Original Article

Fast Food Consumption, Liver Functions, and Change in Body Weight Among University Students: A Cross-Sectional Study

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Abstract

Background: Over the past decades, the consumption of fast foods has increased worldwide and became favored by people of most age groups. The objective of this research was to assess the impact of fast foods on liver enzyme levels and body weight. **Methods:** A cross-sectional study was conducted at Yarmouk University/Jordan using survey questionnaire and enquired university students about their dietary habits, in addition to laboratory investigations of liver enzymes. **Results:** In the cross-tabulation analysis, only age and body mass index (BMI) were significantly associated with alanine aminotransferase (ALT) enzyme level. However, all differences between aspartate aminotransferase (AST) level and other variables were statistically insignificant. The AST/ALT ratio was calculated and revealed significant statistical association with BMI of participants ($P = 0.001$). Change in body weight during one year was significantly associated with eating fast food ($P = 0.031$), drinking beverages with fast food meals ($P = 0.001$), and ALT level ($P = 0.026$). However, this association was statistically insignificant with AST level. **Conclusions:** Fast food consumption among university students in Jordan was not significantly associated with increasing levels of ALT and AST liver enzymes. However, eating fast food and drinking soft drinks were associated with increasing body weight, which is expected to have adverse effect on liver functions in the long term.

Keywords: *Fast foods, Jordan, liver, universities, 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]

In the public debate on fast food consumption, it is often argued that fast food is an important determinant of weight gain and obesity due to high fat content and the massive and widespread fast food industry. Therefore, scientific societies still recommend low-fat diets to promote overall health and the loss of excess bodyweight.[2] Several studies concluded that fast food intake predicts weight gain and obesity in all age groups.[3-8] However, some groups in the population, such as adolescents and young adults, are more likely to be more frequent consumers getting higher proportions of their total daily calories from fast food.[3] The high energy density and high glycemic index of fast foods may increase the prevalence of obesity and cardiovascular risk factors.[9] Nevertheless, a study on metropolitan transit workers reported that the association between fast food consumption and body weight was statistically insignificant.[10]

Eating fast food was found to be associated with weight gain in the Arab Gulf Region countries,[11] and other Arab countries.[12] Furthermore, a causal relationship of fast food and obesity was reported among university students in Lebanon[13] and Saudi Arabia.[14]

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 and nonalcoholic fatty liver disease.[15] Although serum liver enzyme elevation does not accurately measure liver damage, it may be a valuable marker to monitor development of liver disease.[16] In Sweden, it has been reported that increased alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels were associated with fast food consumption.[17] Another study in Germany concluded that excessive calorie intake is associated with

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abnormal ALT and AST levels.[18] A study conducted in Greece reported that adherence to the fast food type dietary pattern was independently associated with higher odds for liver disease.[19] Similar results were reported from Lebanon.[20]

It has been reported that nutrition transition is a crucial factor that can affect dietary habits, particularly in developing countries.[21] Jordan, as one of these countries, is experiencing alarming rates of obesity due to unhealthy dietary habits.[22] Several studies have been conducted to assess the impact of fast foods on health status of Jordanians. Results from these studies have revealed that fast foods are associated with increased risk of colorectal cancer,[23] overweight and obesity among adolescents,[24,25] overweight and obesity among university students,[26] and bacterial contamination of fast food sandwiches.[27]

Nevertheless, up to the researchers' knowledge, no studies have been conducted to assess the impact of fast foods on liver among Jordanians. In this article, we seek to identify the causal effect of fast food consumption on weight gain and levels of liver enzymes among university students. It was hypothesized that frequent fast food consumption would be associated with weight gain and increased levels of liver enzymes.

Methods

In a cross-sectional study, from June to September 2018, 256 university students were interviewed and asked about fast food consumption and other dietary habits. 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 for 4 months. A pilot-tested structured questionnaire was prepared and administered by the trained interviewers to collect information relevant to the current research problem. The questionnaire involved items on demographics, medical history, education level, average monthly family income, daily pocket money, and dietary habits. Educational brochures and pamphlets were distributed 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). To assess the liver function tests, 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 ice box and sent to the central laboratory (distance = 300 m from event location) for immediate analysis every hour during the event days. Analysis of blood samples was carried out via Beckman Coulter AU 480 using kinetic UV method based on the recommendations of the International Federation of Clinical Chemistry.[28] Serum liver enzymes AST and ALT were estimated, and normal kit ranges were: ALT and AST: <50 units per liter (U/L) for males (adult) and <35 U/L for females (adult). AST to ALT ratio was calculated as follows: <1 = Optimal, 1–1.49 = borderline, and ≥1.5 = abnormal.

Definition of fast food

It was made clear to participants that eating shawarma (a Middle Eastern most popular street foods meat preparation made of lamb, mutton chicken, turkey, beef, or veal), burgers, hot dog, and other familiar or habitual types of fast food in the Jordanian context are meant when they were asked about fast food consumption.

Ethical considerations

The study was approved by the Institutional Review Board at King Abdulla University Hospital in Northern Jordan (No. 15/2017). An 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 laboratory 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.

Statistical analysis

All statistical analysis was implemented using the Statistical package for social sciences (SPSS, version 20.0) with $P < 0.05$ considered statistical significance.

Results

Sociodemographic and clinical characteristics of the sample

Of the 201 subjects included in the study, about 58% ($n = 116$) were males and 42% ($n = 85$) were females. The majority of participants (85.1%) were younger than 30 years. About 42% of study subjects had overweight or were obese. Demographic and clinical characteristics of study population are shown in Table 1.

As noted in Table 1, the vast majority of the sample had normal levels of liver enzymes (92.5% and 96.5% for ALT and AST, respectively).

A cross-tabulation analysis was performed to assess the association between demographic characteristics and lifestyle factors with ALT and AST levels as shown in Tables 2 and 3, respectively.

As illustrated in Table 2, only age and BMI were significantly associated with ALT enzyme level. With respect to AST level,

Table 1: Demographic and clinical characteristics of study population (*n*=201)

Characteristic	*n* (%)
Gender	
Male	116 (57.7)
Female	85 (42.3)
Age/year	171 (85.1)
<30	30 (14.9)
≥30	
BMI	
Underweight	15 (7.5)
Normal	101 (50.2)
Overweight	52 (25.9)
Obese	33 (16.4)
ALT level	
Normal	186 (92.5)
High	15 (7.5)
AST level	
Normal	194 (96.5)
High	7 (3.5)
Living status	
With family	160 (79.6)
Dormitory or private	41 (20.4)
Eat shawarma/week	
Never	63 (31.3)
1-3 times	120 (59.7)
More than 3 times	18 (9.0)
Eat other types of fast food	
No	100 (49.8)
Yes	101 (50.2)
Daily pocket/JD	
<3	26 (12.9)
3-5	107 (53.2)
>5	68 (33.8)
Smoking status (if the participant smokes)	
No	122 (60.7)
Yes	79 (39.3)
Passive smoking (if a member in the family smokes)	
No	146 (48.7)
Yes	154 (51.3)

BMI=Body mass index

there were some differences between variables; however, all of these differences were statistically insignificant.

Surprisingly, eating different types of fast food was not associated with significant differences for both ALT and AST levels.

The AST to ALT ratio was calculated and revealed significant statistical association with BMI of participants; however, this correlation was insignificant for eating fast foods and change in body weight as illustrated in Table 3.

Table 2: Cross tabulation of demographic and lifestyle factors associated with ALT level in Northern Jordan (*n*=201)

Variable	ALT		*P*
	Normal *n* (%)	High *n* (%)	
Gender			0.203
Male	105 (90.5)	11 (9.5)	
Female	81 (95.3)	4 (4.7)	
Age/year			0.038
<30	161 (94.2)	10 (5.8)	
≥30	25 (83.3)	5 (16.7)	
BMI			0.050
Underweight	14 (93.3)	1 (6.7)	
Normal	98 (97.0)	3 (3.0)	
Overweight	44 (84.6)	8 (15.4)	
Obese	30 (90.9)	3 (9.1)	
Smoking status			0.473
No	115 (94.3)	7 (5.7)	
Yes	71 (91.7)	8 (8.3)	
Marital status			0.121
Single	154 (93.9)	10 (6.1)	
Married	32 (86.5)	5 (13.5)	
Eat fast food/week			0.550
Never	57 (88.5)	6 (11.5)	
1-3 times	113 (94.2)	7 (5.8)	
≥4 times	16 (88.9)	2 (11.1)	

A binary logistic regression analysis was performed to assess the association between demographic and lifestyle factors with ALT level. Remarkably, BMI and gender were significantly relevant to an increase in ALT level. Table 4 illustrates these associations.

Change in body weight during one year was tested for its correlation with dietary habits and levels of ALT and AST. As illustrated in Table 5, eating fast food, drinking beverages with fast food meals, and ALT level were all significantly associated with the change in body weight. However, this association was statistically insignificant with AST level.

Discussion

The problem of consuming 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 assessed the associations between fast food consumption on one side and major liver enzymes levels and change in body weight on the other side.

Surprisingly, consuming fast food was not significantly associated with differences in both ALT and AST enzyme levels. This result is inconsistent with results from a study conducted in Sweden on 18 persons and reported that increased ALT and AST levels were associated with fast

Table 3: Cross tabulation of AST/ALT ratio with eating fast foods or change in body weight in Northern Jordan (*n*=201)

Variable	AST to ALT ratio			*P*
	Optimal *n* (%)	Borderline *n* (%)	Abnormal *n* (%)	
Change in body weight				0.079
No change	20 (74.1)	3 (11.1)	4 (14.8)	
+ (1-5)	41 (77.4)	10 (18.9)	2 (3.8)	
+ (6-10)	24 (58.5)	12 (29.3)	5 (12.2)	
+ (≥11)	4 (44.4)	5 (55.6)	0 (0.0)	
− (1-5)	32 (69.6)	12 (26.1)	2 (4.3)	
− (6-10)	8 (72.7)	1 (9.1)	2 (18.2)	
− (≥11)	12 (85.7)	2 (14.3)	0 (0.0)	
Eat fast food/week				0.309
Never	39 (61.9)	18 (28.6)	6 (9.5)	
1-3 times	89 (74.2)	22 (18.3)	9 (7.5)	
≥4 times	13 (72.2)	5 (27.8)	0 (0.0)	
BMI				0.001
Underweight	14 (93.3)	0 (0.0)	1 (6.7)	
Normal	88 (87.1)	10 (9.9)	3 (3.0)	
Overweight	27 (51.9)	19 (36.5)	6 (11.5)	
Obese	12 (36.4)	16 (48.5)	5 (15.2)	

Table 4: Logistic regression analysis of demographic factors associated with increased ALT level

Variable	OR	95% Conf. Interval		*P*
		Lower	Upper	
Gender				
Female	1*	1.12	8.95	0.029
Male	3.17			
BMI				
Underweight	1*	0.103	8.73	0.047
Normal	0.926	0.333	25.34	
Overweight	2.90	0.430	35.21	
Obese	3.89			

*Reference for other categories

food consumption.[17] However, in this study, the conditions were completely different. The body weight of the intervention group increased between 5%–15% by eating at least two fast food based meals a day with the goal to double the regular caloric intake in combination with adoption of a sedentary lifestyle for 4 weeks. Moreover, the study from Germany concluded that excessive calorie intake is associated with abnormal ALT and AST levels.[18]

The study from Greece reported that eating fast food was independently associated with higher odds for liver disease.[19] Similar trend was reported in Lebanon.[20] However, studies from Greece and Lebanon did not assess ALT or AST levels. The discrepancy in results may refer to the fact that experimental group in the Swedish study had at least two fast food based meals a day for 4 weeks in combination with adoption of a sedentary lifestyle. However, participants in the current study were asked about the usual weekly consumption of fast food and their physical activity was not restricted. Moreover, the lifestyle factors in Western communities are different from those in the Jordanian context.

In the regression model, males were three times more likely to have increased ALT level compared to females. This result is consistent with previous results reporting that males have greater risk for having abnormal liver functions, chiefly ALT.[29-33] Furthermore, participants who were overweight and obese had an OR of 3 and 4 to have elevated ALT level, respectively. This result is in agreement with previous studies reporting similar trend.[34-36]

With respect to the change in body weight during one year, eating fast food, drinking beverages with fast food meals, and ALT level were all significantly associated with that change. In agreement with our results, previous results concluded that fast food is one of the most significant factors that played an important role in gaining weight and increasing the prevalence of overweight and obesity in Jordan,[24-26] the Arab Gulf Region countries,[11] and other Arab countries.[12] A causal relationship of fast food and obesity was reported among university students in Lebanon[13] and Saudi Arabia.[14] Moreover, in Iran, high intakes of fast foods were significantly associated with overweight among adolescent girls[37] and children.[38]

It has been reported that the use of fructose as a sweetener (e.g., in beverages) has been implicated in the increasing prevalence of liver disease and metabolic syndrome.[39] University students in India gained weight due to soft drink consumption.[40]

Conclusions

In the current study, fast food consumption among university students was not significantly associated with increasing levels of ALT and AST liver enzymes. However, we have found that fast food consumption and soft drinks were associated with increasing body weight, which is expected to have adverse effect on liver functions in the long term.

In the Jordanian context, more research is needed to establish causal relationship between fast food consumption and gaining weight, which may affect liver functions.

To combat the adverse health impact of fast foods in Jordan and other countries, it is the role of Food and Drug Authority and Ministry of Health to establish policies and guidelines for the fast food restaurants to announce about the amount of calories intake for each fast food meal or soft drink. This information should be visibly stated to customers inside the restaurants and in all promotional materials. Moreover, surveillance and monitoring of the implementation and commitment of such policies is crucial.

Table 5: Factors associated with change in body weight during 1 year (*n*=201)

Variable	Change in body weight during one year/kg							*P*
	No change	Increased			Decreased			
	0	1-5	6-10	≥11	1-5	6-10	≥11	
Eat fast food/week								0.031
Never	8 (12.7)	19 (30.2)	6 (9.5)	3 (4.8)	14 (22.2)	5 (7.9)	8 (12.7)	
1-3 times	17 (14.2)	31 (25.8)	28 (23.3)	3 (2.5)	30 (25.0)	5 (4.2)	6 (5.0)	
≥4 times	2 (11.1)	3 (16.7)	7 (38.9)	3 (16.7)	2 (11.1)	1 (5.6)	0 (0.0)	
ALT								0.026
Normal	23 (12.4)	53 (28.5)	35 (18.8)	7 (3.8)	43 (23.1)	11 (5.9)	14 (7.5)	
High	4 (26.7)	0 (0.0)	6 (40.0)	2 (13.3)	3 (20.0)	0 (0.0)	0 (0.0)	
AST								0.301
Normal	27 (13.8)	53 (27.3)	38 (196)	9 (4.6)	43 (22.2)	11 (5.7)	13 (6.7)	
High	0 (0.0)	0 (0.0)	3 (42.9)	0 (0.0)	3 (42.9)	0 (0.0)	1 (14.3)	
Drink beverages with fast food								0.001
Yes	11 (11.3)	36 (37.1)	35 (36.1)	6 (6.2)	7 (7.2)	1 (1.0)	1 (1.0)	
No	16 (15.4)	17 (46.3)	6 (5.8)	3 (2.9)	39 (37.5)	10 (9.6)	13 (12.5)	

Furthermore, the government is responsible for public education and awareness about the negative impact of fast food on health. This might be conducted by using a variety of health education approaches involving health information messages in the teaching curricula at schools and universities, TV channels, awareness campaigns, and social media.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent none and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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