show the findings of statistical analysis. Only marital status influenced the consumers' behavior toward handling poultry meat and eggs ($p<0.05$) while the rest of the demographic characteristics considered in this study had no influence on the consumers' behavior toward handling poultry meat and eggs ($p>0.05$).

Table (11): Consumer behavior of handling poultry meat or eggs. What is the first thing you usually do immediately after you handled these raw foods? Available options included: I touch anything else in the kitchen and start cooking without wiping, rinsing, or washing my hands (1); I wash my hands with soap and water (2); I wipe my hands off with a paper towel, dish cloth, or on my apron or clothing (3); I rinse off my hands, but do not use soap (4); I do not prepare raw poultry meat and eggs (5)

Variable	1 n/%	2 n/%	3 n/%	4 n/%	5 n/%	P-value
Age (y)						
18-33	10/1.6	314/50.6	1/0.2	65/10.5	5/0.8	0.0719
34-49	2/0.3	157/25.3	0/0.0	19/3.1	0/0.0	
> 49	0/0.0	39/6.3	1/0.2	7/1.1	0/0.0	
Marital status						
Single	11/1.8	246/39.7	1/0.2	50/8.1	5/0.8	0.0051
Married	1/0.2	264/42.6	1/0.2	41/6.6	0/0.0	
Employment						
Employee	7/1.1	287/46.3	1/0.2	44/7.1	1/0.2	0.3426
Does not work	5/0.8	223/36.0	1/0.2	47/7.6	4/0.6	
***Family's monthly income**						
<1000	8/1.3	318/51.3	1/0.2	62/10.0	4/0.6	0.5797
1000-3000	2/0.3	168/27.1	1/0.2	25/4.0	1/0.2	
>3000	2/0.3	24/3.9	0/0.0	4/0.6	0/0.0	
Educational Level						
Less than university	2/0.3	44/7.1	0/0.0	12/1.9	1/0.2	0.4851
University education or **higher	10/1.6	466/75.2	2/0.3	79/12.7	4/0.6	
Total	**12/1.9**	**510/82.3**	**2/0.3**	**91/14.5**	**5/0.8**	-

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The results in Table (12) display consumers' practice of washing eggs and poultry meat. More than half of the participants (57.3%) said they always wash poultry meat and eggs before cooking them. On the contrary, a lower percentage (48%) of Thai consumers washed both poultry and eggs (Koppel et al., 2104). In this study, 3.9% of the sample reported they do not wash poultry meat and eggs before cooking them. In line with this finding, 3.0%, 16.9%, and 1.0% of Indian, Korean, and Thai consumers, respectively, did not wash both poultry and eggs (Koppel et al., 2014). The findings of this study related to washing poultry meat were in line with a study conducted by Ovai et al. (2022) where most consumers (98.3%) reported that they wash poultry meat. The statistical analysis results show that all demographic characteristics considered in this study did not influence the participants' practice of washing eggs and poultry meat ($p>0.05$).

Table (12): consumer's practice of washing eggs and poultry meat. Do you wash poultry meat and eggs before cooking them? Yes, I always wash poultry meat (1), Yes, I always wash poultry meat and eggs (2), Yes, I always wash eggs (3), I wash them sometimes if the poultry meat or eggs are dirty (4), Do not wash them (5)

Variable	1	2	3	4	5	P-value
Age (y)						
18-33	142/22.9	222/35.8	3/0.5	14/2.3	14/2.3	0.4514
34-49	58/9.3	110/17.7	1/0.2	1/0.2	8/1.3	
> 49	21/3.4	23/3.7	0/0.0	1/0.2	2/0.3	
Marital status						
Single	118/19.0	173/27.9	3/0.5	8/1.3	11/1.8	0.6708
Married	103/16.6	182/29.4	1/0.2	8/1.3	13/2.1	
Employment						
Employee	130/21.0	186/30.0	2/0.3	7/1.1	15/2.4	0.4519
Does not work	91/14.7	169/27.3	2/0.3	9/1.5	9/1.5	
***Family's monthly income**						
<1000	142/22.9	222/35.8	3/0.5	13/2.1	13/2.1	0.8115
1000-3000	69/11.1	116/18.7	1/0.2	2/0.3	9/1.5	
>3000	10/1.6	17/2.7	0/0.0	1/0.2	2/0.3	
Educational Level						
Less than university	19/3.1	35/5.6	1/0.2	2/0.3	2/0.3	0.8118
University education or **higher	202/32.6	320/51.6	3/0.5	14/2.3	22/3.5	
Total	**221/35.6**	**355/57.3**	**4/0.6**	**16/2.6**	**24/3.9**	**-**

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Table (13) shows the knowledge of participants about diseases caused by poultry meat and eggs for humans. More than half of the participants (59.5%) said they do not know about diseases caused by poultry meat and eggs while the rest of the sample (40.5%) said they know. The statistical analysis results show that marital status and educational level influenced the participants' knowledge of diseases caused by poultry meat and eggs ($p<0.05$) while the rest of the characteristics considered in this study did not influence the previous practice ($p>0.05$). Of a total of participants, 251 reported that they know about diseases caused by poultry meat and eggs where only 9.7% of them mentioned *Salmonella* followed by 1.2%, 0.3%, 0.23 and 0.11 % reported bird flu, *E. coli*, *Campylobacter*, and *Clostridium*, respectively, Figure 1. On the contrary, a higher percentage was obtained by Norazmir et al. (2012) and Abuhlega (2020) where 56.6% and 31.5% of Malaysian and Libyan students know that salmonella can cause food poisoning, respectively. It is worth to note 85.5% did not answer the question which may reflect a lack of information about diseases caused by poultry meat and eggs.

Table (13): Knowledge of diseases caused by poultry meat and eggs. Do you know diseases caused by poultry meat and eggs?

Variable	Yes	No	P-value
Age (y)			
18-33	88/14.2	307/49.5	0.2317
34-49	33/5.3	145/23.4	
> 49	14/2.3	33/5.3	
Marital status			
Single	102/16.5	211/34.0	0.0001
Married	149/24.0	158/25.5	
Employment			
Employee	147/23.7	193/31.1	0.1240
Does not work	104/16.8	176/28.4	
***Family's monthly income**			
<1000	157/25.3	236/38.1	0.7985
1000-3000	83/13.4	114/18.4	
>3000	11/1.8	19/3.1	
Educational Level			
Less than university	15/2.4	44/7.1	0.0132
University education or **higher	236/38.1	325/52.4	
Total	**251/40.5**	**369/59.5**	**-**

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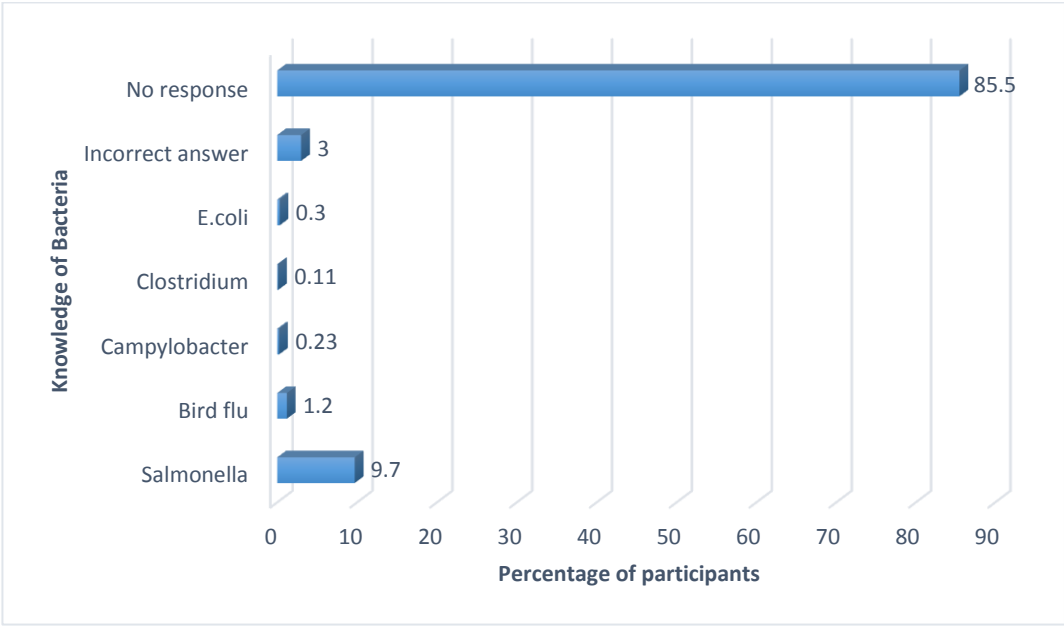

Figure (1): Consumer knowledge of bacteria caused disease transmitted by poultry meat and eggs. If you know bacteria that caused disease transmitted by poultry meat and eggs, mention them

4. Conclusion:

The study explored the awareness of Libyan women regarding the safety of eggs and poultry meat. Overall, the findings of this study show many proper practices in most, or the majority, of the sample. However, a few points should be considered, including displaying the eggs at a cooling temperature in selling places and providing cleaned raw poultry meat that encourages the women not to wash them at home. Also, it should raise awareness about the risks of dishes that contain raw eggs or mayonnaise and storing leftovers for a period that does not exceed two hours in the refrigerator. In addition, raise their awareness about the importance of defrosting poultry meat in the refrigerator. Furthermore, Libyan women need to raise their knowledge level about the diseases caused by raw eggs and poultry meat.

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