# ASSOCIATION BETWEEN FAST FOOD INTAKE, OVERWEIGHT AND DYSLIPIDEMIA AMONG ADOLESCENTS EGYPTIAN CHILDREN

## By

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## ABSTRACT

**Background:** *The causes of obesity are poorly understood and continue to be debated and studied. It is a multifactorial disorder which involves dietary, behavioral, environmental as well as genetic factors. The increased consumption of more energy-dense, nutrient-poor foods with high levels of sugar and saturated fats, combined with reduced physical activity, have led to high obesity rates among children.*

**Aim and objectives:** *To determine the relationship between fast-food intake and overweight and dyslipidemia among adolescent Egyptian children.*

**Subjects and methods:** *This is a cross sectional study was carried out on 210 adolescents aged 9 to 18 years and divided into 2 groups: (Group 1): fast food group that included 164` adolescents, (Group 2): healthy food group that included 46 adolescents. They were selected from pediatric inpatient room and outpatient pediatric clinic at Sayed Galal university hospital from Jan 2021 to May 2021 by simple random method.*

**Result:** *Obesity and dyslipidemia was found to be significantly higher in fast food group compared to normal healthy group (p= 0.05).*

**Conclusion:** *This study demonstrated that frequent Fast-Food consumption may increase risk of obesity and dyslipidemia in Adolescents Egyptian Children. It may suggest evidence for proper dietary education to prevent and manage the risk of overweight/obesity and dyslipidemia in Adolescents Egyptian Children.*

**Keywords:** *Fast food; Consumption; Obesity risk; physical Activity; Dyslipidemia.*

## INTRODUCTION

Fast foods such as burgers, French fries, hot dogs, and soda is of concern because they are typically considered to be nutritionally low in micronutrients, but high in fat, salt, and sugar **(Williams et al.,**

**2014)**. Frequent fast-food consumption has also been associated with low micronutrient and fiber intake, but high calorie and glycemic load (**Fraser et al., 2010**). Additionally, fast food is often served in large portions. This leads to an excess of daily energy intake, as the estimated energy consumption of the average fast-food meal exceeds 800 k calories (**Rosenheck et al., 2008**).

Processed and fast foods such as hamburgers, pizza, and fried chicken are widely consumed by the younger generation in Egypt (**Farzana et al., 2004**), with a reported 56.9% of people consuming fast food in Cairo and 43 % in rural area.

However, over time the abundance of food outlets has changed the Egyptian diet to be more calorie dense, and with a noted decrease in fiber and micronutrient content (**Burgoine et al., 2017**).

Students acclimating to the fast-food culture could potentially shift the population away from traditional dishes and home-cooked meals. Such trends in the population's nutrition transition is associated with lower diet quality (**Athens et al., 2016**), disappearance of family traditions and culture.

The prevalence of dyslipidemia has dramatically increased in children and adolescents, and many of these cases are associated with increased obesity (**Elmaoğulları et al., 2015**).

The worldwide prevalence of obesity in children has increased in the past 3 decades. It is estimated that there are 43 million overweight and obese children under 5 years of age worldwide (**Elmaoğulları et al., 2015**).

## AIM OF THE STUDY

This study aimed to determine the relationship between fast-food intake and overweight and dyslipidemia among adolescent Egyptian children.

**Ethical consideration:**

1. A written informed consent was obtained from parents or the legal guardians before the study.

2. An approved by the local ethical committee was obtained before the study.

3. The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

4. All the data of the patients and results of the study are confidential &the patients have the right to keep it.

5. The patient has the right to withdraw from the study at any time.

**Financial disclosure/Funding:**

## *PATIENTS AND MATERIALS*

This is a cross-sectional study was conducted on 210 Egyptian children and adolescents aged 9 to 18 years. All the studied adolescents were selected from pediatric inpatient room and outpatient pediatric clinic at Sayed Galal university hospital from Jan. 2021 to May 2021 by simple random method.

**Inclusion criteria:** appearenatly healthy Children 9-18 years.

**Exclusion criteria:** Any child complaining of any debilitating diseases e.g. D.M, congenital or acquired heart diseases, hepatic or renal disease.

**Methodology:**

The studied children were classified into two major groups:

1. **Group 1:** Fast food consumer

2. **Group 2:** Healthy food consumer.

**Then all cases were subjected to the following:**

1. **Questionnaire which includes:**

   • Age and sex

   • Demographic information

   • Fast food type, frequency/week, time of fast food intake (breakfast, lunch, dinner) and duration of intake.

2. **Full clinical examination:** All included children had their weights and heights measured according to the standard procedure recommended by the World Health Organization.

   Body weight was measured with minimal clothing and without shoes to the nearest 0.1 kg using a calibrated portable electronic scale

   Height was measured to the nearest 1 cm using a stadiometer, with the participant at full-standing position without shoes.

   Overweight (including obesity) was defined as BMI-for-age z-score> +1 SD based on the WHO growth reference for children.

3. **All the studied children were subjected to the following laboratory work up:** CBC,

ESR, AST, ALT, Urea, Create, (TC), Total cholesterol ,Total triglycerides (TG), low density lipoprotein cholesterol (LDL-c), high density lipoprotein cholesterol (HDL-cholesterol).

**Statistical analysis:** Data will be statistically described in terms of mean standard deviation (SD), median, range and interquartile range (IQR), or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables, including durations of medications and inotropes, between patients with and without hepatic dysfunction was done using Student t test for independent samples in comparing 2 groups of normally distributed data/ large sample and Mann Whitney U test for independent samples for comparing not-normal data. For comparing categorical data, Chi-square (2) test was performed. Exact test was used instead when the expected frequency is less than 5.

## RESULTS

Our results will be demonstrated in the following tables

**Table (1): Socio-demographic characteristics among the studied group**

| | | Group (1) (Fast food consumer) (No. = 164) | | Group (2) (Healthy food consumer) (No. = 46) | | Test value | P-value |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | | |
| **Age (years)** | **Mean± SD** | 12.81± 2.61 | | 13.75± 3.74 | | $z_{MWU}=$ 1.28 | 0.201 |
| | **Median (IQR)** | 12.5 (11.0 – 17.5) | | 14.50 (11.0 – 17.50) | | | |
| | **Range** | 9.0 - 18.0 | | 9.0 - 18.0 | | | |
| **Gender** | **Female** | 104 | 63.7% | 25 | 55.0% | $X^2=$ 0. 520 | 0.471 |
| | **Male** | 60 | 36.3% | 21 | 45.0% | | |
| **Residence** | **Rural** | 51 | 31.3% | 18 | 40.0% | $X^2=$ 0. 554 | 0.457 |
| | **Urban** | 113 | 68.8% | 28 | 60.0% | | |

**Table (1):** Shows insignificant difference as regarding age, sex& residency between both groups.

**Table (2):   Pattern of fast food intake in group (1)**

| Types of fast food | No. | % | Duration of in take | Frequency of intake/week | Time of intake |
|---|---|---|---|---|---|
| Hamburger | 57 | 35 | 60 months | 7 times | Lunch and dinner |
| Fried chicken | 44 | 27 | 36 months | 5 times | Dinner |
| French fries | 26 | 16 | 24 months | 4 times | Lunch and dinner |
| Spicy food | 21 | 13 | 18 months | 3 times | Lunch and dinner |
| Pizza | 15 | 9 | 12 months | 4 times | Breakfast&dinner |

**Table (2):** Shows Hamburger was the most consumption (7times/week) followed by fried chicken (5 times/week) for 60 months &36 months respectively & the most common male was in lunch& dinner.

**Table (3):   Analysis of the questionnaire**

| Age Years | Range 9-18 | Mean ± SD 12.81±2.61 | | | |
|---|---|---|---|---|---|
| Sex | Female 104(63.7%) | Male 60(36.3%) | | | |
| Residency | Rural 51 (31.3%) | Urban113 (68.8%) | | | |
| Types of fast food | Hamburger 35% | Fried chicken 27% | French fries 16% | Spicy food 13% | Pizza 9% |
| Duration of in take | 60 months | 36 months | 24 months | 18 months | 12 months |
| Frequency of intake | 7 times | 5 times | 4 times | 3 times | 4 times |
| Time of intake | Lunch and dinner | Dinner | Lunch and dinner | Lunch and dinner | Breakfast & dinner |

**Table(3):** Shows that females were more consumers of fast food (63.7%) and commonly living in urban area (68.8%),the most commonly consumed fast food was Hamburger (35%) for 60 months, about 7 times/week during lunch& dinner.

## Table (4): Comparison of anthropometric measures in studied groups

| | | Group (1) (Fast food consumer) (No. =164) | | Group (2) (Healthy food consumer) (No. = 46) | |
|---|---|---|---|---|---|
| | | No. | % | No. | % |
| **Weight (Kg)** | **Mean± SD** | 45.20± 12.42 | | 47.10± 12.04 | |
| | **Median (IQR)** | 45.0 (35.5 – 66.50) | | 50.0 (38.0 – 65.0) | |
| | **Range** | 23.0 - 78.0 | | 26.0 - 65.0 | |
| **Weight percentile** | **3rd** | 0 | | 0 | |
| | **10th** | 3 | | 0 | |
| | **25th** | 28 | | 14 | |
| | **50th** | 19 | | 27 | |
| | **75th** | 30 | | 5 | |
| | **90th** | 12 | | 0 | |
| | **97th** | 13 | | 0 | |
| | **>97th** | 59 | | | |
| **Height (cm)** | **Mean± SD** | 150.22± 11.91 | | 151.95± 17.28 | |
| | **Median (IQR)** | 154.0 (140.0 – 167.5) | | 152.0 (136.5 – 180.5) | |
| | **Range** | 125.0 - 175.0 | | 125.0 - 181.0 | |
| **Height percentile** | **3rd** | 4 | | 0 | |
| | **10th** | 33 | | 0 | |
| | **25th** | 47 | | 2 | |
| | **50th** | 49 | | 26 | |
| | **75th** | 25 | | 16 | |
| | **97th** | 6 | | 2 | |
| **BMI (Kg/ m$^2$)** | **Mean± SD** | 19.56± 3.39 | | 18.45± 2.15 | |
| | **Median (IQR)** | 19.0 (16.60 – 25.80) | | 18.80 (16.65 – 21.95) | |
| | **Range** | 14.30 – 27.40 | | 14.80 – 23.20 | |
| **BMI (Z-score)** | **-1** | 37 | | 21 | |
| | **>+1** | 47 | | 4 | |
| | **0** | 45 | | 21 | |
| | **1** | 14 | | 0 | |
| | **2** | 21 | | 0 | |
| **Obesity classification** | **Normal** | 105 | | 41 | |
| | **Overweight** | 47 | | 5 | |
| | **Obese** | 12 | | 0 | |

**Table (4):** Shows significant difference as regarding weight, BMI, overweight and obesity between both groups.

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**Table (5): Comparison between the studied groups regarding laboratory data**

| | | Group (1) (Fast food consumer) (No. = 164) | | Group (2) (Healthy food consumer) (No. = 46) | | Test value | P-value |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | | |
| **ESR** | **Mean± SD** | 14.96± 3.58 | | 13.60± 2.78 | | $z_{MWU}$ = 1.53 | 0.126 |
| | **Median (IQR)** | 14.0 (12.0 – 17.50) | | 12.5 (11.5 – 16.0) | | | |
| | **Range** | 10.0 - 27.0 | | 10.0 - 19.0 | | | |
| **AST** | **Mean± SD** | 31.25± 13.68 | | 27.75± 5.28 | | $z_{MWU}$ = 1.56 | 0.118 |
| | **Median (IQR)** | 30.0 (24.0 – 35.5) | | 25.50 (23.0 – 33.0) | | | |
| | **Range** | 17.0 - 140.0 | | 21.0 - 38.0 | | | |
| **ALT** | **Mean± SD** | 17.06± 8.77 | | 14.60± 6.82 | | $z_{MWU}$ = 1.08 | 0.279 |
| | **Median (IQR)** | 17.50 (10.5 – 22.0) | | 12.0 (8.5 – 21.0) | | | |
| | **Range** | 5.0 – 70.0 | | 6.0 – 26.0 | | | |
| **Urea** | **Mean± SD** | 14.93± 2.51 | | 14.15± 2.5 | | $z_{MWU}$ = 1.29 | 0.197 |
| | **Median (IQR)** | 15.0 (13.0 – 17.0) | | 13.0 (12.0 – 16.0) | | | |
| | **Range** | 10.0 – 19.0 | | 11.0 – 19.0 | | | |
| **Creatinine** | **Mean± SD** | 0.72± 0.15 | | 1.10± 1.96 | | $z_{MWU}$ = 0.758 | 0.449 |
| | **Median (IQR)** | 0.70 (0.60 – 0.80) | | 0.70 (0.60 – 0.80) | | | |
| | **Range** | 0.30 – 1.00 | | 0.30 – 9.40 | | | |
| **Presence of dyslipidemia** | **Normal** | 92 | 56.3% | 34 | 75.0% | $X^2$= 2.34 | 0.126 |
| | **Anemic** | 72 | 43.8% | 12 | 25.0% | | |

**Table (5):** shows insignificant difference as regarding ESR, AST, ALT, urea and creatinine.

## Table (6): Comparison between the studied groups as regarding lipid profile

| | | Group (1) (Fast food consumer) (No. = 164) | | Group (2) (Healthy food consumer) (No. = 46) | | Test value | P-value |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | | |
| Total cholesterol (mg/dl) | Mean± SD | 172.39± 33.02 | | 160.10± 21.01 | | $z_{MWU}=$ 2.02 | 0.043 |
| | Median (IQR) | 161.0 (154.0 – 244.50) | | 158.0 (153.5 – 204.5) | | | |
| | Range | 140.0 - 300.0 | | 139.0 - 246.0 | | | |
| Triglyceride (mg/dl) | Mean± SD | 79.06± 19.98 | | 81.95± 6.24 | | $z_{MWU}=$ 3.33 | 0.001 |
| | Median (IQR) | 77.5 (68.0 – 142.5) | | 82.5 (79.5 – 89.0) | | | |
| | Range | 56.0 - 158.0 | | 63.0 - 89.0 | | | |
| LDL (mg/dl) | Mean± SD | 96.84± 24.79 | | 82.95± 21.60 | | $z_{MWU}=$ 2.56 | 0.004 |
| | Median (IQR) | 90.50 (82.5 – 151.0) | | 76.5 (69.0 – 129.5) | | | |
| | Range | 56.0 – 137.0 | | 57.0 – 150.0 | | | |
| HDL(mg/dl) | Mean± SD | 55.68± 13.12 | | 58.75± 8.93 | | $z_{MWU}=$ 0.725 | 0.469 |
| | Median (IQR) | 57.50 (52.0 – 71.0) | | 59.50 (54.0 – 72.5) | | | |
| | Range | 25.0 – 81.0 | | 33.0 – 76.0 | | | |
| Presence of dyslipidemia | Normal | 123 | 75.0% | 44 | 95.0% | $X^2=$ 3.86 | 0.05 |
| | Dyslipidemic | 41 | 25.0% | 2 | 5.0% | | |

**Table (6):** Shows significant difference between both groups in all lipid profile and dyslipidemia except HDL.

## DISCUSSION

Obesity is currently the most common dietary problem; it is one of the most significant public health issues in developing societies. The prevalence and severity of overweight are increasing among children. Childhood obesity is a multifactorial condition that results from an interaction between genetics and environment.

This study was carried out on 210 adolescents aged 9 to 18 years and divided into 2 groups: Group (1): Fast food consumer that included 164 adolescents Group (2): Healthy food group that included 46 adolescents. The duration of the study continued 5 months.

As regard socio-demographic characteristics among the two studied groups. There was no statistically significant difference between group (1) and group (2) regarding age, gender and residence. The majority of them were females with mean age 13 years.

Our results were supported by study of **Payab et al., (2015)**. As they reported that a total of 13,486

children and adolescents out of 14,880 invited subjects (participation rate of 90.6%) were evaluated in the current study. The average age of girls and boys was 12.58 (SD: 3.32) and 12.36 (SD: 3.39) years, respectively.

Also, **Talat & El Shahat, (2016)** included 900 students at preparatory schools in urban Sharkia Governorate (432 males and 468 females). According to the age of the studied students (school grades), the highest rate of overweight was among the second-grade students aged 13–14 years (21.5%) while the highest rate of obesity was among the third-grade students aged 14–15 years (11.8%).

The present study showed that as regard comparison between the studied groups regarding anthropometric measurements. There was no statistically significant difference between group (1) and group (2) regarding weight (p= 0.461) and weight percentile (p= 0.240), There was no statistically significant difference between group (1) and group (2) regarding height (p= 0.826) and height percentile (p= 0.134), There was no statistically significant difference between group (1) and group (2) regarding BMI (p= 0.137). There was statistically significant difference between group (1) and group (2)

regarding BMI (Z- score) (p= 0.026). Twenty-eight (35%) adolescents in group (1) and 2 (10%) adolescents in group (2) were overweight with statistically significant difference between the two groups (p= 0.024).

In accordance with our results, study of **Yoon et al. (2020)** as they reported that the risk for obesity (BMI $\geq$ 25 kg/m2) was higher in those consuming fast food (FF) 3–4 times/week (Model 1: OR, 2.064; 95% CI, 1.124–3.790; p = 0.020) and $\geq$ 1 time/week (Model 1: OR, 2.043; 95% CI, 1.091–3.825; p = 0.026) compared with people consuming FF < 1 time/month (reference group).

Similarly, **Banik et al. (2020)** demonstrated that there was a significant association of fast-food consumption with the higher prevalence of obesity (29.9% in fast food consumer's vs. 9.1% in non-consumers, p < 0.05).

The prevalence of obesity has been continuously increasing and doubled in the past three decades and become a worldwide problem. Increased weight gain and large waist circumference are main causes of metabolic dysfunction such as impaired blood pressure (BP), glucose intolerance, and dyslipidemia (i.e., low levels of high-density lipoprotein [HDL]-

cholesterol, and high levels of triglyceride, total cholesterol or low-density lipoprotein [LDL]-cholesterol), all of which are strongly associated with the increased prevalence of type 2 diabetes (T2D) and cardiovascular disease (CVD). The consumption of FF has been increasing worldwide because of its convenience to access and palatability, but it has been associated with the increased incidence of obesity and related metabolic disorders (i.e., dyslipidemia, metabolic syndrome, T2D, and CVD) **(Ng, M., et al., 2014)**.

The current study showed that as regard comparison between the studied groups regarding lipid profile. Total cholesterol was significantly higher in fast food group compared to normal healthy group (p= 0.043). Serum triglyceride was significantly lower in fast food group compared to normal healthy group (p= 0.001). LDL level was significantly higher in fast food group compared to normal healthy group (p= 0.004). There was no statistically significant difference between group (1) and group (2) regarding HDL (p= 0.469) and height percentile (p= 0.134). Dyslipidemia was found to be significantly higher in fast food

group compared to normal healthy group (p= 0.05).

Our results were in line with study of **(Yoon et al., 2020)** as they demonstrated that frequent FF consumption contributes to the increased risk of obesity and dyslipidemia in Korean adults aged 20–39 years. Furthermore, it shows that people who consume breakfast irregularly had a higher risk of dyslipidemia than those who consume breakfast regularly among frequent FF consumers (1 time ≥ week). These outcomes may provide evidences for dietary education to prevent and manage the risk of obesity and related metabolic disorder in Korean's adults aged 20–39 years.

In the study of **Elmaoğulları et al. (2015)**, among 823 obese children and adolescents, 353 (42.9%) met the dyslipidemia criteria: 21.7% had hypertriglyceridemia, 19.7% had low levels of HDL-C, 18.6% had hypercholesterolemia, and 13.7% had high levels of LDL-C. Older age and/or high body mass index (BMI) were related to increased prevalence of dyslipidemia.

In the study in our hands, as regard comparison between the studied groups regarding other laboratory data. There was no statistically significant difference between group (1) and group (2)

regarding ESR (p= 0.126). There was no statistically significant difference between group (1) and group (2) regarding AST (p= 0.118). There was no statistically significant difference between group (1) and group (2) regarding ALT (p= 0.279). There was no statistically significant difference between group (1) and group (2) regarding blood urea (p= 0.179). There was no statistically significant difference between group (1) and group (2) regarding serum creatinine (p= 0.126).

However, **Doost Mohammadi et al. (2019)** showed that the number of the monthly fast-food consumption, including Bandary sandwiches, sausages, Falafel, Pizza, Snack, and cheeseburgers was significantly higher in the cases with NAFLD and increased ALT, AST than in the control group. The average monthly number of all types of fast food, in the present research, was significantly higher in the case group than in the control group (p=0.002). Interestingly, **Kolahi et al. (2015)** found out in their study that healthy people consumed fast food (hamburgers, sausages, kielbasa, and fries) more frequently (0.8 times per week) than the people with fatty liver disease (0.4 times per week). Their results are quite different from our results.

Also, **Notova et al. (2018)** demonstrated that Consumption of fast-food products was accompanied by significantly lower values of total protein and greater activity of AST and ALT in serum which were in contrary to our results.

## *CONCLUSION*

This study demonstrated that frequent Fast-Food consumption may increase risk of obesity and dyslipidemia in Adolescents Egyptian Children. It may suggest evidence for proper dietary education to prevent and manage the risk of overweight/obesity and dyslipidemia in Adolescents Egyptian Children.

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# العلاقه بين تناول الوجبات السريعة و زيادة الوزن واضطربات دهون الدم في الاطفال المصريين المراهقين

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استهلاك الوجبات السريعة هو اتجاه ناشئ بين المراهقين في جميع أنحاء العالم. للوجبات السريعة العديد من الخصائص المتأصلة مثل حجم الحصة المفرط، حيث تقترب الوجبات الكبيرة المفردة في كثير من الأحيان من متطلبات الطاقة اليومية الفردية أو تتجاوزها، استساغة، مع التركيز على تفضيلات الذوق البدائية للسكر والملح والدهون المضافة، كثافة عالية للطاقة وأخيرًا وليس آخرًا، ارتفاع نسبة السكر في الدم.

عسر شحميات الدم هو أحد عوامل الخطر المستقلة الأكثر أهمية لاحتشاء عضلة القلب الحاد. يعتبر الاستهلاك المفرط للدهون المشبعة والكوليسترول جنبًا إلى جنب مع التدخين وزيادة الوزن/ السمنة من عوامل الخطر في إنتاج اضطراب شحميات الدم لدى الأطفال والمراهقين، بغض النظر عن تاريخ العائلة.

**الهدف من البحث:** تهدف الدراسة إلى تحديد العلاقة بين تناول الوجبات السريعة وزيادة الوزن وخلل شحميات الدم لدى الأطفال المصريين المراهقين.

**الوسائل والأدوات:** أجريت هذه الدراسة كدراسة مقطع عرضي على 100 مراهق تتراوح أعمارهم بين 9 و 18 عامًا وتم تقسيمهم إلى مجموعتين: (المجموعة 1): مجموعة الوجبات السريعة التي شملت 80 مراهقًا، (المجموعة 2): مجموعة طعام صحي ضمت 20 مراهقًا خلال الفتره من الأول من ابريل الي الأول من سبتمبر لسنة 2021 خلال ترددهم علي قسم طوارئ الأطفال والعياده الخارجيه لقسم الأطفال بمستشفي الحسين الجامعي ومستشفي سيد جلال الجامعي بالقاهره وتم اختيارهم بطريقه عشوائيه بسيطه، حيث تم إخضاعهم جميعا لاخذ التاريخ الطبي كاملا، والفحص السريري الشامل، وعمل الفحوصات المخبريه اللازمه.

**أظهرت النتائج الرئيسية للدراسة ما يلي:**

- كان ثمانية وعشرون (35٪) مراهقًا في المجموعة (1) و 2 (10٪) من المراهقين في المجموعة (2) يعانون من زيادة الوزن مع وجود فرق معتد به إحصائيًا بين المجموعتين (ع = 0.024).

- كان الكوليسترول الكلي أعلى معنويا في مجموعة الوجبات السريعة مقارنة بالمجموعة الصحية العادية (ع = 0.043).

- كانت نسبة الدهون الثلاثية في الدم أقل بشكل ملحوظ في مجموعة الوجبات السريعة مقارنة بالمجموعة الصحية العادية

- كان مستوى البروتين الدهني منخفض الكثافه أعلى بشكل ملحوظ في مجموعة الوجبات السريعة مقارنة بالمجموعة الصحية العادية

- لــم يكــن هنــاك فــروق ذات دلالــة إحصــائية بــين المجموعــة (1) والمجموعـة (2) فيمـا يتعلق البروتين الدهني مرتفع الكثافه والنسبة المئوية للارتفاع (ع = 0.134).

- وجـد أن عسـر شـحميات الـدم أعلـى بشـكل ملحـوظ فـي مجموعـة الوجبات السريعة مقارنة بالمجموعة الصحية العادية.

بنـاءً علـى نتائجنـا، نوصـي بـإجراء مزيـد مـن الدراسـات علـى المرضى الأكبر حجمًا وفترة المتابعة الأطول للتأكيد على استنتاجنا.