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Knowledge and awareness of food safety among middle school students in Tripoli, Libya

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Abstract

Introduction: To protect public health in society, it is imperative to promote good food safety practices by raising awareness and knowledge, especially among school students. This study aimed to assess the food safety knowledge and practices among middle school students in Tripoli, Libya.

Methods: The study was conducted through a questionnaire to find out the level of food safety knowledge and practices among randomly selected students from several municipalities in Tripoli city, Libya, from May to November 2019. Approval from the director of the Basic Education Administration was taken. Data were analyzed to determine the association of demographics and the level of knowledge and practices, the correlation between knowledge and practice scores. The data analysis was performed by SPSS. A Chi-square test was used to find out the association. A $p < 0.05$ was considered statistically significant.

Results: There was a total of 591 students surveyed. A good level of food safety knowledge was found in 325(55%) and the level of food safety practices was high in 558(94.4%). Only 102(17.3%) of the students always washed their hands before eating in school. There was a significant association ($p < 0.05$) between gender and municipality with the knowledge scores.

Conclusion: The level of food safety practices was high but only half of the middle school students surveyed had a good level of knowledge.

Keywords: food safety, knowledge, Libya, middle school students, practices

Introduction

One of the most important factors of foodborne disease prevention is educating consumers.¹ Adolescents' habits are difficult to change in adulthood.² Knowledge of personal hygiene practices does not necessarily change the behavior during adult life.³

Previous studies have shown several cases of food poisoning because of pathogenic microorganisms among school students.⁴⁻⁶ School students are considered active consumers and they purchase food without the knowledge and irresponsibly from places outside the school during school hours.⁷

There are almost no previous local studies on food safety knowledge and practices among school students in Libya. Therefore, this study was carried out to find out the awareness of students about food safety, and to help authorities establish effective plans to reduce the spread of foodborne illness.

Method

A cross-sectional study was conducted on a random sample of the students from the six middle schools. Two schools, a girls' and a boys' school from each municipality in Tripoli (Ain Zara, Abu Saleem, and Tripoli center) were chosen. The study period was from May to Nov 2019. Approval from the director of the Basic Education Administration was taken. The survey was carried out using a face-to-face questionnaire in the Arabic language based on previous studies.⁸⁻¹⁰ The researcher visited the classrooms of schools and handed out the questionnaire to students during extracurricular activities. The researcher briefly explained the aims of the study to students with the help of their teacher. The questionnaire consisted of three parts: personal information, knowledge of food safety (22 questions), and awareness of food safety practices (11 questions).

For 22 knowledge questions, the correct answer was given a score-1 and for the wrong answer a score-zero. Thus, a maximum score

was 22. A score of ≤ 11 represented a poor level of knowledge and ≥ 12 a good level.

Answers to the questions in the practices part were graded as follows: 'almost never' 1 point, 'sometimes' 2 points, 'often' 3 points, and 'always' 4 points. Scores ranged from 11 to 44. A Score of 11 to 22 represented a low level and 23 to 44 a high level of awareness. The content validity of the questionnaire was reviewed by two experts from the university.

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. Chi-square test (X^2) was used to determine the association of knowledge and practices with demographics. A $p < 0.05$ was considered significant.

Result

A total of 591 students participated in the study, Table 1. Females were 297(50.3%) and males 294(49.7%). The number of students in the age group 13-14 y was 119(60.1%) and >16 y 17(2.9%). The students from Abu Saleem were 202(34.2%), 209(35.4%) were from Tripoli center and 180(30.4%) were from Ain Zara. There were 276(46.7%) of the students' mothers with university education and 14(2.4%) were uneducated.

More than half of the respondents 325(55.0%) had a good level of food safety knowledge scoring between 12-22 of the total score and less than half of students 266(45.0%) had a poor level of food safety knowledge scoring between 0-11 of the total score. The mean score of the food safety knowledge was 12.1 ± 3.34 .

The 470(79.0%) students responded that food poisoning is caused by pathogenic microorganisms, Table 2.

There were 202(34.2%) of students who knew that leftover chicken eaten cold can cause poisoning, Figure 1 and 348 58.9% knew

undercooked chicken or meat can cause poisoning, Figure 2.

There was a significant association between food safety knowledge and gender and students' municipality, and no significant association with age and mother's education level, Table 3.

The majority of respondents 558(94.4%) had a high level of awareness of food safety practices scoring between 23-44 of the total score. While only 33(5.6%) of respondents had a poor level of food safety practices scoring between 11-22 of the total score. The mean awareness score was 30.9 ± 5.54 . Less than half of respondents, 248(41.9%) reported that they "always" check the expiry date on food packages before buying, Table 4.

There were 550(93.1%) who reported they "always" washed their hands with water and soap after using the bathroom (urinating or defecating), Figure 3.

There was no significant association between the demographic characteristics of students (gender, age, municipalities, and Mothers' education level) and food safety practices, Table 5.

There was a small positive linear relationship ($r=0.195$) between knowledge and practices, but the correlation was statistically insignificant ($p > 0.05$).

Table 1. Demographic characteristics of the respondents

Variable	N	%
Gender		
Females	294	49.7
Males	297	50.3
Age (y)		
11- 12	119	20.1
13- 14	355	60.1
15- 16	100	16.9
>16	17	2.9
Municipality		
Abu Saleem	202	34.2
Tripoli center	209	35.4
Ain Zara	180	30.4
Mothers' Education Level		
Uneducated	14	2.4
Basic education	85	14.4
Secondary education	152	25.7
University education	276	46.7
M.Sc. and Ph.D.	64	10.8

Table 2. Knowledge of food safety among respondents

Question	Correct answers N(%)	Incorrect Answers N(%)	Do not Know N(%)	No response (%)
Food poisoning is caused by pathogenic microorganisms	470 (79.5)	30 (5.1)	87 (14.7)	4 (0.7)
Food poisoning causes serious diseases that lead to hospital and sometimes to death	484 (82.0)	46 (7.9)	59 (9.8)	2 (0.3)
The numbers of pathogenic bacteria multiply rapidly at room temperature	291 (49.2)	106 (17.9)	193 (32.7)	1 (0.2)
When flies land on food, it makes it harmful to health	504 (85.3)	48 (8.1)	38 (6.4)	1 (0.2)
Did you know that you should always wash your hands after coughing or sneezing?	535 (90.5)	31 (5.2)	24 (4.1)	1 (0.2)
To determine the safety of milk, you must taste it first, and not just look at the expiration date only	261 (44.0)	251 (43.0)	79 (13.0)	0 (0)
Eating canned food from a swollen can is harmful to health and may lead to death	418 (70.7)	76 (12.9)	97 (16.4)	0 (0)
Raw chicken, fish, and red meat are not placed in the same place in the refrigerator	265 (44.8)	208 (35.2)	117 (19.8)	1 (0.2)
The best way to avoid food poisoning from fruits and vegetables is to wash them under running water	538 (91.03)	26 (4.4)	25 (4.23)	2 (0.34)
To avoid food poisoning, the kitchen sink drain should be cleaned every week	358 (60.6)	75 (12.7)	156 (26.4)	2 (0.3)
Salmonella bacteria can cause food poisoning	106 (18.0)	31 (5.2)	447 (75.6)	7 (1.2)

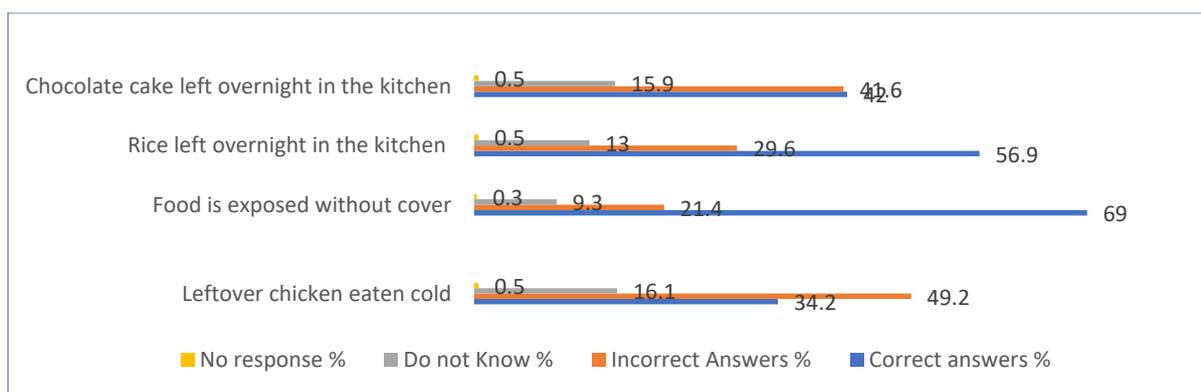


Figure 1. knowledge of food that causes food poisoning among respondents

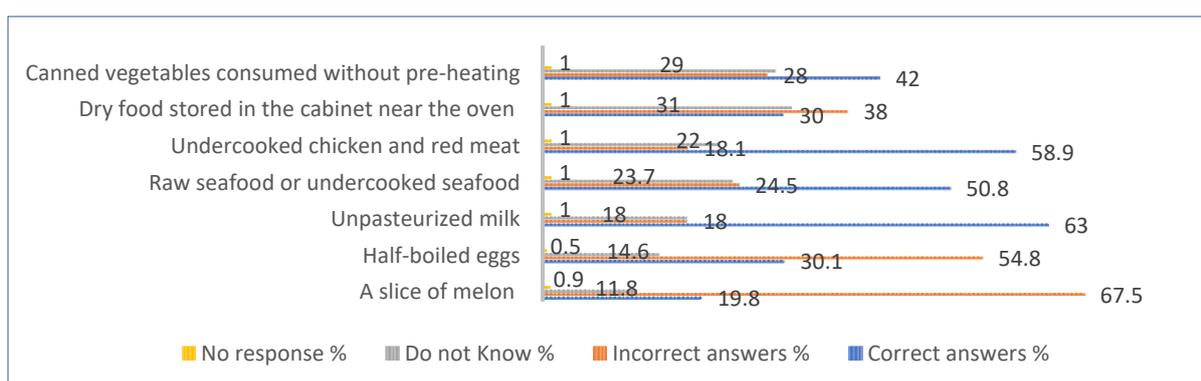


Figure 2. knowledge of food that increases the risk of food poisoning among respondents

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

Variables	Total knowledge scores		p-value
	Good N(%)	Poor N(%)	
Gender			
Females	160(27.1)	134(22.7)	0.00001
Males	107(18.1)	190(32.1)	
Age (y)			
11-12	56(9.5)	63(10.7)	0.7309
13-14	161(27.2)	194(32.8)	
15-16	41(6.9)	59(10.0)	
>16	9(1.5)	8(1.4)	
Municipality			
Abu Saleem	95(16.0)	107(18.1)	0.0095
Tripoli center	107(18.1)	102(17.3)	
Ain Zara	65(11.0)	115(19.5)	
Mothers' Education Level			
Uneducated	4(0.7)	10(1.7)	0.5075
Basic education	34(5.8)	51(8.6)	
Secondary education	73(12.4)	79(13.4)	
University education	125(21.2)	151(25.5)	
M.Sc. and Ph.D.	30(5.1)	34(5.8)	

Table 4. Food safety practices among respondents

Practices	Almost never N(%)	Sometimes N(%)	Often N(%)	Always N(%)	No response N(%)
I check the expiry date on food packages before buying	95 (16.1)	126 (21.3)	108 (18.3)	248 (41.9)	14 (2.4)
I wash fresh eggs just before cooking them	125 (21.2)	71 (12.0)	55 (9.3)	322 (54.5)	18 (3.0)
I do not eat raw eggs without cooking and food made from raw eggs	202 (34.2)	123 (20.8)	76 (12.9)	168 (28.4)	22 (3.7)
I do not taste food to know if it is safe or not	189 (32.0)	109 (18.4)	93 (15.7)	179 (30.3)	21 (3.6)
I eat well-done meat and I do not eat rare meat	68 (11.5)	53 (9.0)	53 (9.0)	393 (66.5)	24 (4.0)
I prefer to reheat leftovers by using a microwave oven	316 (53.5)	135 (22.9)	110 (18.6)	19 (3.2)	11 (1.8)

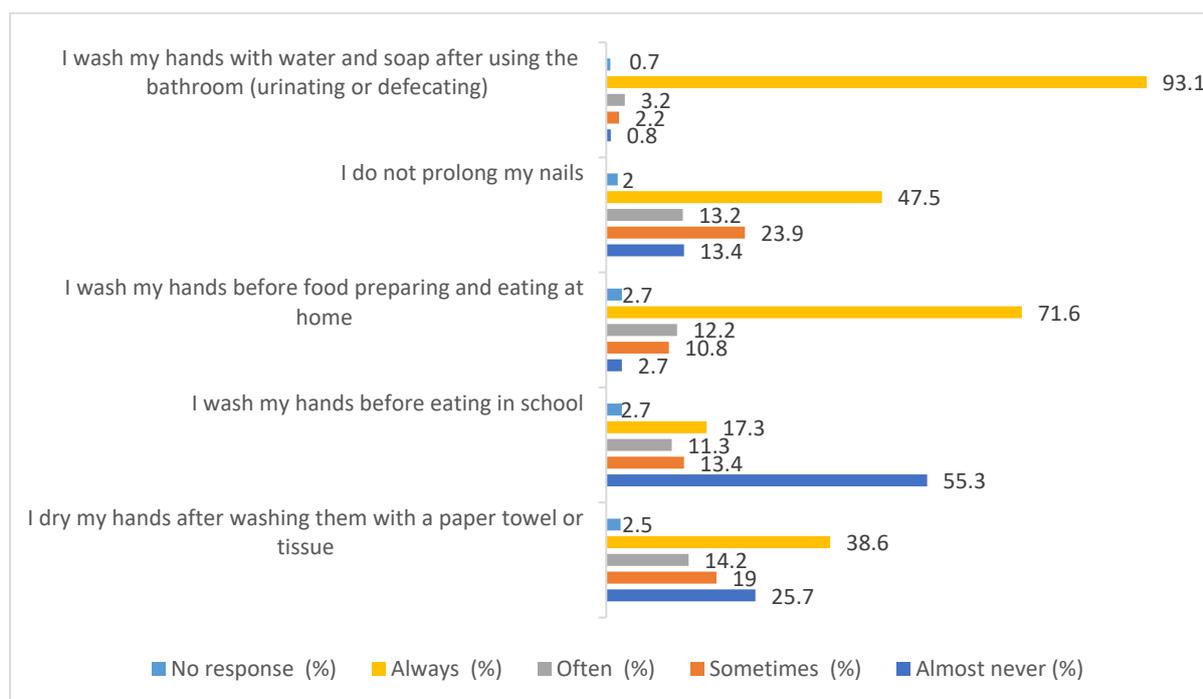


Figure 3. Practices of hands washing among respondents

Table 5. The association between demographic characteristics of respondents and food safety practices level

Variables	Total practices scores		p value
	Low N(%)	High N(%)	
Gender			
Females	17(2.9)	277(46.9)	0.8343
Males	16(2.7)	28(47.5)	
Age (y)			
11-12	9(1.5)	110(18.6)	0.7183
13-14	17(2.9)	338(57.2)	
15-16	6(1.0)	94(15.9)	
>16	1(0.2)	16(2.7)	
Municipality			
Abu Saleem	9(1.5)	193(32.7)	0.6896
Tripoli center	13(2.2)	196(33.1)	
Ain Zara	11(1.9)	169(28.6)	
Mothers' education level			
Uneducated	1(0.2)	13(2.1)	0.1565
Basic education	5(0.8)	80(13.5)	
Secondary education	14(2.4)	138(23.4)	
University education	12(2.0)	264(44.7)	
M.Sc. and Ph.D.	1(0.2)	63(10.7)	

Discussion

Our study found that more than half 325(55%) of the middle school students surveyed had a good level of food safety knowledge with a mean score of 12.1 ± 3.34 .

Today, foodborne diseases are the most important health problems that threaten the health of millions of people in the world.¹¹ Thus assessing food safety knowledge and behavior of students is an important means to put into plans to provide more effective education and reduce the risk of foodborne diseases.¹²

In the present study males were 297(50.3%), slightly more than females. The result of this study was similar to a previous study conducted in Malaysia in which males numbered more than females.⁸ This is in contrast to other similar studies conducted in Nigeria, China, and Libya that found males number lower than females.¹²⁻¹⁵ It is worthy to observe that a high percentage of students' mothers in this study received a university education 276(46.7%). This finding was similar to a previous study in Libya where the

majority of students' mothers had a university education.¹⁵ While this finding was in contrast to a study conducted in Bhaktapur where only 9(2.65%) of students' mothers had a bachelor.¹⁶

Our findings of a mean score of a good level of food safety knowledge score (mean 12.1 ± 3.34) in more than half (325, i.e. 55%) of the students may be attributed to the lack of education programs targeted the schools' students to improve their knowledge about food safety. The results of this study are in contrast to the results of similar studies which reported that the majority of the students considered in those studies had a good level of knowledge on food safety.^{8,12,13,15,17}

The majority of the respondents (558, i.e. 94.4%) had a high level of food safety practices scoring between 23-44 of the total score. The mean of the food safety practices scores of the respondents was 30.9 ± 5.54 of the scores ranging from 11-44 which falls in the scores range of the high level. The high scores of food safety practices could be because some practices may be related to inherited social

habits or linked to religion but not necessarily based on knowledge. On the contrary, the Saudi population had adequate knowledge of food safety, but this knowledge did not translate to practice.¹⁸ This finding was comparable to a study conducted in Nigeria that reported the majority of respondents had a high level (385, i.e. 97.7%) of practices on food safety.¹³ Also, in a study conducted in Libya 1641(87.5%) and 183(9.8%) of respondents had a moderate and high level of food safety practices, respectively.¹⁵ While the percentage of the respondents who had a high level of food safety practices in similar studies carried out in Malaysia and Nigeria was 287(71.9%) and 269(65.8%), respectively which were lower than the one obtained in this study.^{8,12}

Hand washing practice is very important for students, because the hands may be a means of transporting pathogenic microbes to their bodies after using the toilette, coughing, sneezing, playing, or touching garbage, etc.¹⁹ It is worthy to note that only 102(17.3%) of respondents indicated they "always" wash their hands before eating in school. That could be attributed to the fact that the schools in Tripoli had no suitable facilities for students to wash their hands.¹⁵ A study carried out in Ghana reported that hand washing facilities in the schools were inadequate.¹⁹ Interestingly in the study conducted in Greece, the larger percentage of responding students washed their hands before buying something from the canteen at various times but no one does that always.²⁰ This study is in line with a related study conducted in Bhaktapur, Nepal, where only 29(8.5%) of students reported they washed their hands in school.¹⁶ By contrast, other studies found that the percent of students who always wash their hands before eating food in school was higher than that obtained in this study.^{8,12,13}

The results of this study showed a significant association ($p < 0.05$) between gender and students' municipality with their knowledge scores. While there was no significant difference ($p > 0.05$) between age and level of mother's education and knowledge scores.

Also, the results of this study showed an insignificant association ($p > 0.05$) between the demographic characteristics considered in this study and practice scores. This study is in line with a related study conducted in Nigeria where an insignificant association was found between age and mothers' educational level and knowledge scores ($p > 0.05$), and also an insignificant association between age, gender, and mother's educational level and practices scores ($p > 0.05$).¹³ Also, in Libya, a significant association was found only between the students' municipality and knowledge scores ($p < 0.05$), while a significant association was obtained ($p < 0.05$) between the students' municipality and the mothers' education level and practices scores.¹⁵ Similarly, in Iran there was an insignificant association was found between gender and knowledge scores of students.²¹

The results showed a small, positive linear relationship between the food safety knowledge and food safety practices of the students ($r = 0.195$). The correlation was insignificant ($p > 0.05$). This is similar to the result obtained in a similar study in Libya where an insignificant small positive correlation between the two variables ($r = 0.096$, $p > 0.05$).¹⁵ While this result is in contrast to similar studies conducted in Malaysia and Nigeria where a significant correlation was found between food safety knowledge and food safety practices of the students.^{8,13}

Based on our findings we recommend: 1. The educational material related to food safety should be included in the curriculum of schools; 2. Presenting lectures and workshops at present targeting this category of students and their teachers in all matters related to food safety; 3. Providing schools with appropriate printed guidelines about food safety rules and the importance of washing hands before eating and after using the toilet; 4. Conducting a comprehensive study to know the situation of schools regarding the availability of the necessary supplies for handwashing; 5. Raising the level of individuals working in the school health office to perform their health advisory

role, especially concerning the importance of handwashing; 6. Based on the fact that the majority of mothers received an education, targeting them with an educational program of food safety will be successful, and thus positively reflecting on the level of students.

Conclusion

Although the results of this study showed that the middle schools' students had a good level of food safety knowledge and a high level of food safety practices, there is a great need to raise the level of awareness at many knowledge points where the students' answers were incorrect and require improvement in their incorrect practices.

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Conflict of Interest

The authors declare no conflict of interest.

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Author Contribution

All authors contributed substantially. Concept, design, planning- AT; Literature review- AT, GM; Data collection/analysis- AT, GM; Draft manuscript- AT; Revision of draft- GM; Final manuscript- AT, GM; Accountability of the work- AT.

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Supplement

Questionnaire

Dear students,

Your school has been selected to conduct a questionnaire aimed at assessing the level of knowledge of food safety rules and their application in daily life, which will take approximately 15 minutes to complete. Your contribution to this study will have a positive impact to find out the information related to the extent of students' knowledge of food safety rules and food safety practices in order to achieve the safety of this group and raise level of awareness of food safety. We thank you in advance for your cooperation with us, the Department of Food Sciences and Technology, Faculty of Agriculture, University of Tripoli.

Part 1. Demographic characteristics of the student

1. Gender: a. Female b. Male
2. Age in y: a. 11-12 b. 13-14 c. 15-16 d. >16
3. municipality: a. Abu Saleem b. Tripoli Center c. Ain Zara.
4. Mothers' Education: a. uneducated b. Basic c. Secondary d. University d. M.Sc./Ph.D.

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

N	Statement	Yes	No	dont know
1	Food poisoning is caused by pathogenic microorganisms.			
2	Food poisoning causes serious diseases that lead to hospital and sometimes to death.			
3	The numbers of pathogenic bacteria multiply rapidly at room temperature.			
4	When flies land on food, it makes it harmful to health.			

5	Did you know that you should always wash your hands after coughing or sneezing?			
6	To determine the safety of milk, you must taste it first, and not just look at the expiration date only.			
7	Eating canned food from a swollen can is harmful to health and may lead to death.			
8	Raw chicken, fish, and red meat are not placed in the same place in the refrigerator.			
8	The best way to avoid food poisoning from fruits and vegetables is to wash them under running water.			
10	To avoid food poisoning, the kitchen sink drain should be cleaned every week.			
11	Salmonella bacteria can cause food poisoning.			
Do the following foods cause food poisoning?				
12	Leftover chicken eaten cold			
13	Food is exposed without cover.			
14	Rice left overnight in the kitchen.			
15	Chocolate cake left overnight in the kitchen.			
Do the following foods increase the risk of food poisoning?				
16	A slice of melon .			
17	Half-boiled eggs.			
18	Unpasteurized milk.			
19	Raw seafood or undercooked seafood.			
20	Undercooked chicken and red meat.			
21	Dry food stored in the cabinet near the oven.			
22	Canned vegetables consumed without pre-heating.			

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

N	Practice	Almost never	Sometimes	Often	Always
1	I check the expiry date on food packages before buying.*				
2	I wash fresh eggs just before cooking them.**				
3	I do not eat raw eggs without cooking and food made from raw eggs.				
4	I do not taste food to know if it is safe or not.				
5	I eat well-done meat and I do not eat rare meat.***				
6	I prefer to reheat leftovers by using a microwave oven.				
7	I dry my hands after washing them with a paper towel or tissue.				
8	I wash my hands before eating in school.				
9	I wash my hands before food preparing and eating at home.				
10	I do not prolong my nails.				
11	I wash my hands with water and soap after using the bathroom (urinating or defecating).				

If the student does not do a certain practice, a note is taken in front of the statement. *I'm not buying, **I don't cook, ***I don't eat meat.