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Factors influencing knowledge and behaviors related to food safety during purchasing among consumers in Libya

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Abstract

Introduction: Libyan consumers mainly rely on purchasing food products and preparing them at home. Therefore, knowing the rules of food safety when purchasing is key to protect them from foodborne diseases. This study aims to assess food safety knowledge and behaviours during purchasing among consumers in Libya.

Method: The study was carried out through the internet by Qsurvey and filling paper questionnaires by self-administration method to explore the level of food safety knowledge and practices during purchasing among consumers in Libya, from March to December 2020. Data were analyzed by SPSS. A Chi-square test was used to determine the influence of demographics on the level of knowledge and behaviours. Bivariate correlation coefficient analysis was used to determine the correlation between knowledge and behaviours scores. A p value of <0.05 was considered statistically significant.

Result: There was a total of 1027 consumers surveyed. A good level of food safety knowledge was found in 531(51.7%) and the level of food safety behaviours was moderate in 684(66.6%). The age and monthly income influence food safety knowledge ($P<0.05$) while gender and age influence food safety behaviour during purchasing ($P<0.05$).

Conclusion: The level of food safety knowledge was good and the level of behaviours was only moderate. Therefore, there is a need to raise awareness of the population related to food safety.

Keywords: Food safety, knowledge, Libya, consumers, behaviour

Introduction

Foodborne diseases (FBD) are considered a global burden and thus require international efforts that include cooperation and grants, knowledge dissemination, and government commitment, especially in developing countries.¹ Food poisoning was among the fifteen diseases reported in Libya in 2010, with 904 people infected.² The number of food poisoning cases recorded in Libya in the years 2001, 2002, 2003, and 2004 were 297, 278, 129, and 779, respectively.³

Consumers are increasingly concerned about food safety. However, the increase in FBDs incidences indicates that people still have improper practices.⁴ Since most outbreaks occur at home, restaurants, and/or social events. Attention should be paid to raising awareness.¹ Food safety education requires training on safe handling practices, preparation, and storage.⁵ The 2018 World Bank report estimates total annual productivity losses in low- and middle-income countries of FBD at \$95.2 billion. While the annual cost of treating these diseases is \$15 billion.⁶

As a result of the lack of previous studies on food safety knowledge and behaviors during purchasing among the population in Libya. Therefore, this study aimed to evaluate knowledge and behaviors of food safety, explore the factors influencing knowledge and behaviors, and determine the correlation between scores of knowledge and behaviors.

Method

A cross-sectional study was conducted on a random sample of the Libyan population. The number of participants in the study reached 1027, of whom 867 participated through the internet by Qsurvey and 160 by filling out paper questionnaire forms by self-administration method. The survey was conducted from March to December 2020. The questionnaire consisted of three parts: personal information regarding consumers' gender, age, marital status, education level,

and monthly income of the family, knowledge of food safety (21 questions), and awareness of food safety behaviors (20 questions).

The answers to the food Safety during purchasing questions were calculated by being given a score-1 for the correct answer and for the wrong answer a score of zero. Thus, the maximum score was 21. A score of ≤ 11 represented a poor level of consumer knowledge, 12 to 15 represented good, and 16 to 21 was an excellent level.

For 20 questions about behaviors during purchasing, the answers to questions were rated as follows: "no" 1 point, "rarely" 2 points, "sometimes" 3 points, "often" 4 points, and "always" 5 points. Behavior scores vary from 20 to 105. Scores from ≤ 52 represent a low level of food safety behavior, 53 to 78 are medium and scores from 79 to 105 are considered high. The questionnaire was examined by 3 experts in the field of food sciences and technology to verify the validity of the questions included in the questionnaire and almost all the recommended observations were taken. Also, 26 questionnaires were distributed initially to a random sample of people, to determine the validity and reliability of the questionnaire. The questions were linguistically simplified to be more clear.

The data analysis was performed using the Statistical Package for the Social Sciences (SPSS), Version 22.0. Descriptive statistics were conducted to determine the means, percentages, standard deviations, and frequencies. The chi-square test (X^2) was applied to determine the association between the dependent and independent variables. Bivariate correlation coefficient analysis was used to determine the correlation between food safety knowledge scores and food safety behaviors scores. A $p < 0.05$ was considered statistically significant.

Result

Of 1027 respondents, 419(40.8%) were females and 608(59.2%) were males. The

majority of the respondents (343, 33.4%) were between the age of 26 and 35 y. More than half of the respondents (563, 54.8%) were single. Regarding the level of education of respondents, 687(66.9%) received a university education. The highest percentage of respondents (352, 34.3%) with a monthly income of >450-1000 Libyan Dinar, Table 1.

More than half of the respondents, 531(51.7%), had a good level of food safety knowledge scoring between 12-15 of the total score and 326(31.7%) of them had an excellent level of food safety knowledge scoring between 16-21 of the total score. Only 170(16.6%) of respondents had a poor level of food safety scoring ≤ 11 . The mean score for food safety knowledge was 14.0 ± 2.78 . Regarding the questionnaire on what food contamination means, 942(91.7%) of the participants responded correctly that it means that the food contains chemicals and/or microorganisms that are harmful to health, Table 2. The age and monthly income influenced food safety knowledge ($p < 0.05$), while gender, marital status, and educational

level did not influence food safety knowledge ($p > 0.05$), Table 3.

The majority of respondents 684(66.6%) had a moderate level of awareness of food safety behaviors, scoring between 53-78 of the total score. Only 45(4.4%) of respondents had a low level of food safety behaviors, scoring between 21-52 of the total score while 298(29.0%) of the respondents had a high-level scoring between 79-105 of the total score. The mean awareness score was 71.6 ± 10.97 . A low percentage of respondents, 189(18.4%) reported that they always the price does not determine the purchase decision of their food, Table 4. The gender and age of respondents influenced food safety behavior during purchasing ($p < 0.05$), and marital status, educational level, and monthly income did not influence food safety behaviour ($p > 0.05$), Table 5.

There was a modest positive linear correlation ($r = 0.379$) between knowledge and behaviors regarding food safety, but the correlation was statistically insignificant ($p > 0.05$).

Table 1. Demographic details of the respondents on knowledge and behavior regarding food safety

| Demographic variables | Categories | N | % |
|-------------------------------|-------------------------|-----|------|
| Gender | Female | 419 | 40.8 |
| | Male | 608 | 59.2 |
| Age (y) | 18- 25 | 322 | 31.4 |
| | 26- 35 | 343 | 33.4 |
| | 36- 45 | 230 | 22.4 |
| | 46- 55 | 102 | 9.9 |
| | > 55 | 30 | 2.9 |
| Marital status | Single | 563 | 54.8 |
| | Married | 464 | 45.2 |
| Educational level | Basic education | 28 | 2.7 |
| | Secondary education | 147 | 14.3 |
| | University education | 687 | 66.9 |
| | M.Sc./Ph.D. | 165 | 16.1 |
| Monthly income of the family* | ≤ 450 | 101 | 9.80 |
| | >450-1000 | 352 | 34.3 |
| | >1000-2000 | 185 | 18.0 |
| | >2000-3000 | 63 | 6.1 |
| | >3000 | 39 | 3.8 |
| | I do not like to answer | 287 | 28.0 |

*Libyan Dinar

Table 2. Food safety knowledge among the sample population

| Question | Gender | Correct answer N/% | Incorrect answer N/% | Do not know N/% | No response N/% | p-value |
|---|--------|--------------------|----------------------|-----------------|-----------------|---------|
| Food contamination means that it contains chemicals and/or microorganisms that are harmful to health. | Female | 382/37.2 | 14/1.4 | 23/2.23 | 1/0.1 | 0.3903 |
| | Male | 560/54.5 | 24/2.3 | 23/2.23 | | |
| | Total | 942/91.7 | 38/3.7 | 46/4.5 | | |
| Food with higher nutritional value is higher in price. | Female | 173/16.8 | 215/20.9 | 31/3.0 | 1/0.1 | 0.0735 |
| | Male | 219/21.3 | 354/34.4 | 34/3.3 | | |
| | Total | 392/38.1 | 569/55.3 | 65/6.3 | | |
| Additives are non-nutritive substances that are intentionally added to food to improve its properties and are in quantities meeting the regulations controlling them. | Female | 338/32.9 | 38/3.7 | 42/4.1 | 1/0.1 | 0.6972 |
| | Male | 492/47.9 | 48/4.7 | 68/6.6 | | |
| | Total | 830/80.8 | 86/8.4 | 110/10.7 | | |
| Freezing food does not kill bacteria but stops their proliferation. | Female | 271/26.4 | 48/4.7 | 98/9.5 | 2/0.2 | 0.0108 |
| | Male | 338/32.9 | 90/8.8 | 180/17.5 | | |
| | Total | 609/59.3 | 138/13.4 | 278/27.1 | | |
| During shopping, you should first buy non-perishable food (such as canned and dried food) and then buy chilled and frozen food. | Female | 275/26.8 | 94/9.2 | 49/4.8 | 1/0.1 | 0.9072 |
| | Male | 408/39.7 | 131/12.8 | 69/6.7 | | |
| | Total | 683/66.5 | 225/21.9 | 118/11.5 | | |
| Fresh meat, poultry, and seafood should be placed in airtight containers or safely packed in a shopping cart. | Female | 357/34.8 | 22/2.1 | 38/3.7 | 4/0.4 | 0.0473 |
| | Male | 508/49.5 | 55/5.4 | 43/4.2 | | |
| | Total | 865/84.2 | 77/7.5 | 81/7.9 | | |
| During shopping, hands should be cleaned before eating any food samples by carrying wet wipes or a bottle of sanitizer. | Female | 378/36.8 | 29/2.8 | 12/1.2 | 0/0.0 | 0.0000 |
| | Male | 484/47.1 | 90/8.8 | 34/3.3 | | |
| | Total | 862/83.9 | 119/11.6 | 46/4.5 | | |
| When shopping, you should buy food items enough for only a week. | Female | 284/27.7 | 103/10.0 | 32/3.1 | 0/0.0 | 0.7215 |
| | Male | 401/39.0 | 163/15.9 | 44/4.3 | | |
| | Total | 685/66.7 | 266/25.9 | 76/7.4 | | |
| Food packages with holes, tears, or openings should not be purchased. | Female | 400/38.9 | 12/1.2 | 7/0.7 | 0/0.0 | 0.9974 |
| | Male | 581/56.6 | 17/1.6 | 10/1.0 | | |
| | Total | 981/95.5 | 29/2.8 | 17/1.7 | | |
| Frozen food should be solid with no signs of product thawing. | Female | 360/35.0 | 22/2.1 | 37/3.6 | 0/0.0 | 0.2179 |
| | Male | 506/49.3 | 49/4.8 | 53/5.2 | | |
| | Total | 866/84.3 | 71/6.9 | 90/8.8 | | |
| You should feel the coolness of the chilled food when you buy it. | Female | 364/35.4 | 21/2.0 | 33/3.2 | 1/0.1 | 0.2559 |
| | Male | 533/51.9 | 40/3.9 | 35/3.4 | | |
| | Total | 897/87.3 | 61/5.9 | 68/6.6 | | |
| Failure to seal the jars indicates that the product may be contaminated or its contents have been tampered with. | Female | 386/37.6 | 15/1.5 | 17/1.7 | 3/0.3 | 0.2046 |
| | Male | 542/52.8 | 24/2.3 | 40/3.9 | | |
| | Total | 928/90.4 | 39/3.8 | 57/5.6 | | |
| Food cans with deep dents, swelling, rust, or bending by the top or side welding indicate possible spoilage. | Female | 356/34.6 | 32/3.1 | 31/3.0 | 1/0.1 | 0.1122 |
| | Male | 542/52.8 | 35/3.4 | 30/3.0 | | |
| | Total | 898/87.4 | 67/6.5 | 61/6.0 | | |
| you should pick cold packs when buying dairy products. | Female | 357/34.8 | 31/3.0 | 29/2.8 | 2/0.2 | 0.0167 |
| | Male | 555/54.0 | 26/2.5 | 27/2.6 | | |
| | Total | 912/88.8 | 57/5.6 | 56/5.4 | | |
| You should buy clean eggs that are free of cracks and/or breaks. | Female | 406/39.5 | 5/0.5 | 8/0.8 | 0/0.0 | 0.5069 |
| | Male | 596/58.0 | 5/0.5 | 7/0.7 | | |
| | Total | 1002/97.5 | 10/1.0 | 15/1.5 | | |
| Buying milk and dairy products at the end of a shopping trip reduces their time outside of refrigeration. | Female | 328/32.0 | 49/4.8 | 41/4.0 | 2/0.2 | 0.0054 |
| | Male | 520/50.6 | 55/5.3 | 32/3.1 | | |
| | Total | 848/82.6 | 104/10.1 | 73/7.1 | | |
| Perishable food should be refrigerated within two hours of purchasing it and only one hour if the ambient temperature exceeds 32°C. | Female | 238/23.2 | 15/1.5 | 165/16.0 | 3/0.3 | 0.0177 |
| | Male | 373/36.3 | 38/3.7 | 195/19.0 | | |
| | Total | 611/59.5 | 53/5.2 | 360/35.0 | | |
| You should use coolers or insulated bags for perishable food if the shopping trip from the market to the house exceeds 30 minutes. | Female | 234/22.8 | 82/8.0 | 101/9.8 | 2/0.2 | 0.3191 |
| | Male | 341/33.2 | 139/13.5 | 128/12.5 | | |
| | Total | 575/56.0 | 221/21.5 | 229/22.3 | | |
| Street milk can only be used after it has been boiled for half an hour. | Female | 172/16.8 | 77/7.5 | 170/16.6 | 0/0.0 | 0.0511 |
| | Male | 261/25.4 | 141/13.7 | 206/20.0 | | |
| | Total | 433/42.2 | 218/21.2 | 376/36.6 | | |
| Food is checked to see if it is safe or not by tasting it. | Female | 231/22.5 | 155/15.1 | 31/3.0 | 6/0.6 | 0.6641 |
| | Male | 314/30.6 | 247/24.0 | 43/4.2 | | |
| | Total | 545/53.1 | 402/39.1 | 74/7.2 | | |
| Food sold in supermarkets and large shopping centers is of higher quality than in small shops | Female | 239/23.3 | 131/12.7 | 49/4.8 | 0/0.0 | 0.0670 |
| | Male | 312/30.4 | 233/22.7 | 63/6.1 | | |
| | Total | 551/53.7 | 364/35.4 | 112/10.9 | | |

Table 3. Association between the demographic characteristics of the respondents and the knowledge level of food safety

| Variable | | Total knowledge scores | | | p-value |
|--------------------------|-------------------------|------------------------|-----------|-----------|---------|
| | | Excellent N(%) | Good N(%) | Poor N(%) | |
| Gender | Females | 136(13.2) | 212(20.6) | 71(7.0) | 0.8404 |
| | Males | 190(18.5) | 319(31.1) | 99(9.6) | |
| Age (y) | 18- 25 | 74(7.2) | 171(16.7) | 77(7.5) | 0.0000 |
| | 26- 35 | 107(10.4) | 190(18.5) | 46(4.5) | |
| | 36- 45 | 89(8.7) | 107(10.4) | 34(3.3) | |
| | 46- 55 | 45(4.4) | 47(4.6) | 10(1.0) | |
| | > 55 | 11(1.0) | 16(1.5) | 3(0.3) | |
| Marital status | Single | 164(15.9) | 297(28.9) | 102(10.0) | 0.0912 |
| | Married | 162(15.8) | 234(22.8) | 68(6.6) | |
| Educational level | Basic education | 8(0.7) | 12(1.2) | 8(0.8) | 0.2634 |
| | Secondary education | 51(5.0) | 71(6.9) | 25(2.4) | |
| | University education | 205(20) | 369(35.9) | 113(11.0) | |
| | M.Sc./Ph.D. | 62(6.0) | 79(7.7) | 24(2.3) | |
| Monthly income of family | ≤450 | 19(1.9) | 62(6.0) | 20(1.9) | 0.0294 |
| | >450-1000 | 112(10.9) | 179(17.4) | 61(6.0) | |
| | >1000-2000 | 63(6.1) | 98(9.5) | 24(2.3) | |
| | >2000-3000 | 31(3.0) | 25(2.4) | 7(0.7) | |
| | >3000 | 12(1.2) | 22(2.1) | 5(0.5) | |
| | I do not like to answer | 89(8.6) | 145(14.1) | 53(5.2) | |

Table 4. Food safety behaviors during purchasing among the sample population

| Practices | No N (%) | Rarely | Sometimes N (%) | Often N (%) | Always N (%) | No response N (%) |
|---|------------|------------|-----------------|-------------|--------------|-------------------|
| Price does not determine the purchase decision of my food. | 55 (5.4) | 59 (5.7) | 408 (39.7) | 315 (30.7) | 189 (18.4) | 1 (0.1) |
| Promotional items (gifts) provided with food affect my purchasing decisions. | 263 (25.6) | 191 (18.6) | 274 (26.7) | 183 (17.8) | 112 (10.9) | 4 (0.4) |
| I pay attention to the trademark or the producer of food products. | 34 (3.3) | 51 (5.0) | 144 (14.0) | 330 (32.1) | 466 (45.4) | 2 (0.2) |
| I check the expiration date before buying food products. | 12 (1.2) | 25 (2.4) | 88 (8.6) | 177 (17.2) | 725 (70.6) | 0 (0.0) |
| I check for bulges or dents in food containers before I buy them. | 11 (1.0) | 17 (1.7) | 54 (5.3) | 115 (11.2) | 827 (80.5) | 3 (0.3) |
| I absolutely refuse and return a food product that I later find out is defective. | 66 (6.4) | 93 (9.1) | 172 (16.7) | 243 (23.7) | 453 (44.1) | 0 (0.0) |
| I check the safety of food packages and that their contents have not been tampered with before I buy them. | 31 (3.0) | 42 (4.1) | 67 (6.5) | 196 (19.1) | 690 (67.2) | 1 (0.1) |
| I check if food products in the market are displayed according to the appropriate temperature. | 110 (10.7) | 95 (9.2) | 204 (19.9) | 266 (25.9) | 351 (34.2) | 1 (0.1) |
| I follow the storage instructions on the food label. | 98 (9.5) | 124 (12.1) | 217 (21.1) | 245 (23.9) | 338 (32.9) | 5 (0.5) |
| I make sure the food product is free of preservatives. | 195 (19.0) | 226 (22.0) | 258 (25.1) | 188 (18.3) | 157 (15.3) | 3 (0.3) |
| I make sure that the food product is free of industrial colors. | 183 (17.8) | 202 (19.7) | 238 (23.2) | 188 (18.3) | 215 (20.9) | 1 (0.1) |
| I care about the calorie content of food. | 320 (31.2) | 202 (19.7) | 218 (21.2) | 141 (13.7) | 145 (14.1) | 1 (0.1) |
| I pay attention to market cleanliness where I buy food. | 16 (1.6) | 17 (1.7) | 58 (5.6) | 211 (20.5) | 724 (70.5) | 1 (0.1) |
| I care about the ingredients in the food I buy. | 71 (6.9) | 88 (8.6) | 198 (19.2) | 270 (26.3) | 399 (38.9) | 1 (0.1) |
| I check if the product I purchase has any harmful effects on human health. | 65 (6.3) | 62 (6.0) | 149 (14.5) | 220 (21.4) | 530 (51.6) | 1 (0.1) |
| I do not buy homemade food products such as sweets, harissa, and bread that are offered in the markets. | 179 (17.4) | 130 (12.7) | 249 (24.2) | 223 (21.7) | 244 (23.8) | 2 (0.2) |
| I buy with satisfaction any food product, regardless of where and how it was prepared and whether it is healthy or not. | 120 (11.7) | 77 (7.5) | 105 (10.2) | 160 (15.6) | 563 (54.8) | 2 (0.2) |
| I put frozen food directly into the freezer when I get home. | 24 (2.3) | 12 (1.2) | 40 (3.9) | 158 (15.4) | 791 (77.0) | 2 (0.2) |
| I check for the veterinary seal of meat quality when purchasing. | 344 (33.5) | 169 (16.5) | 147 (14.3) | 140 (13.6) | 226 (22.0) | 1 (0.1) |
| I take non-plastic bags from home when shopping instead of using the plastic bags present in the markets. | 667 (65.0) | 148 (14.4) | 101 (9.8) | 50 (4.9) | 59 (5.7) | 2 (0.2) |

Table 5. Association between demographic characteristics of the sample population and behavior on food safety

| Variable | Total knowledge scores | | | p-value |
|-------------------------------------|------------------------|---------------|-----------|---------|
| | Low N(%) | Moderate N(%) | High N(%) | |
| Gender | | | | |
| Females | 15 | 258 | 146 | 0.0025 |
| Males | 30 | 426 | 152 | |
| Age (y) | | | | |
| 18- 25 | 22 | 222 | 78 | 0.0276 |
| 26- 35 | 17 | 226 | 100 | |
| 36- 45 | 4 | 154 | 72 | |
| 46- 55 | 1 | 64 | 37 | |
| >55 | 1 | 18 | 11 | |
| Marital status | | | | |
| Single | 31 | 371 | 161 | 0.1522 |
| Married | 14 | 313 | 137 | |
| Educational level | | | | |
| Basic education | 2 | 18 | 8 | 0.8584 |
| Secondary education | 8 | 93 | 46 | |
| University education | 30 | 464 | 193 | |
| M.Sc./Ph.D. | 5 | 109 | 51 | |
| Monthly income of the family | | | | |
| ≤450 | 5 | 70 | 26 | 0.7791 |
| >450-1000 | 20 | 228 | 104 | |
| >1000-2000 | 8 | 129 | 48 | |
| >2000-3000 | 1 | 45 | 17 | |
| >3000 | 1 | 27 | 11 | |
| I do not like to answer | 10 | 185 | 92 | |

Discussion

In the present study males were 608(59.2%), more than females. The result of this study was similar to a previous study conducted in Libya in which males numbered more than females.⁷ This is in contrast to other similar studies conducted in Turkey and Kazakhstan, Jordan, and Libya.⁸⁻¹⁰ The results show the number of single consumers was 563(54.8%), slightly more than married ones. On contrary, the number of married was higher in studies conducted in Turkey and Jordan.¹¹⁻¹³

Regarding the level of education, 852(83%) of respondents had a university education. This finding was similar to a previous study in Jordan where the majority of respondents (176, 85%) had a university education.⁹ However, this finding was in contrast to a study conducted in Palestine.¹¹

Knowledge is defined as the capacity to acquire, retain and use information. It is also a mixture of comprehension, experience, discernment, and skill.¹² In the present study, the mean score of food safety knowledge

(14.0±2.78) in more than half (531, 51.7%) of the consumers reflects a good level. Therefore, educational programs for the population may improve their knowledge about food safety. The results of some studies from Libya have reported lower scores for knowledge among middle and secondary school students, a mean score of 12.1±3.34 (out of the total score of 22) and 14.4±2.71 (out of the total score of 23), respectively.⁸⁻¹⁰ Also, in Kazakhstan, the mean score of consumers' knowledge was 14.74±3.86 (out of the total score of 30) which is lower than the present study.⁵ In Turkey, the mean score of consumers' knowledge was 20.82±4.20 (out of a total score of 30) which is higher than the obtained finding.⁵ In another study from Libya, the mean food safety knowledge score of the women was 8.5±0.71 (out of the total score of 11) which is higher than the present study.¹³

There was a weakness in some important knowledge points such as in answering "Food with higher nutritional value is higher in price", where only 392(38.1%) of respondents correctly answered in the present study. Similarly, 305(38.3%) Belgian and Romanian

consumers also reported they use the price for the evaluation of food quality.⁴

The age and monthly income of the family influenced food safety knowledge ($p < 0.05$), but gender, marital status, and educational level did not ($p > 0.05$). Similarly, age influenced the knowledge level of university students in Libya.¹⁴ Unlike our finding, in Palestine, the educational level influenced knowledge ($p < 0.05$) while age and gender did not influence ($p > 0.05$).¹¹

Practice is regarded as the application of rules and knowledge that leads to action.¹² The mean of the food safety practices scores of the respondents was 71.6 ± 10.97 of the total score of 105 which falls in the scores range of the moderate level. Unsafe food safety practices are prevalent among consumers of all ages and that may make them prone to food hazards.¹⁵⁻¹⁶ On the contrary, the level of food safety practices among secondary students was moderate with a mean score, of 37.29 ± 3.54 of a total score of 52. Which was higher than that obtained in this study.¹² Also, in Turkey, the mean was 14.43 ± 2.56 of the total score of 20 which was higher than our finding.⁵ while the mean in Kazakhstan was 11.84 ± 2.9 of the total score of 20 which was lower.⁵ Consumer purchasing behavior is a key of prevent foodborne diseases. Consumers are the last point of contact with food. Therefore, consumers' knowledge and behaviors of food safety have the main role in limiting the prevalence of foodborne disease outbreaks.¹⁷ The results show that Libyan consumers need to raise their awareness of food safety behaviors related to many purchasing behaviors that include price, promotional items, trademark or the producer, rights to return food products, food temperature, storage instruction, preservatives, industrial colors, calorie content, ingredients, homemade food, veterinary seal, non-plastic bags. Our findings were contrary to those of the study in Jordan, where consumers appeared to follow food safety rules when purchasing their food.⁹

There was an influence of the gender and age of respondents on food safety behavior during purchasing, and marital status, educational level, and monthly income of the family did not influence. Similarly, in Libya, gender influenced the food safety behavior of university students.¹⁴ The result is also in line with results obtained in Jordan except for income which influenced consumer behavior during purchasing.⁹

Consumers with more knowledge about food hygiene had better food handling behaviors.¹⁸ However, the finding of our study shows an insignificant modest positive correlation between food safety knowledge and behaviors ($r = 0.379$; $p > 0.05$). On the contrary significant modest positive correlation was found between knowledge and practice scores regarding food poisoning in Palestine ($r = 0.23$, $p < 0.001$).¹¹

Food safety is a public health issue. The lack of awareness of the consequences of outbreaks of FBDs results in substantial costs to the consumer, health care centers, and food producers, and a decrease in individual productivity, and thus an impact on the country's economy in general.¹⁹ The increase of awareness of food safety is carried out through informative campaigns targeting populations, especially those with limited income and low education levels, by improving the levels of education.²⁰ Based on the results of this study, it seems that Libyan consumers need a continuous and effective program from the competent authorities to address the weaknesses in their knowledge and practices related to food safety. The competent authorities should use their capabilities and perform their assigned role to raise the level of food safety among consumers in the country, which includes: I) Distributing brochures and posters in shops, markets, and malls to explain how to safely deal with food during purchase. II) Intensifying its awareness campaigns about food safety through its websites and pages on the Internet and television. III) Targeting consumers with awareness lectures about the proper handling of food in their workplaces or inviting them to attend in a certain place. IV)

Conducting more comprehensive studies to assess the level of food safety awareness among consumers in the whole country.

Conclusion

The findings of this study show that the level of knowledge of Libyan consumers was relatively good and the practices were only moderate. The findings of this study show that age and the monthly income of the family influenced food safety knowledge. Gender and age of respondents influenced food safety behavior during purchasing of food.

Conflict of Interest

None

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None

Author Contribution

Substantial contributions to the conception, design, acquisition, analysis, or interpretation of data: TA, AA; Literature review: TA, AA; Drafting the work or revising it critically for important intellectual content: TA; Final approval of the version to be published: TA, AA; Accountable for all aspects of the work for accuracy/integrity: TA; Guarantor: TA.

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**Supplement
Questionnaire**

Part 1. Demographic characteristics of the consumers

1. Gender: a. Female b. Male
2. Age in y: a. 18-25 b. 26-35 c. 36-45 d. 46-55 e. >55.
3. Martial Status: a. Single b. Married.
4. consumers' Education: a. Basic b. Secondary c. University d. M.Sc./Ph.D.
5. Income: a. ≤ 450 b.> 450-1000 c. >1000-2000. d. >2000-3000 e. >3000 f. I don't like to answer.

Part 2. Questions on knowledge of food safety, please (✓) one correct answer.

| N | Statement | Yes | No | Don't know |
|----|---|-----|----|------------|
| 1 | Food contamination means that it contains chemicals and/or microorganisms that are harmful to health. | | | |
| 2 | Food with higher nutritional value is higher in price. | | | |
| 3 | Additives are non-nutritive substances that are intentionally added to food to improve its properties and are in quantities meeting the regulations controlling them. | | | |
| 4 | Freezing food does not kill bacteria but stops their proliferation. | | | |
| 5 | During shopping, you should first buy non-perishable food (such as canned and dried food) and then buy chilled and frozen food | | | |
| 6 | Fresh meat, poultry, and seafood should be placed in airtight containers or safely packed in a shopping cart. | | | |
| 7 | During shopping, hands should be cleaned before eating any food samples by carrying wet wipes or a bottle of sanitizer. | | | |
| 8 | When shopping, you should buy food items enough for only a week. | | | |
| 9 | Food packages with holes, tears, or openings should not be purchased. | | | |
| 10 | Frozen food should be solid with no signs of product thawing | | | |
| 11 | You should feel the coolness of the chilled food when you buy it. | | | |
| 12 | Failure to seal the jars indicates that the product may be contaminated or its contents have been tampered with. | | | |

- 13 Food cans with deep dents, swelling, rust, or bending by the top or side welding indicate possible spoilage.
- 14 you should pick cold packs when buying dairy products.
- 15 You should buy clean eggs that are free of cracks and/or breaks.
- 16 Buying milk and dairy products at the end of a shopping trip reduces their time outside of refrigeration.
- 17 Perishable food should be refrigerated within two hours of purchasing it and only one hour if the ambient temperature exceeds 32°C.
- 18 You should use coolers or insulated bags for perishable food if the shopping trip from the market to the house exceeds 30 minutes.
- 19 Street milk can only be used after it has been boiled for half an hour.
- 20 Food is checked to see if it is safe or not by tasting it.
- 21 Food sold in supermarkets and large shopping centers is of higher quality than in small shops

Part 3. Food Safety Practices, please (v) one correct answer.

- | N | Practice | No | Rarely | Sometimes | Often | Always |
|----|---|----|--------|-----------|-------|--------|
| 1 | Price does not determine the purchase decision of my food. | | | | | |
| 2 | Promotional items (gifts) provided with food affect my purchasing decisions. | | | | | |
| 3 | I pay attention to the trademark or the producer of food products. | | | | | |
| 4 | I check the expiration date before buying food products. | | | | | |
| 5 | I check for bulges or dents in food containers before I buy them. | | | | | |
| 6 | I absolutely refuse and return a food product that I later find out is defective. | | | | | |
| 7 | I check the safety of food packages and their contents have not been tampered with before I buy them. | | | | | |
| 8 | I check if food products in the market are displayed according to the appropriate temperature. | | | | | |
| 9 | I follow the storage instructions on the food label. | | | | | |
| 10 | I make sure the food product is free of preservatives. | | | | | |
| 11 | I make sure that the food product is free of industrial colors. | | | | | |
| 12 | I care about the calorie content of food. | | | | | |
| 13 | I pay attention to market cleanliness where I buy food. | | | | | |
| 14 | I care about the ingredients in the food I buy. | | | | | |
| 15 | I check if the product I purchase has any harmful effects on human health. | | | | | |
| 16 | I do not buy homemade food products such as sweets, harissa, and bread that are offered in the markets. | | | | | |
| 17 | I buy with satisfaction any food product, regardless of where and how it was prepared and whether it is healthy or not. | | | | | |
| 18 | I put frozen food directly into the freezer when I get home. | | | | | |
| 19 | I check for the veterinary seal of meat quality when purchasing. | | | | | |
| 20 | I take non-plastic bags from home when shopping instead of using the plastic bags present in the markets. | | | | | |