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The Association of Trans Fatty Acids Intake and Obesity among College Students at the University of Jordan, Amman, Jordan

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ABSTRACT

Background: The increasing rates of obesity among young adults, particularly college students, have become a significant public health concern. Dietary habits, especially the consumption of trans fatty acids (TFAs) were shown to be correlated with an increase in obesity among populations undergoing lifestyle changes. Therefore, this study aimed to assess the dietary intake of TFAs and their association with obesity among a specific group of college students at the University of Jordan, Amman, Jordan.

Methods: In a cross-sectional study, 400 students were recruited through convenience sampling, from both genders aged 18-35 years, representing undergraduate and postgraduate students at the University of Jordan, Amman, Jordan. Dietary TFA intake was assessed using a semi-quantitative food frequency questionnaire (FFQ).

Results: The mean daily dietary intake of TFAs and the percentage of TFAs of total energy varied significantly among different body mass index (BMI) categories, including obese, overweight, and normal, with values of 2.67, 2.31, and 1.76 g/day and 1.2%, 1.0%, and 0.8%, respectively. The mean BMI increased significantly across TFA intake quartiles including 22.68±3.0 kg/m², 25.67±4.9 kg/m², 28.81±3.7 kg/m², and 30.61±5.3 kg/m², respectively. TFA intake level was significantly and positively associated with obesity risk [RR: 4.71 (3.15-7.03), $p<0.001$].

Conclusion: Higher intake of TFAs was positively linked to an increase in BMI among university students. These findings highlight the need for nutritional awareness regarding dietary TFAs intake and unhealthy eating habits in this population.

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Introduction

Over the past twenty years, global obesity rate among children and adolescents aged 5-19 years has quadrupled, increasing from 2% to 8%, while in adults aged 18 years and older, has doubled approximately from 7% to 16% (1). As obesity rate rises globally, regional data show increasing trend in Jordan too. Approximately three-quarters of both men and women in Jordan have been overweight or obese (2). Furthermore, the high prevalence of obesity among college students in Jordan has become a serious concern, indicating that the local obesity rate is alarming. Recently, it has been estimated that the occurrence of overweight or obesity was 30% in a selected sample of Jordanian university students (3).

This trend mirrors a wider global health crisis, as the ongoing obesity epidemic leads to many adverse health outcomes, lower quality of life, and over 2.8 million deaths annually (4). The main determinants of obesity-related non-communicable diseases (NCDs) were reported as obesity, hypertension, and hyperglycemia (5, 6). Lifestyle changes, including increased consumption of energy-dense foods and reduced physical activity, have accompanied this rise in obesity and related NCDs (7). In Jordan, these trends indicate a move away from the traditional Mediterranean diet, leading to a more sedentary lifestyle and increased fast-food consumption (8).

In this context, college students are particularly vulnerable to developing unhealthy eating habits due to academic challenges and the need to adapt to new environments and dietary routines (9, 10). Yun et *al.* conducted a cross-sectional study involving 300 university students to examine their eating patterns. The study revealed that snacking and eating fried foods occurred more frequently than the daily consumption of fruits and vegetables, which was commonly low (11). Similarly, in Jordan, a cross-sectional study was conducted to assess students' eating habits at the University of Jordan (UJ). The findings showed that the "snacking" dietary pattern accounted for the largest proportion of variance, which was typically characterized by high consumption of processed foods, sugar, and fat (12).

It is well established that a high-fat diet, especially one high in saturated fatty acids (SFAs), can lead to obesity (13, 14). Among dietary fats, trans fatty acids (TFAs) are unsaturated fatty acids with at least one double bond in the trans configuration. The chemical structure of TFAs is similar to that of SFAs, with a slight difference in the conformation of the carbon chain (15). This similarity in conformation could lead to a similar health effect. Trans fatty acids naturally originate (nTFAs) from dairy and meat fats or are industrially produced (iTFAs) through partial hydrogenation of vegetable oils and during heating processes (15).

Moreover, TFAs content varies among different food groups. Data from our previous study showed that the average TFAs level in food groups in Jordan ranged from 2.46g/100 g fat to 5.6 g/100 g fat. The highest TFAs content was found in baklava, burger, and shawarma. Additionally, TFAs content in traditional foods like Jameed and Arabic cheese was 3.64% and 4.8%, respectively (16). A study conducted to assess the link between dietary TFAs and body mass index (BMI) in healthy adults found that BMI increased by one point for every additional 2.3 grams of TFAs consumed each day (17). Although more than 278,000 deaths worldwide each year can be linked to high consumption of iTFAs worldwide (18), the connection between TFA consumption and obesity still remains controversial. In contrast, a study observed weak trends toward greater increases in waist circumference and total fat mass in the TFA group compared to the other fatty acids control group (19). This suggests that TFAs intake may not necessarily contribute to negative changes in body composition or obesity (19).

Several estimates of TFA intake were based on outdated or incomplete databases. Additionally, TFA intake was assessed using food frequency questionnaires (FFQ). A limitation of FFQ is that the accuracy of TFA intake measurements can be questionable. Data on TFA intake and its link to obesity in developing countries are outdated and limited (8). Therefore, this study aimed to assess the dietary intake of TFAs and their association with obesity among a selected group of UJ students aged 18 to 35 years in Amman, Jordan.

Materials and Methods

This cross-sectional study was conducted to evaluate the association between dietary TFAs intake and obesity among students at the UJ. A convenience sample of 400 students, aged 18–35 years, was recruited. Recruitment was undertaken over five months from August to December 2024. The study was conducted at a single center (UJ), and data were collected in person using a structured questionnaire administered by a trained interviewer. All participants, of either sex, aged 18-35 years, were selected using a convenience sampling technique. Participants were chosen from all nineteen faculties at UJ, including the Health, Scientific, and Humanitarian fields. The students were contacted at the colleges. Inclusion criteria were normal, overweight, or obese students aged 18-35 years of either sex who were free of diabetes mellitus (DM) or chronic diseases. Exclusion criteria were BMI less than 18.5 kg/m², those diagnosed with Type 1 diabetes mellitus (T1DM) or Type 2 diabetes mellitus (T2DM), endocrine disorders, and chronic diseases such as liver, kidney, and pulmonary diseases. It also excluded individuals with coronary heart disease (CHD), heart failure, and peripheral vascular disease (20), polycystic ovary syndrome (PCOS) (21), athletes (22), smokers (23), alcohol drinkers, or those taking medications that influence body weight, insulin resistance or lipid profiles (24).

Each participant was personally interviewed using a structured questionnaire to collect information on demographic data, including personal details and medical history. Physical activity level was measured with the International Physical Activity Questionnaire (IPAQ) questionnaire. Since all participants were classified as having low physical activity, physical activity was not included as a covariate in the statistical analyses. Each participant was personally interviewed using a structured semi-quantitative FFQ to assess TFA intake over the past four weeks. It was adapted and tailored to the typical Jordanian daily meal pattern as described by Mashal *et al.* (25).

Additional information about the cooking method, sauces or dressings added, and the type and amount of fat used was also documented. Eventually, the FFQ was made sensitive to fat intake. The FFQ included over 90 food items and was divided into 9 food groups. The content validity of the FFQ was evaluated, and a pilot study was conducted to standardize the assessment tool and determine its reliability. The Cronbach's alpha coefficient was σ=0.621 for 30 items. The frequency of each food item consumed daily and weekly was recorded. All participants were asked to answer questions about their usual portion sizes and how frequently they consumed food items. Estimation of portion sizes was conducted using visual aids and food models to minimize errors. Food processor software of ESHA was used to estimate TFA intake. The TFA content of foods was updated with a food database from previous researches (25-27).

Dietary intake of TFAs was reported in grams per day, as a percentage of fat energy, and as a percentage of total energy. The contribution of each food group (FG) to TFA intake was calculated by dividing the TFA intake from that specific FG by the total TFA intake, then multiplying by 100. Anthropometric measurements, such as height and body weight were collected for each participant. Body weight and height were measured and recorded following a standardized procedure by a well-trained nutritionist. Weight was measured using a portable digital body composition scale analyzer (Huawei Smart Scale 3, China). BMI was calculated using the formula of BMI=weight/height^2 (kg/m^2). It was classified according to the World Health Organization (WHO) guidelines as normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (>30 kg/m^2) (1). The protocol was approved by the Institutional Review Board (IRB) of the Deanship of Scientific Research at the UJ (No. 256/2024). All data were collected confidentially. Written informed consent was obtained from all participants prior to their interviews.

The Statistical Package for the Social Sciences (SPSS) for Windows 20.0 software (version 20.0, IBM, Inc., Chicago, IL, USA) was used for the statistical analyses. Assessing data normality was a prerequisite for many statistical tests. The Shapiro-Wilk test was used to test normality for all predictors. Therefore, based on the normality test, the group differences were examined using parametric and non-parametric analysis as appropriate. Mean and standard deviation (SD) were calculated for continuous variables, whereas categorical variables were reported as counts and frequency distribution (%). Differences between groups were estimated using analysis of variance (ANOVA) or Chi-square (χ^2) as appropriate. Bivariate correlations between BMI and dietary intake were assessed using Spearman's correlation. To examine the association between BMI (dependent variable) and other indicators (independent variables), linear regression models were used. Logistic regression was used to examine the relationship between TFA intake and obesity risk. *P* values of <0.05 were considered significant.

Results

Demographic and anthropometric characteristics of the sample population were shown in Table 1. All subjects were classified based on BMI as normal, overweight, or obese. There were significant differences in the mean age among the three BMI groups ($p<0.05$), with an average age of 21.1±2.13 years. The study included 112 (28.00%) males and 288 (72.00%) females. The percentages of overweight and obese females (25.75% and 20.5%) were significantly higher than those of males (12.25% and 6.75%), respectively. Approximately 96.75% of the participants were bachelor's degree students, while only 3.25% were postgraduate students. Approximately 38% were overweight, and 27.25% were obese.

Table 2 displays the average total energy and macronutrient intake, including TFAs and their caloric contribution, across different BMI categories of the study participants. The results showed no significant differences ($p>0.05$) among the normal, overweight, and obese groups regarding total energy intake (1915.9±542.6, 2017.3±651.9, and 2097.7±573.2 Kcal, respectively), carbohydrate intake (184.2±66.6, 190.4±75.6, and 198.0±66.4 g/day, respectively), fat intake (101.4±33.0, 107.0±33.6, and 109.0±29.4 g/day, respectively), and fat energy (912.5±296.8, 962.8±302.3, and 980.6±264.3 Kcal, respectively).

Table 1: General characteristics of study population.

Variable	Category	Normal weight n=139 n (%)	Overweight n=152 n (%)	Obese n=109 n (%)	Full sample n=400 n (%)	*P* value
Age*		20.81±2.02	21.49±2.51	20.91±1.53	21.10±2.13	0.010
Gender	Male	36 (9.00)	49 (12.25)	27 (6.75)	112 (28.00)	0.321
	Female	103 (25.75)	103 (25.75)	82 (20.50)	288 (72.00)	
	Total	139 (34.75)	152 (38.00)	109 (27.25)	400 (100.00)	
Educational level	Bachelor	135 (33.75)	144 (36.00)	108 (27.00)	387 (96.75)	0.440
	Post- graduate	4 (1.00)	8 (2.00)	1 (0.25)	13 (3.25)	
	Total	139 (34.75)	152 (38.00)	109 (27.25)	400 (100.00)	
Physical activity	High	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	
	Moderate	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	
	Low	139 (34.75)	152 (38.00)	109 (27.25)	400 (100.00)	1.000

*Data were presented as mean±SD.

Table 2: Mean Total energy and macronutrient intake.

Variable	BMI categories			
	Normal n=139	Overweight n=152	Obese n=109	*P* value
	Mean±SD	Mean±SD	Mean±SD	
Total energy (Kcal)	1915.9±542.6	2017.3±651.9	2097.7±573.2	0.060
Protein (g/day)	69.6±23.2	76.6±30.1	84.8±30.3	0.001
Carbohydrate (g/day)	184.2±66.6	190.4±75.6	198.0±66.4	0.300
Fat (g/day)	101.4±33.0	107.0±33.6	109.0±29.4	0.150
TFAs (g/day)	1.8±0.6	2.3±0.8	2.7±0.8	0.001
% of TFAs of fat energy	1.8±0.4	2.2±0.4	2.5±0.4	0.001
% of TFAs of total energy*	0.8±0.1	1.0±0.1	1.2±0.2	0.001

Abbreviations: BMI: Body Mass Index, g: Gram, Kcal: Kilo calories, TFAs : Trans fatty acids. Statistical significance when $p<0.05$. *Percent of total TFA/100 g fat of food items consumed daily (gTFA/100 g fat/day).

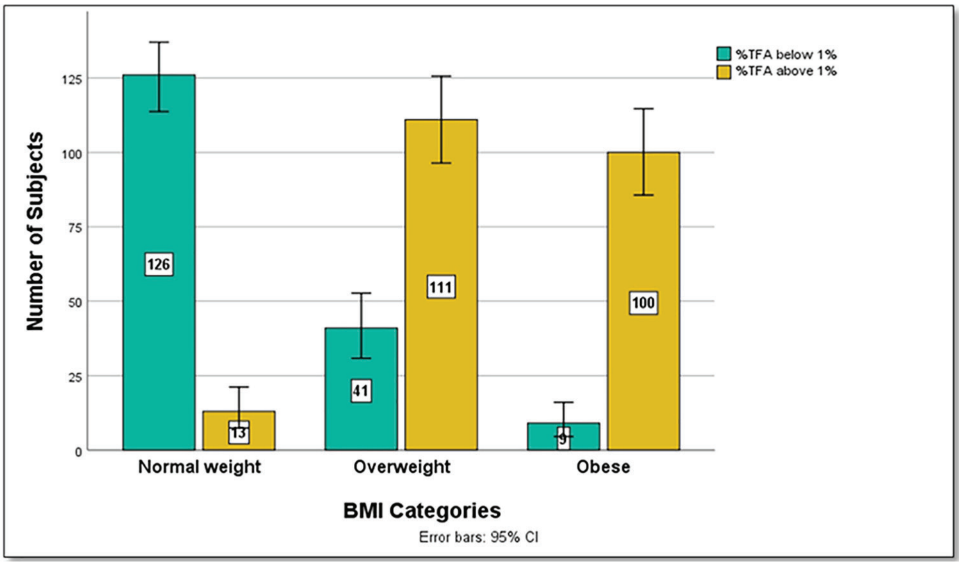

Figure 1: Number of subjects in body mass index categories by TFA% of total energy.

However, there are significant differences ($p<0.05$) among the groups for protein intake (69.6±23.2, 76.6±30.1, and 84.8±30.3 g/day, respectively), TFAs intake (1.8±0.6, 2.3±0.8, and 2.7±0.8 g/day, respectively), TFAs% of fat energy (1.8±0.4, 2.2±0.4, and 2.5±0.4%, respectively), and TFAs% of total energy (0.8±0.1, 1.0±0.1, and 1.2±0.2%, respectively). As shown in Figure 1, about 73% of overweight subjects and 92% of obese subjects consumed more than the recommended TFAs intake. Conversely, approximately 91% of normal-weight subjects consumed less than the recommended TFAs intake.

Table 3: The correlations among selected variables of the sample population.

Variable	BMI	Total energy intake (Kcal)	Protein (g/day)	CHO (g/day)	Fat (g/day)	TFAs (g/day)	TFAs of fat energy%	TFAs of total energy%
BMI	1	0.15	0.23	0.11	0.13	0.47	0.60	0.64
Total energy (Kcal)	-	1	0.87	0.92	0.90	0.82	0.22	0.07
Protein (g/day)	-	-	1	0.79	0.70	0.77	0.35	0.15
CHO (g/day)	-	-	-	1	0.70	0.73	0.29	0.00
Fat (g/day)	-	-	-	-	1	0.76	0.02	0.10
TFAs (g/day)	-	-	-	-	-	1	0.62	0.59
TFAs of fat energy%	--	-	-	-	-	-	1	0.81
TFAs of total energy%	-	-	-	-	-	-	-	1

Abbreviations: BMI: Body Mass Index, g: Gram, Kcal: Kilo calories, TFAs : Trans fatty acids. Values were statistically significant at $p<0.05$.

Table 4: The association between body mass index and selected variables in all subjects.

Variables	β- coefficients	*P* value
TFAs (g/day)	2.717	0.001
% of TFAs of total energy	15.726	0.001
Fat energy (Kcal)	0.002	0.047
TFAs energy (Kcal)	0.302	0.001

Abbreviations: BMI: Body Mass Index, g: Gram, Kcal: Kilo calories, TFAs : Trans fatty acids. Dependent variable: Body mass index (BMI). Statistically significant when $p<0.05$.

The Spearman correlation analyses were presented in Table 3 as bivariate correlations and were not adjusted for potential confounders such as age or gender. BMI was positively and significantly correlated with total energy intake ($r_s=0.15$, $p=0.003$), protein ($r_s=0.23$, $p<0.001$), carbohydrate ($r_s=0.11$, $p=0.031$), fat ($r_s=0.13$, $p=0.011$), and TFAs intake (g/day) ($r_s=0.47$, $p<0.001$), TFAs% of fat energy ($r_s=0.60$, $p<0.001$), and % of TFAs of total energy ($r_s=0.64$, $p<0.001$). Furthermore, total energy intake was positively and significantly correlated with protein ($r_s=0.87$, $p<0.001$), carbohydrate ($r_s=0.92$, $p<0.001$), fat ($r_s=0.90$, $p<0.001$), TFAs (g/day) ($r_s=0.82$, $p<0.001$), and % of TFAs of fat energy ($r_s=0.22$, $p<0.001$).

Linear regression analyses were performed. The estimated changes in BMI for each unit change in the independent variables (regression coefficients) were demonstrated in Table 4. TFA (g/d), the percentage of TFA in total energy, fat energy (Kcal), and TFA energy (Kcal) were included as independent variables; while BMI served as the dependent variable. An increase of 1 g of TFA was associated with a 2.71-unit increase in BMI (β=2.717; $p<0.05$). These relationships between daily TFA intake, TFA% of total energy, and BMI were illustrated in Figure 2 and Figure 3, respectively.

To calculate the percentage contribution of each FG to TFAs intake, dietary TFAs were categorized into 9 FG (Figure 4). Milk and milk products contributed the most to TFAs (25.63%), followed by fast foods (21.25%), meat and meat products (15.17%), and oils and fats (14.54%). Other food groups contributing less to dietary TFAs intake included sweets (10.02%), bread and grains (5.27%), snacks (3.20%), soups (2.49%), and Arabic sweets (2.43%).

To examine the relationship between TFA intake and BMI, subjects were divided into quartiles based on their percentage of TFA intake of total energy (Figure 5). The average BMI increased significantly across the quartiles of TFA intake ($p<0.005$). The mean BMI was 22.68±3.0 kg/m², 25.67±4.9 kg/m², 28.81±3.7 kg/m², and 30.61±5.3 kg/m² across the quartiles, respectively. A dose-response trend was observed, showing that higher TFA intake was linked to higher BMI values.

To examine the relationships among TFA intake levels, selected conventional predictors, and obesity risk, binary logistic regression models were used. In these models, the groups of obese and normal-weight individuals were included as the binary dependent variable and coded as 1 and 0. The relative risks (RR) for subjects with obesity compared to those with normal weight in the presence of selected predictors were shown in Table 5.

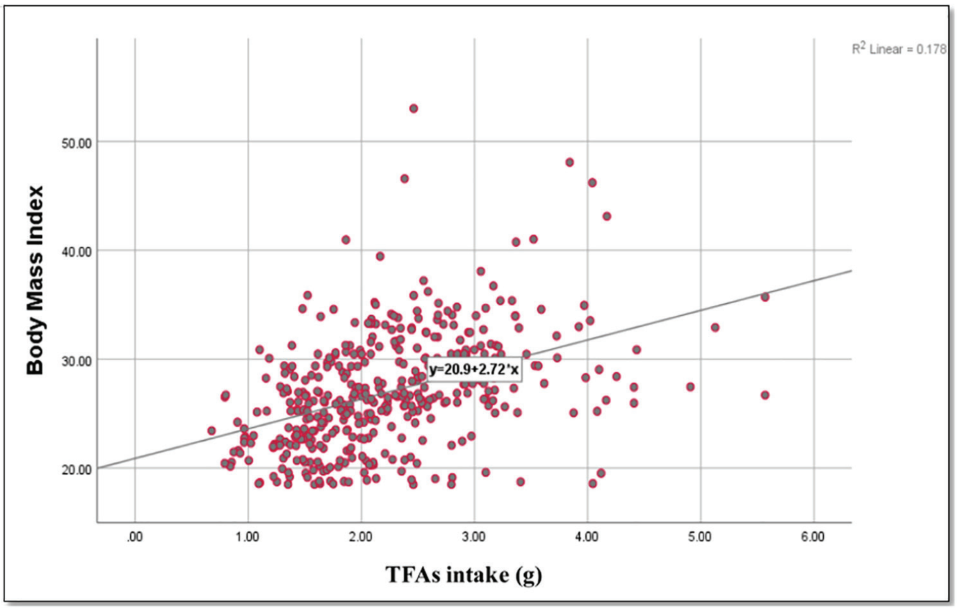

Figure 2: The Association between daily TFAs intake (g/day) and body mass index.

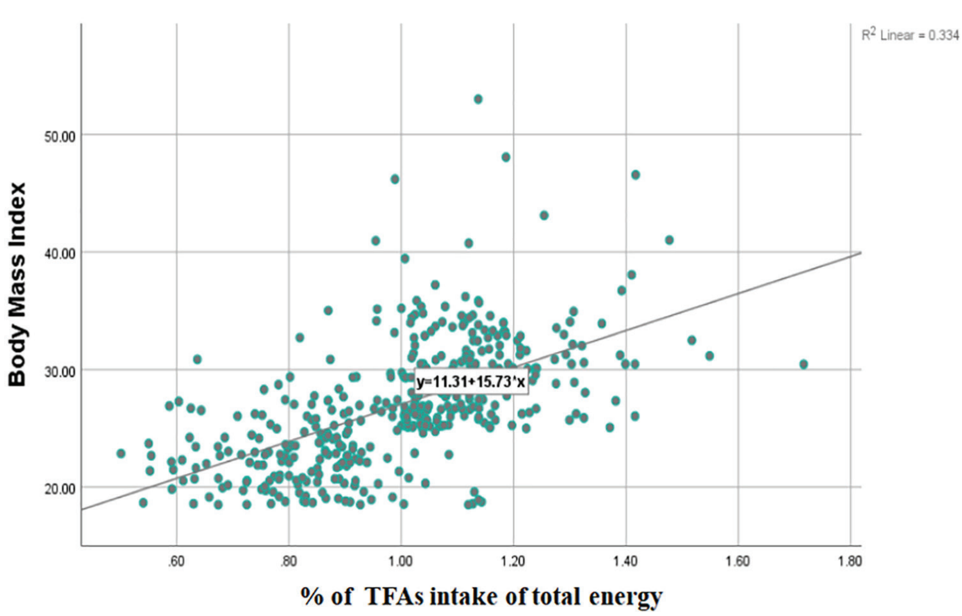

Figure 3: The Association between % trans fatty acids of total energy and body mass index (BMI).

When all indicators were included in the model, only age [RR: 1.14, 95%CI: 02-1.28, *p*=0.01] and TFA intake level [RR: 4.98, 95%CI: 3.29-7.53, *p*<0.001] were associated with obesity risk. Even after adjusting for dietary intake of TFAs, total energy intake showed no association with obesity risk [RR=1.00, 95%CI:1.00–1.01, *p*<0.001]. Although the *p* value was significant, the 95% confidence interval (95%CI) included the value of one (null value), which indicated no effect. The RR for obesity was also analyzed in a single logistic regression. In this model, TFA intake levels were significantly positively associated with obesity risk [RR: 4.71, 95%CI: 3.15-7.03, *p*<0.001].

Discussion

In this study, the prevalence of overweight and obesity was approximately 38% and 27%, respectively. The prevalence of overweight/obesity was higher in females (~46%) than in males (19%), with a difference of 27%. The prevalence rate of overweight and obesity among Jordanian students was 18.8% and 4.5%, respectively. Overweight and obesity were shown to be more common among male students compared to females (28). The findings from a recent study revealed that overweight/obesity was more common among males (45.5%) compared to females (31.3%) of university students in Bangladesh (29).

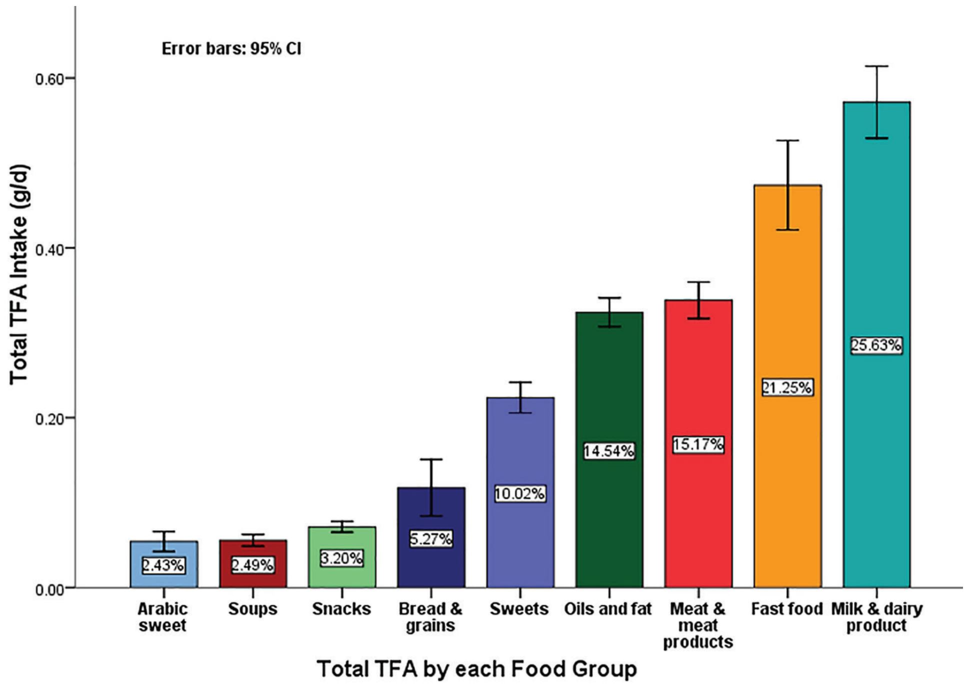

Figure 4: Contribution of trans fatty acids from selected food groups.

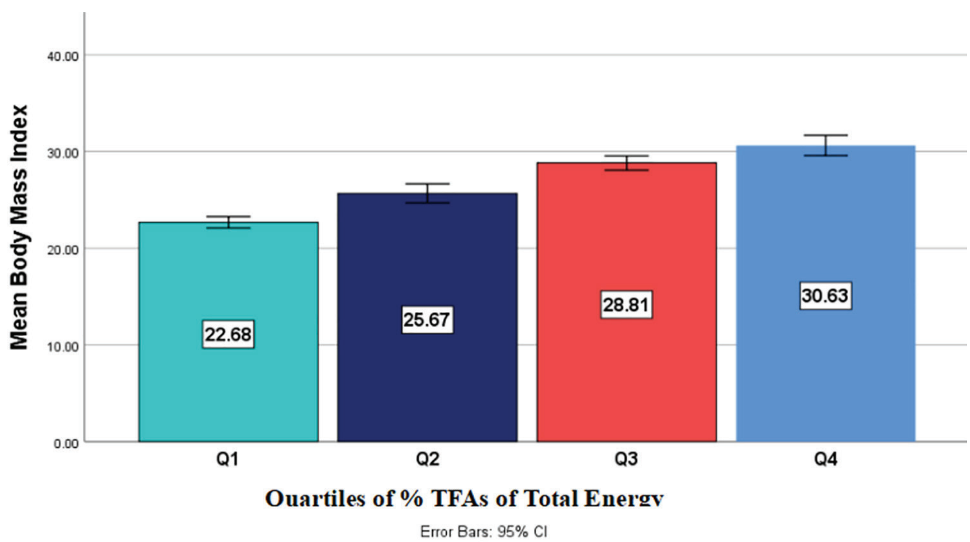

Figure 5: Mean BMI across quartiles of % trans fatty acids intake of total energy.

Table 5: Relative risks for obesity in a selected sample of University of Jordan (UJ) students.

Predictor	Odds ratio (95%CI)	*P* value
Age	1.14 (1.02-1.28)	0.010
Gender (M/F)	0.85 (0.50-1.45)	0.560
Total energy intake[1]	1.00 (1.00-1.01)	0.001
Dietary TFA intake g/day[2]	4.98 (3.29-7.53)	0.001

1: Controlling for TFA intake levels. 2: Controlling for total energy intake. TFA: Trans fatty acids. M: Male. F: Female.

This discrepancy in our results regarding gender differences may be due to a higher proportion of females in our sample. Sedentary lifestyles and increased access to processed foods are considered major contributors to the epidemic of obesity (30, 31).

In this context, the dietary intake pattern of our sample population was evaluated. Total energy intake was insignificantly higher in overweight and obese participants. However, a cross-sectional study involving a total of 450 Saudi female students from the University of Tabuk, Tabuk, Saudi Arabia showed that the timing of energy intake was associated with overweight and obesity risk. Greater energy intake at dinner was positively associated with obesity, whereas greater energy intake at breakfast was negatively associated with overweight and obesity (32).

The present study showed that the mean % of TFAs in total energy intake among overweight and obese students was 1.0% and 1.2%, respectively, exceeding the WHO recommendation of less than 1% of total energy intake. In contrast, normal-weight students' mean TFAs intake was 0.8%, which falls within this recommended limit. This pattern is further emphasized by the high proportion of overweight (73%) and obese (92%) students who consumed above the WHO's recommended TFAs intake limit. This high consumption likely results from a shift toward a Western lifestyle in Jordan, especially among university students. Their eating habits now mainly consist of a high intake of fast food, a major source of TFAs (25).

Similarly, a previous case-control study was conducted in Jordan in 2017 to investigate the relationships between dietary intake of TFAs and obesity among school children. The results showed that the average percentage of TFAs was 2.38±1.52% of total energy for all participants, which exceeds the WHO limit for TFA intake (33). However, a systematic review conducted in 2017 found that 76% of all countries included had an average TFA intake below 1% of total energy (34). This reduction in TFA intake in these countries can be attributed to the implemented regulations on trans fat use in industry. However, Jordan remains a high consumer of TFAs among countries in WHO's EMR, and TFA intake in Jordan exceeds the WHO limit (35).

Given the overall TFA intake established in our study groups, it is important to identify the main dietary sources contributing to these levels. This study revealed that milk and milk products, fast foods, and meat and meat products were the main contributors, accounting for approximately 25.63%, 21.25%, and 15.17% of total TFAs intake, respectively. Milk and milk products were the highest contributors across food groups. This may be due to the high contribution of milk, yogurt, Jameed, animal butter, white and processed cheese, and ice cream in the Jordanian eating pattern. Furthermore, frequent and high consumption of fast foods such as sandwiches, bakeries, and fried foods among college students seems to increase the contribution of the fast food group to daily TFAs intake (16).

Similarly, Mashal *et al.* showed that fast food, meats, and dairy products were major contributors to TFAs intake in a selected sample of Jordanian subjects. This dietary trend highlights a potential public health concern, linking TFAs intake with increased risk of obesity (25). Data from a recent study suggested that dietary intake plays a far greater role than reduced physical activity in the elevated obesity prevalence associated with economic development (36). However, our data showed that the majority of our sample had low levels of physical activity, which may mask the actual effect of physical activity on obesity.

The present study also demonstrated the strength and direction of the link between TFAs intake and obesity. Our findings showed that BMI was moderately and strongly correlated with both daily TFA intake (g/day) and TFAs% of total energy (r_s=0.47 and r_s=0.64; p<0.05, respectively). Consistent with the correlations observed above, a significant positive association was found for every 1% increase in TFA% of total energy intake. BMI was independently associated with an increase of 15.7 kg/m² (β=15.7) (p<0.05). Similarly, for each 1 g of daily TFA intake, BMI increased by 2.7 kg/m² (β=2.7) (p<0.001). This association aligns with the findings of a cross-sectional study involving 1018 adults aged 20-85 years. The results showed that each gram per day of TFAs was linked to a 0.44 increase in BMI (17).

Furthermore, a clear and consistent dose-response relationship was observed in the present study, with the mean BMI gradually increasing from the lowest (22.68 kg/m²) to the highest quartiles (30.63 kg/m²) of TFAs intake. These findings suggest that higher dietary TFAs intake to be associated with a stepwise increase in BMI in this population. In the present study, the likelihood of having obesity has increased by almost 5 folds as dietary TFAs intake increases [RR: 4.71 (3.15-7.03), p<0.001]. In line with this, children and adolescent patients who exceeded the iTFAs intake recommendation of 1% of energy experienced a fivefold increase in central adiposity (37), including meta-analyses performed by de Souza *et al.* (38).

This review consistently reported that higher TFA intake was linked to an elevated risk of all-cause mortality, cardiovascular disease (CVD), and associated mortality, coronary heart disease (CHD), ischemic stroke, and T2DM. The consistent direction and significance across both linear regression (for BMI) and logistic regression (for obesity risk) models strengthen the argument for TFA intake as an important dietary factor in developing obesity. Although these are observational findings and do not establish direct causation, they offer compelling epidemiological evidence supporting ongoing public health efforts to reduce TFA consumption.

The observed relationship between TFA intake and BMI could be due to its influence on the regulation of many physiological processes, such as lipid metabolism, inflammation, oxidative stress, endoplasmic reticulum (ER) stress, autophagy, and apoptosis. This dysregulation has been proposed as a potential underlying mechanism that may contribute to the negative effects of TFAs on obesity and cardiometabolic health (39). Obesity and TFAs have a complex relationship involving various behavioral, hormonal, and metabolic factors. TFAs can contribute to increased abdominal fat and weight gain, which are associated with a higher risk of obesity. TFAs promote visceral fat accumulation in the abdominal area. This is because TFA consumption may increase the genetic susceptibility of obesity-related genes, particularly FTO single-nucleotide polymorphisms, to changes in waist circumference or BMI (40). Furthermore, high TFAs diets tend to cause fat to accumulate in the liver rather than in fat tissue. In response, fat tissue may try to compensate by producing more fat through de novo lipogenesis. However, the specific mechanisms that direct fat to the liver remain unclear (39).

Assessment of TFA intake was estimated through FFQs, which are susceptible to recall bias and may yield estimates of questionable validity regarding measurement error and the imprecision of both qualitative and quantitative estimates of fat in foods. Factors such as cooking methods, industry supply, and incomplete food composition tables influence the fatty acid composition of specific foods. The majority of our sample had low levels of physical activity, which may mask the actual effect of physical activity on obesity.

The study did not include objective biomarkers (e.g., serum TFAs concentrations) to validate dietary intake, which may limit the reliability of intake assessment. Furthermore, these findings are based on a specific population (e.g., college students); hence, they could not be generalized to populations with different age groups, dietary patterns, and cultural habits. Therefore, prospective studies examining the temporal relationship between TFAs intake and weight gain or obesity development over time are needed. Additionally, integrating objective biomarkers of TFAs intake to validate self-reported data and strengthen the findings was not evaluated. Future studies including more diverse age groups, genders, and socio-economic backgrounds are recommended to enhance the generalizability of findings across different populations.

Conclusion

This study revealed a positive association between TFA intake and obesity among university students in Jordan. The results emphasized the potential obesity risks linked to consuming foods high in TFAs. These findings highlight the importance of public health strategies, including nutritional education and counseling to reduce TFA intake, as well as policy regulations to limit TFA content in commonly consumed foods. Further long-term prospective studies are recommended to establish causality and identify effective prevention methods.

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Authors' Contribution

O.A.D: Conceptualization, Data Collection, Data Analysis & Interpretation, and Writing – original draft. R.H.Mashal: Conceptualization, Methodology, Data Analysis & Interpretation, Writing – review and editing, and Supervision. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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