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Original Article

Mediterranean Fast Food: A Leading Cause of Hypercholesterolemia among University Students in Northern Jordan

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Abstract

Background: Consumption of fast food is pervasive among young adults. This research aimed to assess the impact of consuming fast foods on total cholesterol level among university students in Northern Jordan.

Methods: Using a cross-sectional design, a blood sample to investigate cholesterol level was drawn from a sample of university students in Northern Jordan. Besides, students' dietary habits and anthropometric measurements were obtained.

Results: Out of 201 participants, 57% (n=115) were male and 43% (n=86) were female. More than three quarters of the sample ate shawarma (Mediterranean fast food) at least once per week. About 44% of the study subjects had increased BMI and about 37% had increased serum cholesterol level. Participants' gender, age, marital status, physical activity, BMI, living status, and daily pocket money significantly correlated with cholesterol level (P<0.05). In the regression analysis, eating fast foods and increased BMI were strong predictors of high cholesterol level. Students who ate shawarma more than 3 times a week had more than 8 folds to have hypercholesterolemia (OR=8.4; CI: 2.62-26.72), and obese students were more than 14 folds at higher risk to have hypercholesterolemia compared to those with normal BMI (OR=14.2; CI: 4.80-42.29). In addition, male students had doubled odds for having abnormal cholesterol level compared to females (OR=2.1; CI: 1.10-4.44).

Conclusion: Fast food consumption among university students in Jordan was significantly associated with increased total cholesterol level. Encouraging healthy diet and lifestyle are the basis for prevention of dyslipidemia.

Keywords: Fast foods; Jordan; Mediterranean; Students

Introduction

Over the past decades, the consumption of fast foods has increased worldwide and became favored by people of most age groups as they are quick to prepare, easy to access, and relatively inexpensive (1). However, eating fast food has been

shown to have adverse health effects, and the majority of studies on this subject have focused on the relationship between fast food consumption and weight gain and concluded that fast food intake predicts weight gain and obesity in all age groups (2,3).

The high energy density and high glycemic index of fast foods may increase the prevalence of obesity and cardiovascular risk factors (4). Fast food consumption is usually associated with higher fat intake as fast foods are rich sources of saturated fatty acids and trans-fatty acids leading to excess adiposity (5). Eating fast food was found to be associated with weight gain in Arab countries (6, 7). Causal relationship of fast food and obesity was reported among university students in Lebanon (8) and Saudi Arabia (9).

It has been reported that nutrition transition is a crucial factor which can affect dietary habits, particularly in developing countries (10). In most Eastern Mediterranean countries, the frequency of eating food prepared outside the home is also increasing (11). Jordan, as one of these countries, is experiencing alarming rates of obesity due to unhealthy dietary habits (12). Fast foods are associated with increased risk of colorectal cancer (13), overweight and obesity among adolescents (14,15), overweight and obesity among university students (16), and food poisoning from fast food sandwiches (17). Shawarma is the most popular fast food in the Middle Eastern Arab countries, especially in Jordan. Nevertheless, up to the researchers' knowledge, no studies have been conducted to assess the impact of this fast food on serum cholesterol level in the Mediterranean region.

We aimed to determine the effect of shawarma consumption on serum cholesterol level among university students in Jordan. Besides, we assessed factors associated with eating fast food.

Materials and Methods

Using a cross sectional design, from June to September 2019, 256 healthy university students were interviewed and asked about fast food consumption and other dietary habits. Students with comorbidities which may elevate cholesterol level and affect study results, and subjects with anti lipid treatment were excluded. Out of the 256 responses, 55 were excluded as they either submitted incomplete information, or their blood samples were clotted leaving 201 responses valid for the final analysis.

Setting and data collection

The study took place at Yarmouk University in Northern Jordan where trained research assistants interviewed students over 4 months. The interviewers were a postgraduate student and two fifth year medical students who were trained for two days on the purpose of the study, field protocol, questionnaire administration, and ethical issues. A pilot-tested structured questionnaire was prepared and administered by the trained interviewers to collect information relevant to the current research problem. The instrument was pre-tested for language clarity during the training and modified based on the feedback. The questionnaire involved items on demographics, medical history, education level, average daily pocket money, and dietary habits. Educational brochures and pamphlets were handled to students at the time of data collection.

Anthropometric and blood measurements

Anthropometric measurements including body weight and height were obtained to calculate the body mass index (BMI) according to the standard formula (body weight (kg)/height (m^2)). Participants were asked about their body weight before one year. The change in body weight of participants was recorded by comparing the self-reported weight before one year and the current body weight.

To assess the serum cholesterol level, a 10 ml whole blood sample was obtained by a laboratory technician from all participants who agreed to participate. The procedure involved using sodium fluoride potassium oxalate tubes, and samples were kept in an ice box and sent to the central labora-

tory (distance = 300 meters from the university location) for immediate analysis every hour during the data collection period. Analysis of blood samples was carried out *via* Beckman Coulter AU 480 using the kinetic UV method based on the recommendations of the International Federation of Clinical Chemistry (18). Serum cholesterol level was defined according to the Third Report of the National Cholesterol Education Program (NCEP-Adult Treatment Panel III). Serum total cholesterol levels were estimated, and normal kit ranges were: (normal < 200 mg/dL and high ≥ 240 mg/dL).

Definition of fast food

Shawarma is a Middle Eastern most popular street foods meat preparation made of lamb, mutton chicken, turkey, beef, or veal. Lamb fat may be added to provide extra fat for juiciness and flavor (19). Shawarma, in the Middle Eastern Arab countries, is commonly served as a sandwich or wrap and typically served with garlic sauce, fries, and pickles (20). It was made clear to participants that eating shawarma is meant when they were asked about fast food consumption.

Statistical Analysis

Survey data were analyzed using the Statistical Package for Social Sciences (SPSS Version 23). Range and logical checks were used to detect errors in data entry. Detected errors were corrected by returning to the original data forms. Cross tabulation analysis was performed to assess factors associated with eating fast food and factors associated with cholesterol level using the chi square test for categorical variables. A backward wald stepwise multivariate logistic regression was used to determine the effect of a given variable while simultaneously controlling for potential confounders. A $p<0.05$ considered statistical significance in all cases.

Compliance with Ethical Standards

The study was approved by the Institutional Review Board (IRB) at King Abdulla University in Northern Jordan. Informed consent was obtained from every participant and all study procedures followed Helsinki declaration guidelines. Mobile phone numbers of all participants were collected to inform them about lab results based on the consents. Participants were notified that their information will be used for research purposes only and no one other than the research team will have access to them.

Results

Socio-demographic and clinical characteristics of the sample

Of the 201 subjects included in the study, about 57% (n=115) were males and 43% (n=86) were females. The majority of participants (85.1%) were younger than 30 years. About 44% of the study subjects had overweight or were obese and about 37% had increased serum cholesterol level. The demographic and clinical characteristics of the study population are shown in Table 1.

Table 1: Demographic, dietary, and clinical characteristics of the study population (n=201)

Characteristic	*n (%)*
Gender	
Male	115 (57.2)
Female	86 (42.8)
Age/year	
<30	177 (88.1)
≥30	24 (11.9)
BMI	
Underweight	15 (7.5)
Normal	98 (48.8)
Overweight	46 (22.9)
Obese	42 (20.9)
Serum cholesterol level	
Normal	127 (63.2)
High	74 (36.8)
Living status	
With family	114 (56.7)
Dormitory or private	87 (43.3)
Exercising 30 minutes/day	
No	119 (59.2)
Yes	82 (40.8)
Eat shawarma/week	
Never	52 (25.9)
1-3 times	110 (54.7)
More than 3 times	39 (19.4)
Drink beverages with shawarma	
Yes	125(62.2)
No	76 (37.8)
Daily pocket /JD	
< 3	26 (12.9)
3-5	107 (53.2)
> 5	68 (33.8)

BMI: Body mass index

As noted in Table 1, more than three quarters of the sample ate shawarma at least once per week. A cross tabulation analysis was performed to assess factors associated with eating fast foods. As illustrated in Table 2, all socio-demographic characteristics had significant statistical associations with eating fast food except participants' age and their marital status.

Table 2: Cross-tabulation of factors associated with eating shawarma among university students in Northern Jordan (n=201)

Variable	*Eating fast food/week*			*P value*
	Never n (%)	1-3 times n (%)	≥ 4 times n (%)	
Gender				0.001
Male	21 (18.2)	60 (52.2)	34 (29.6)	
Female	31 (36.0)	50 (58.1)	5 (5.8)	
Age/year				0.881
<30	45 (25.4)	98 (55.4)	34 (19.2)	
≥30	7 (29.2)	12 (50.0)	5 (20.8)	
Marital status				0.714
Single	42 (25.3)	93 (56.0)	31 (18.7)	
Married	10 (28.6)	17 (48.6)	8 (22.9)	
BMI				0.004
Underweight	8 (53.3)	5 (33.3)	2 (13.3)	
Normal	25 (25.5)	60 (61.2)	13 (13.3)	
Overweight	13 (28.3)	25 (54.3)	8 (17.4)	
Obese	6 (14.3)	20 (47.6)	16 (38.1)	
Cholesterol level				0.001
Normal	41 (32.3)	76 (59.8)	10 (7.9)	
High	11 (14.9)	34 (45.9)	29 (39.2)	
Living status				0.001
With Family	42 (36.8)	65 (57.0)	7 (6.1)	
Private dormitory	10 (11.5)	45 (51.7)	32 (36.8)	
Daily pocket money				0.033
Less than 3 JD	10 (38.5)	14 (53.8)	2 (7.7)	
3-5 JD	24 (22.4)	66 (61.7)	17 (15.9)	
More than 5 JD	18 (26.5)	30 (44.1)	20 (29.4)	

The binary logistic regression analysis revealed students' gender, living status, BMI, and their daily pocket money as significant predictors of factors associated with eating shawarma. As shown in (Table 3), male students were more than 3 folds more likely to eat shawarma compared to females (OR=3.3; CI: 1.27-8.67).

Another cross tabulation analysis was performed and assessed factors correlated with cholesterol level. This analysis revealed significant statistical associations as illustrated in Table 4.

Table 3: Logistic regression analysis of factors associated with eating shawarma

Variable	*OR*	*95% Conf. Interval*		*P value*
		Lower	Upper	
Gender				
Male	3.3	1.27	8.67	0.014
Female	1*			
Living status				
With Family	1*			
Private dormitory	4.1	1.41	12.14	0.010
BMI				
Normal	1*			
Overweight	2.0	0.37	10.65	0.41
Obese	16.9	2.43	117.73	0.004
Daily pocket money				
Less than 3 JD	1*			
3-5 JD	1.4	0.17	3.43	0.76
More than 5 JD	2.7	0.92	7.92	0.05
* Reference for other categories				

Table 4: Cross-tabulation of factors associated with Cholesterol level among university students in Northern Jordan (n=201)

Variable	*Cholesterol level*		*P value*
	Normal/ n (%)	High/ n (%)	
Gender			0.001
Male	61 (53.0)	54 (47.0)	
Female	66 (76.7)	20 (23.3)	
Age/year			0.001
<30	119 (67.2)	58 (32.8)	
≥30	8 (33.3)	16 (66.7)	
Marital status			0.018
Single	111 (66.9)	55 (33.1)	
Married	16 (45.7)	19 (54.3)	
Physical activity			0.001
Yes	66 (80.5)	16 (19.5)	
No	61 (51.3)	58 (48.7)	
BMI			0.002
Underweight	15 (100.0)	0 (0.0)	
Normal	75 (76.5)	23 (23.5)	
Overweight	29 (63.0)	17 (37.0)	
Obese	8 (19.0)	34 (81.0)	
Living status			0.040
With Family	79 (69.3)	35 (30.7)	
Private dormitory	48 (55.2)	39 (44.8)	
Daily pocket money			0.032
Less than 3 JD	15 (57.7)	11 (42.3)	
3-5 JD	75 (70.1)	32 (29.9)	
More than 5 JD	37 (54.4)	31 (45.6)	
Eat shawarma/week			0.001
Never	41 (78.8)	11 (21.2)	
1-3 times	76 (69.1)	34 (30.9)	
≥ 4 times	10 (25.6)	29 (74.4)	

A binary logistic regression analysis was performed to assess the association between demographic and lifestyle factors with increased total cholesterol level. Expectedly, eating fast foods and increased BMI were strong predictors of high cholesterol level. Those who ate shawarma more than 3 times a week had more than 8 folds to have hypercholesterolemia (OR=8.4; CI: 2.62-26.72), and obese students were more than 14 folds at higher risk to have the similar risk compared to those with normal BMI (OR=14.2; CI: 4.80-42.29). In addition, male students had doubled odds for having abnormal cholesterol level compared to females (OR=2.1; CI: 1.10-4.44). Other factors included participants' age and their physical activity level. Table 5 illustrates these significant associations.

Table 5: Logistic regression analysis of factors associated with increased total cholesterol level

Variable	*OR*	*95% Conf. Interval*		*P value*
		Lower	Upper	
Gender				0.05
Male	2.1	1.10	4.44	
Female	1*			
Age/year				
<30	1*			
≥30	3.6	1.11	11.59	0.032
BMI				
Normal	1*			
Overweight	1.9	0.85	4.38	0.11
Obese	14.2	4.80	42.29	0.001
Eating shawarma/week				
Never	1*			
1-3 times	1.2	0.50	3.26	0.60
More than 3 times	8.4	2.62	26.72	0.001
Physical activity				
Yes	1*			
No	2.5	1.10	5.86	0.028
* Reference for other categories				

Discussion

Eating fast food has dramatically increased among populations, especially adolescents and young adults. It has been implicated as a likely contributing factor to the growing obesity rates worldwide. The current study studied the associations between fast food consumption and total serum cholesterol level.

Fast food and cholesterol level

The prevalence of hypercholesterolemia in Jordan increased from 23.0% in 1994 (21) to 44.3% in 2017 (22). Close to previous statistics from the general population in Jordan, results of the current study revealed that about 37% of the sample had increased cholesterol level. However, as the sample was of young age, the prevalence of hypercholesterolemia was expected to be lower than that for the general population. This increase in the prevalence of hypercholesterolemia among young students could be explained by lifestyle changes and by changes in food consumption pattern. It has been reported that some groups in the population like adolescents and young adults are more likely to be more frequent fast food consumers (2). An increased risk of elevated total cholesterol concentrations has been observed with increasing frequency of eating away from home (23-25).

Concerning gender, males had a doubled risk of having increased cholesterol level compared to fe-

males (OR=2.1; CI: 1.10-4.44). This result is inconsistent with a recent study from Jordan [22] which reported females to have slightly higher odds for having increased cholesterol level compared to males. The inconsistency may refer to the difference in the samples between studies. The current study sampled university students who are exposed to fast food outlets more than the sample from the general population in the other study. Simultaneously, males may have greater exposure to fast food restaurants than females, especially for male students who live in private dormitories as they lack cooking experience compared to females.

Students whose age was ≥30 years were at higher risk to have increased cholesterol level (OR=3.6; CI: 1.11-11.59). This result is in agreement with Abujbara et al (2018) who found that about 41% and 53% of Jordanians aged 30-39 and 40-49 years has increased total cholesterol levels compared to about 30% among those younger than 30 years.

Concerning physical activity, students who were physically inactive were at higher risk for increased cholesterol level compared to those who were physically active (OR=2.5; CI: 1.10-5.86). Sedentary lifestyle increased the risk of dyslipidemia (26,27).

Fast food and BMI

Results of the current study shown significant statistical association between eating shawarma and overweight and obesity (*P*=0.004). This result is in agreement with previous studies from Arab countries (6,7). A causal relationship of fast food and obesity was reported among university students in Lebanon (8), Saudi Arabia (9), and Iran (28). More frequent consumption of fried foods is associated with a higher risk of developing overweight and obesity (29). This result support the findings of the current study as shawarma, in Jordan, is commonly served with fried potatoes as mentioned earlier.

Body mass index was a predictor of cholesterol level. Overweight students had a doubled risk of having increased cholesterol level and obese students had more than 14 folds similar risk compared to students with normal BMI. This result is in agreement with results of Abujbara et al (22). The greater the increase in body mass index the greater the abnormalities in lipid levels. Approximately, 60-70% and 50-60% of patients who are obese and overweight are dyslipidemic, respectively (30).

Factors associated with eating fast food

Factors significantly associated with the frequency of eating fast food included gender, living status, BMI, and daily pocket money of students. The frequency of eating fast food was significantly different for males than for females. Body mass indices of men were significantly higher than those of women. These results are congruent with results from previous study aimed at assessing sex differences in fast food consumption (31).

The results of the current study can be explained and supported by the nature of the conservative communities in Mediterranean region where some females still feel shy to eat outside. Moreover, females pay greater attention than males to their body weight for cosmetic reasons and other reasons associated with the opportunity to get married.

Students who study away from their families have difficulties in their eating styles and those who live in private dormitories are more prone to eat fast foods compared to students living with their families (32). This trend was seen in the current study revealing that about 37% of students who live in private dormitories eat shawarma more than 3 times/week compared to only 6% among those lived with their families. Study pressure, exams, lack of time, and lack of experience in preparing foods can play important role, as well.

Frequency of eating shawarma was significantly associated with students' daily pocket money. Economic status is one of determinants of takeaway and fast food consumption (33). Differences according to age and marital status were statistically insignificant.

To combat the adverse health impact of fast foods in Jordan, and other countries, it is the role of Food and Drug Authority (FDA) and Ministry of Health (MoH) to establish policies and guidelines of declaring the amount of calories intake of each

fast food meal or soft drink by type and size in all fast food restaurants. This piece of information should be visibly stated to costumers inside the restaurants and in all promotional materials. At the same time, surveillance and monitoring of the implementation and commitment to such policies are crucial. Besides, the government should be responsible for educating the public about the negative impact of fast food on their health. This might be conducted by using a variety of health education approaches involving health information messages through curricula at schools and universities, TV channels, awareness campaigns, and social media.

A limitation of the current study is the inability to generalize results over general population or other communities. Larger scale studies with longitudinal design can produce more accurate inference or a cause-effect relationship.

Conclusion

In the current study, shawarma consumption was significantly associated with increased total cholesterol level among university students. In addition, our study concluded that shawarma consumption was associated with increased body weight. At national and international levels, encouraging healthy lifestyle, healthy dietary habits, and physical exercise are crucial factors in preventing dyslipidemia.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that they have no conflict of interest.

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