Asociaciones entre el patrón dietético, el estatus socioeconómico y la obesidad en adultos jóvenes jordanos: un estudio transversal

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Resumen

Fundamentos: La transición dietética ha contribuido al aumento de la prevalencia de la obesidad, particularmente entre los adultos jóvenes. Este estudio evalúa la relación entre los patrones dietéticos, el estatus socioeconómico y la obesidad en adultos jóvenes jordanos**.**
Métodos: Se realizó un estudio transversal con 214 participantes jóvenes. Se utilizaron un cuestionario estructurado, mediciones antropométricas y un registro de alimentos de 3 días. Se empleó la correlación de Pearson para explorar la relación lineal entre las variables**.**
Resultados: Los resultados muestran que el 40% de los hombres son obesos en comparación con el 19,1% de las mujeres. Los hombres tenían una ingesta de energía significativamente mayor (3089,1 ± 362 kcal, p = 0.000). Además, el 76,6% de los participantes no cumplió con el requerimiento diario de ingesta de calcio, y el 81,9% de las mujeres no alcanzó la ingesta recomendada de hierro. El ingreso familiar se asoció inversamente de manera significativa con el índice de masa corporal (r = -0,167; p < 0,05), y la educación materna se asoció inversamente con la relación cintura-cadera (r = -0,048; p < 0,01)**.**
Conclusiones: El estudio resalta el impacto de los factores socioeconómicos en la obesidad. Una proporción considerable de participantes no cumplió con el requerimiento diario de nutrientes esenciales, lo que resalta el efecto potencial en la salud a largo plazo. Existe una necesidad de intervenciones específicas para promover patrones dietéticos saludables.

Palabras clave: Obesidad; Patrones Dietéticos; Encuestas de Nutrición; Jordania; Adultos Jóvenes.

Associations between Dietary Pattern, Socioeconomic Status, and Obesity among Jordanian Younger Adults: A Cross-sectional Study

Summary

Background: Dietary transitions have contributed to the increasing prevalence of obesity, particularly among younger adults. The study evaluates the relationship between dietary patterns, socioeconomic status, and obesity among Jordanian younger adults**.**
Methods: A cross-sectional study was conducted on 214 younger adult participants. A structured questionnaire, anthropometric measurements, and a 3-day food record were used. Pearson correlation was used to explore the linear relationship between variables**.**
Results: The results show that 40% of males are obese compared to 19.1% of females. Males had significantly (p = 0.000) higher energy intake (3089.1 ± 362 kcal)**,** 76.6% of participants did not meet the daily requirement of calcium intake, and 81.9% of females did not meet iron intake. Family income was significantly inversely associated with body mass index (r= - 0.167**,** p < 0.05), and mother education was significantly inversely associated with waist-hip ratio(r= - 0.048**,** p < 0.01)**.**
Conclusions: The study highlights the impact of socioeconomic factors on obesity. A considerable proportion of participants did not meet the daily requirement of essential nutrients, which highlights the potential effect on long-term health. There is a need for targeted intervention to enhance healthy dietary patterns**.**

Key words: obesity; Dietary patterns; Nutrition surveys; Jordan; Young adult.

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Introducción

During younger adulthood, individuals experience physical maturity with specific nutritional needs to support their health and prevent obesity and related chronic diseases. The prevalence of obesity and overweight increases rapidly during this stage (1). The transition from adolescence to adulthood and living independently from parents has been linked to changes in dietary habits, including reduced consumption of fruits and vegetables (2). Additionally, factors such as the availability of unhealthy food options in the workplace and the influence of friends' attitudes can affect dietary choices (3).

Dietary patterns refer to foods and beverages consumed over a specific period (4). Dietary patterns are a complementary approach that represents the synergistic effects of food and nutrients on long and short-term health outcomes (5). Urbanization led to a rapid transition in dietary patterns (6) from traditional starchy staple food, fruit, and green leafy vegetables (7) Western diet, which is characterized by high consumption of processed foods, red meat, refined grains, sugary desserts and beverages, edible oil, and fried food (8). The negative effects of adopting a Western diet have been recognized in low and middle-income countries. The changes in dietary patterns, consumption toward fast and processed food among the largest population are accompanied by health-related diet problems and social and economic costs (9). Moreover, evidence from developing countries suggests a link between the Western diet and increasing the prevalence of cardiometabolic risk. However, unhealthy dietary patterns often provide excess calories with a lack of essential nutrients contributing to the development of obesity, diabetes, and cardio-metabolic disorders (10).

The shifting of dietary patterns has both short and long-term health effects and provides valuable insight into the potential increased prevalence of non-communicable diseases such as cardio-metabolic disorders, obesity, and diabetes type II, which put pressure on public health intervention. Jordan like other developing countries experiences a transition from traditional dietary patterns to fast processed food. In addition, most of the previous studies explore dietary patterns among the adult population, and lack of studies exploring dietary patterns in younger adulthood. Therefore, this study evaluated the relationship between dietary patterns, socioeconomic status, and obesity among Jordanian younger adults.

Material y métodos

Study design

A cross-sectional study was conducted among (214) participants in younger adulthood (18-21 years) during the period from November 2023 to May 2024 in different areas in Amman. Participants willing to complete a dietary diary were recruited for the study. The study was conducted following the declaration of Helsinki. The Institutional Review Board of Jerash University approved the study protocols (9/2/6/2955). At enrollment, written informed consent was obtained from the participants.

Data collection procedure

The data was collected using a structured questionnaire that included, the participant's socioeconomic data; age, sex, parental education and employment status, size of the family, and monthly household income.

Anthropometric measurements

Qualified researchers perform anthropometric measurements according to the standard protocols (11) by the calibrated

scale (TCS height measure electronic body weight). The participant's weight was measured with light clothes and bare feet. The participants were asked to stand in the center of a calibrated scale. The mean value of two measurements was obtained and recorded to the nearest 0.1 kg.

The height was measured with the participant standing upright without shoes and their heels against the stadiometer with their head in a horizontal Frankfort position. The mean of the two measurements was recorded to the nearest millimeter.

Body mass index (BMI) was calculated based on weight divided by squared height in meters. BMI classification was as follows: < 18.5 was considered underweight, healthy 18.5 and 24.9, overweight 25-29.9, and obese ≥ 30 (12).

The waist circumference (WC) was measured by flexible non-stretch tape and the participants were asked to wear light clothes and stand with their feet together. The measurement was taken at the end of normal expiration at the midpoint between the iliac crest and the margin of the lowest palpable rib. The mean of two measurements was taken to the nearest millimeter. The WC below 94 cm in males was considered normal and below 80 cm in females (13). Hip circumference (HC) was measured while the participants stood upright and their feet were about shoulder width. The flexible tape was placed at the level of the widest part of the buttocks. The mean of two measurements was recorded. The normal range of males' HC from 85-100 cm, and females from 90-105 cm.

The waist-hip ratio (WHR) was calculated by dividing the waist (cm) by the hip circumference (cm). The WHR > 0.90 in males and > 0.85 in females is at risk of central obesity (12).

Dietary assessment

Dietary intake was assessed using a 3-day food record. Participants were instructed to record all food and beverages they consumed over two consecutive weekdays and one weekend day, using standard household measurement tools. The participants were provided with a food log book to help them record all the food they consumed at home and when ordering food or eating out and the amount of food they consumed, ingredients, and food brands. The recorded household measures of food and beverage were converted to weight in grams and milliliters. Middle East Food Composition Tables and the food processor SQL software (ESHA research, version 10.90) (14) were used to estimate the daily energy intake, micronutrients, and macronutrients intake (15).

The participants' nutrient intake was compared against the recommendations of the European Food Safety Authority (EFSA). The recommended average energy intake for male and female participants, depending on their level of physical activity, was 2340-3343 kcal and 1887-2674 kcal, respectively. The recommended average requirement from the total energy intake included 0.66g/kg of protein, 45-60% of total carbohydrates, 25g/day of dietary fiber, and 20-35% of total fat; polyunsaturated fatty acids (PUFAs) 6-10%, saturated fatty acids (SFAs) < 10% and trans fatty acids (TFAs) < 1% (16,17).

The adequate intake (AIs) and Average Requirements of minerals and vitamins are summarized in table 1 (17)**.**

Statistical analysis

The statistical analysis was conducted using SPSS software version 22 (SPSS statistics for Windows V22, IBM Corp., Armonk, NY, USA). The categorical variables (gender, parental education level, employment, BMI categories,

and micronutrients) were analyzed using frequency distribution as percentages (%). Mean and standard deviation were used for continuous variables (age, income, weight, height, BMI, waist circumference, WHR, energy intake, macronutrients, and fatty acids intake). Pearson Correlation Coefficients were used to evaluate the linear relationship between dietary patterns, using a 3-day food record, and socioeconomic status (parental education and employment status, family size, and family monthly income), and obesity which was measured using different anthropometric measurements (weight, BMI, waist circumference, and WHR). A p-value < 0.05 will be considered significant.

Table 1. The adequate intake (AIs) and Average Requirements of minerals and vitamins.

Vitamins and minerals	Males	Females
Calcium (mg/day)	1000	1000
Iron (mg/day)	8	18
Sodium (mg/day)	2300	2300
Potassium (mg/day)	3500	3500
Vitamin B6 (mg/d)	1.7	1.6
Vitamin C (mg/day)	110	95
Riboflavin (mg/day)	1.6	1.6
Vitamin D (µg/d)	15	15
Vitamin K (µg/d)	70	70

Resultados

As shown in table 2 the study included 214 participants with a mean age of 19.03 ± 1.06 years. Regarding parental education, the majority of fathers (80.3%) had bachelor's degrees or higher, and 16.4% had a diploma degree. While the majority of the mothers (43.5%) had attained diploma degrees and (36%) of mothers had a bachelor's degree or higher. Additionally, in terms of employment, 73.8% of the fathers worked in the private sector, and of the mothers, 63.1% were employed. The family size was varied, with most of the families (65.9%) having 3-5 members. The average family monthly family income was 1073 ± 431.8 JD.

The differences between participants' anthropometric data are presented in table 3. The results show that the males had significantly (p = 0.006) higher average weight (84.6 ± 13kg) compared to females (79.9 ± 11kg). Also, males were significantly taller (174.3 ± 6.2m) than females with average height (167.2 ± 6.1m) respectively. However, there were no significant differences in average BMI between males (27.9 ± 4) and females (28.7 ± 4.6), both groups were within an overweight category. Moreover, a higher proportion of males (40%) were classified as obese when compared to females (19.1%), and most females were classified within normal weight (40.4%) compared to males (15%). On the other hand, males had significantly (p = 0.000) higher waist circumference (88.87 ± 8cm) compared to females (84.95 ± 8 cm). In addition, males had significantly (p = 0.000) a higher WHR (0.83 ± 0.1) compared to females (0.79 ± 0.1).

Table 2. Sociodemographic characteristics of the participants.

Variables	N= 214
Age (years) (mean ± SD)	19.03 ± 1.06
Father education level	
≤ secondary level	7 (3.3%)
Diploma	35 (16.4%)
Bachelor's and higher education	172 (80.3%)
Mother education level	
≤ secondary level	44 (20.5%)
Diploma	93 (43.5%)
Bachelor's and higher education	77 (36%)
Father employment status	
Public work	56 (26.2%)
Private work	158 (73.8%)
Mother employment status	
unemployed	79 (36.9)
Employed	135 (63.1%)
Number of family members	
≤ 2	8 (3.7%)
3-5	141 (65.9%)
≥ 6	65 (30.4%)
Family monthly income (JD / month) (mean ± SD)	1073 ± 431.8

JD: Jordanian Dinars

Table 3. Anthropometrics data of the participants.

Nutrients	Males n= (120)	Females (n= 94)	p-value
Weight (kg)	84.6 ± 13	79.9 ± 11	0.006*
Height (m)	174.3 ± 6.2	167.2 ± 6.1	0.000**
BMI (kg/m^2)	27.9 ± 4	28.7 ± 4.6	0.161
18.5 – 24.9	18 (15%)	38 (40.4%)	
25-29.9	46 (38.3%)	31 (33%)	
30-34.9	48 (40%)	18 (19.1%)	
> 35	8 (6.7%)	7 (7.4%)	
Waist circumference (cm)	88.87 ± 8	84.95 ± 8	0.000**
Hip circumference (cm)	106.5 ± 6.5	106.98 ± 6.7	0.626
WHR	0.83 ± 0.1	0.79 ± 0.1	0.000**

BMI: body mass index; WHR: waist-hip ratio. ** Correlation is significant at the 0.01 level;
* Correlation is significant at the 0.05 level

The dietary intake among participants is presented in table 4. The results show that males had significantly (p = 0.000) higher energy intake (3089.1 ± 362 kcal) compared to females (2366.1 ± 463). Additionally, there were no significant differences in the carbohydrate intake between males and females; they consumed the same amounts of carbohydrates (269 ± 58g) for males and (269.4 ± 58g) for females. There were no significant differences in dietary fiber intake (p = 0.696). The amount of dietary fiber intake was similar for males (16 ± 8g) compared to females (16 ± 7.7 g). Moreover, there were no significant differences in dietary intakes of proteins, fat, cholesterol, polyunsaturated fatty acid (PUFA), and monounsaturated fatty acid (MUFA).

Table 4. Energy intake, macronutrients, and fatty acid intake among participants.

Nutrients	Males n= (120)	Females (n= 94)	p-value
Energy (kcal)	3089.1 ± 362	2366.1 ± 463	0.000**
Carbohydrate (%)	50.4 ± 9	50.7 ± 9	0.829
Carbohydrate (g)	269 ± 58	269.4 ± 58	0.964
Dietary fiber (g)	16 ± 8	16 ± 7.7	0.696
Protein (%)	17.2 ± 5.3	16.8 ± 5.2	0.632
Protein (g)	92.9 ± 33	90.4 ± 34.6	0.533
Total fat (%)	32.0 ± 8.9	31.6 ± 9	0.753
Total fat (g)	77.5 ± 28.4	76.3 ± 29	0.770
Cholesterol (mg)	340.5 ± 197	342.6 ± 201.5	0.805
MUFAs%	16.3 ± 11.5	13.4 ± 9.4	0.050
PUFAs%	19.4 ± 5.4	18 ± 5.3	0.069
SATs%	31.2 ± 6	31 ± 6.1	0.843

MUFAs: monounsaturated fatty acids; PUFAs: polyunsaturated fatty acids; SATs: saturated fatty acids. ** Correlation is significant at the 0.01 level; MUFAs: monounsaturated fatty acid; PUFA: polyunsaturated fatty acid.

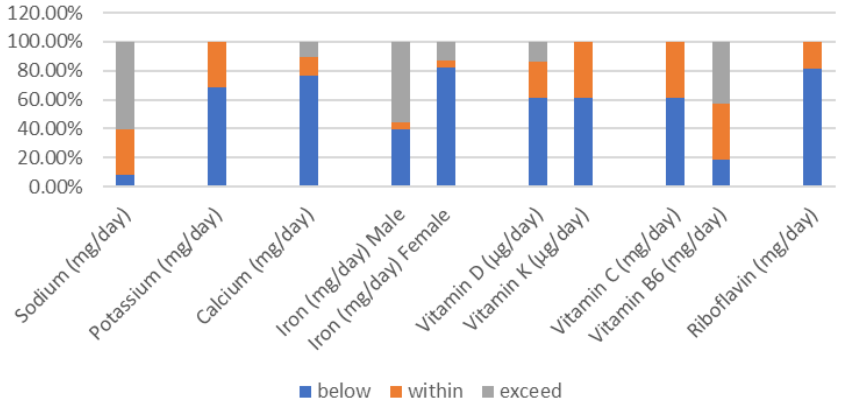

Figure 1. Distribution of vitamins and minerals intake among participants according to EFSA and WHO guidelines.

The nutrient intake among participants is summarized in figure 1. The results show that the majority of the participants (76.6%) did not meet the calcium intake recommendation. Most of the females were below the dietary recommendation intake of iron (81.9%) when compared to 55.8% of males who exceed the recommendation. In addition, both genders have a significant (60.7%) exceed the recommended sodium intake, and (68.7%) had potassium intake below the recommended. Moreover, a significantly higher proportion of the participants are below the recommended intake of vitamin D and K (61.2% µg/day), Riboflavin (81.3%), and Vitamin C (61.2%).

The Pearson correlation between participants' anthropometric measures with socioeconomic characteristics, calorie Intake, macronutrients, and fatty acids intake is presented in table 5. Mother's education and employment status were significantly inversely associated with WHR ($r = -0.048$, $p< 0.01$) and ($r = -0.039$, $p< 0.01$) respectively. The family income was significantly inversely associated with participants' weight ($r= -0.222$, $p< 0.01$) and BMI ($r= -0.167$, $p< 0.05$). In addition, energy intake was significantly positively associated with waist circumference ($r = 0.171$, $p< 0.05$) and WHR ($r= 0.244$, $p< 0.01$).

Table 5. The Pearson correlation between participants' anthropometric measures with socioeconomic characteristics, calorie Intake, macronutrients, and fatty acids intake.

Variables	Weight (kg)	BMI (kg/m^2)	Waist circumference (cm)	WHR
Number of family members	0.070	- 0.066	- 0.030	- 0.048*
Father education status	0.096	0.164	0.022	- 0.088
Mother education status	- 0.049	0.029	- 0.063	- 0.048*
Mother employment status	- 0.012	- 0.092	- 0.038	- 0.039*
Income (JD/month)	- 0.222**	- 0.167*	- 0.027	- 0.302
Energy (kcal)	0.112	0.013	0.171*	0.244**
Carbohydrates (%)	0.095	0.046	0.049	- 0.015
Fibers (g)	- 0.022	- 0.080	0.011	0.008
Sugar (g)	- 0.080	- 0.092	0.013	- 0.027
Protein (%)	-0.076	- 0.119	- 0.023	- 0.044
Total fat (%)	- 0.067	- 0.034	0.007	0.017
SAT (%)	- 0.006	0.067	-0.100	- 0.104
PUFA (%)	- 0.053	- 0.045	-0.006	0.082
MUFA (%)	- 0.015	- 0.064	-0.045	0.061
Cholesterol (mg/day)	- 0.078	- 0.019	- 0.004	0.005

JD: Jordanian Dinars; BMI: body mass index; WHR: waist hip ratio. ** Correlation is significant at the 0.01 level * Correlation is significant at the 0.05 level.

Discusión

Obesity is an epidemic disease associated with globalization and environmental factors (18, 19). The current study's findings found that overweight was prevalent among younger adult participants with a higher prevalence among males. In 2022, the WHO reports declared that 43% of adults aged eighteen and older were overweight and 16% were obese. Whereas in 2030, nearly 1 in 2 adults will be obese, and nearly 1 in 4 adults will have severe obesity (20; 21). A study conducted by Hales et al (22) using the United States National Health and Nutrition Examination Survey (NHANES) data found that the prevalence of obesity is lower among adults under 40 years old and higher prevalence among older adult women compared to men.

In the current study, the results found an inverse significant relationship between WHR with family size and parent's education. The study results attributed that individuals from larger family members are more likely to have poorer diet quality, less variety, inadequate nutrient intake, and may struggle to control their family members' dietary patterns. Conversely, parents with higher education tend to make healthier food choices and encourage healthy dietary habits in their family members. Additionally, a study of national Lebanese adolescents found that higher maternal education was associated with a higher intake of traditional Lebanese dietary patterns rich in fruit, vegetables, olive oil, and fish (23). On the other hand, previous research concluded that higher energy from meat-based dietary patterns was most common among younger people with higher education (24) and older individuals with lower educational status, and higher BMI (25).

There is an inverse correlation between family income and BMI, which indicates that obesity is more prevalent in urban areas (26) and higher economic status, which leads to the adoption of a Westernized dietary pattern that includes highly refined carbohydrates and processed meat (24). Western diet is an unhealthy dietary pattern that is a consequence of globalization (27), characterized by high consumption of red meat, and processed and fast food high in sodium (23). Moreover, meat-based dietary patterns are more common in urban areas among younger males with higher educational levels (28). The social and economic disparities

in accessing a nutrient-rich diet may be explained that healthy food choices are primarily influenced by food prices (29). Additionally, processed energy-dense foods with added sugar and fat are cheaper than unprocessed and nutrient-rich foods, such as fish, lean meat, fruit, and vegetables (30).

The participants' intake of energy, carbohydrates, and protein fulfilled the EFSA and WHO guidelines. Despite no significant differences in fatty acid consumption, participants consume higher TFAs and cholesterol, alongside lower fiber consumption. Moreover, this pattern corresponds to stage 4 of Popkin's nutrition transition framework, which is defined as a diet high in fats, refined sugars, carbonated beverages, and processed foods (31). Unhealthy dietary patterns have been linked to an imbalance between energy intake and expenditure (Ward et al., 2019), as well as excessive consumption of processed fatty foods rich in TFAs and SFAs, energy-dense, and nutrient-poor foods (32, 33). Higher consumption of SFAs and TFAs may exacerbate insulin resistance and impair glucose tolerance (34). Moreover, a dietary pattern rich in omega-6 polyunsaturated fatty acids (n-6 PUFAs) and the intake of carbohydrates and protein has been associated with non-alcoholic fatty liver disease (35).

The results of the current study found a significant positive correlation between energy intake with waist circumference and WHR, suggesting that energy intake is the key contributor to central obesity. Processed fast food in the Western diet was associated with an increased risk of abdominal obesity and metabolic syndrome (36). BMI and body fat were positively associated with energy-dense meat patterns in women of New Zealand European following lower carbohydrate intake and high SFA intake (37). A longitudinal study found that the transition from a rice-based Chinese traditional diet rich toward a modern dietary pattern was negatively associated with waist circumference, and BMI, but not with hypertension (38).

Furthermore, the higher energy intake among participants was associated with a deficit of essential nutrient intake among participants. However, the majority of the participants did not meet the AI and average requirement of EFSA and WHO guidelines, especially for calcium, potassium, vitamin C, D, and riboflavin. Moreover, female participants show a substantial deficit of iron intake compared to men who tend to exceed the recommendation. On the other hand, sodium intake among participants exceeds the recommendation. Western diet pattern leads to increased obesity and suboptimal nutrition status due to consuming diets with a positive energy balance and low micronutrients (39). Moreover, the understanding of obesity exceeds the imbalance between energy intake and expenditure, food quality affects the body's regulation of metabolism, satiety, and hunger (40). Cross-sectional studies found that age from (14 to 23 years) is associated with negative changes in fruit and vegetable consumption, which increases their risk of obesity (1). Moreover, consuming low energy-dense foods from fruits and non-starchy vegetables was associated with a reduced risk of adiposity (41). Additionally, a cross-sectional study by Zeba et al. (42) revealed that low-educated females with lower income adhere to a traditional diet experiencing deficiencies in iron and vitamin A.

Conclusion

The dietary patterns of younger adults vary depending on their age, sex, family size, parental education level, and economic status. However, younger adults are more likely to have a dietary pattern that is high in calories, and high-fat diet, and lacking in essential

nutrients. In addition, there is a relationship between family size, mother's education, and employment status with WHR. Family monthly income was linked to higher weight and BMI. Furthermore, waist circumference and WHR are associated with calorie intake.

The study provides a starting point to understand the impact of socio-demographic status on the dietary patterns among younger adolescents in Jordan. Furthermore, nutritional education should encourage younger adults to promote adequate energy consumption from healthy dietary patterns.

The study has several limitations including that the sample size is not representative due to the willingness of some individuals to attain the study. Although 3-day food records take into account food preparation, the reliance on 3-day food records to estimate the energy and nutrient intake may not be accurate due to overestimation or underestimation of calorie intake.

More research is needed to understand the challenges people face in maintaining a healthy diet and conduct demographic and environmental studies to help in formatting policies that can alleviate the negative consequences of the transition from a traditional diet to a Western diet. Another important point is to develop a dietary pattern system to track the transition of dietary patterns among the general population.

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