

# **An assessment of the nutritional quality of high school students in Istanbul Province using the Healthy Eating Index methodology**

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## **Abstract**

Adolescence represents a critical period in physical maturation, and acquiring healthy eating habits during this phase can help reduce the risk of obesity and chronic diseases in later life. This study aims to evaluate the nutritional quality of 104 students aged 15-17 in a high school in Istanbul's Pendik district. Data were collected through a questionnaire covering General Characteristics, Physical Activity Information, Nutrition Frequency, and a 24-hour Nutritional Consumption Record. Individual nutritional records were analyzed using the BEBIS 9 program, and the Healthy Eating Index-2015 (HEI-2015) was calculated. The findings revealed that 18.3% of students were classified as overweight, and 6.7% as obese based on Body Mass Index (BMI), with no significant gender difference in BMI values. Approximately 45.2% of students engaged in regular physical activity, with a notably higher proportion among male students. Despite a low number of students adhering to high-quality diets, 93.3% were categorized as having poor diet quality. The prevalence of inadequate diet quality was high, with no significant gender difference. Additionally, 63.5% of students expressed a preference for fast food. The study highlights imbalances in adolescents' diet, a lack of nutrition knowledge, and low levels of physical activity. Trends towards white bread, excessive sugar consumption, and insufficient fruit and vegetable intake contribute to malnutrition risk. Fast-food consumption on school premises and cafeteria food negatively impact the overall healthy nutrition index. Therefore, offering healthy options, especially in cafeterias, is crucial for young individuals.

**Keywords:** Healthy Eating Index-2015, Diet Quality, Adolescent Nutrition

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## **I. Introduction**

Nutrition refers to the process of consuming the necessary nutrients in appropriate amounts and timing to support bodily function [1]. In order to maintain good long-term health and a high quality of life, it is crucial to have a well-balanced diet that provides sufficient amounts of nutrients from different food categories [2]. Attaining a state of good eating habits during childhood and adolescence is highly significant. Malnutrition throughout adolescence can lead to obesity, which is a significant contributor to the onset of various chronic diseases, including cardiovascular conditions, diabetes, and cancer, later in life [3]. For the successful development of healthy persons, it is crucial to have a widespread understanding and practice of balanced nutrition in society [4].

Despite the prevalence of a Mediterranean-style diet in our nation, there is a notable prevalence of obesity among children and adolescents [5]. Based on the most recent findings from the Turkey Nutrition and Health Survey (TBSA) in 2017, it was determined that 13.3% of teens between the ages of 15 and 18 are classified as overweight (M: 13.5%; F: 13.0%), while 8.3% are classified as obese (M: 8.3%; F: 8.2%) [6]. Due to the high occurrence of obesity in teenagers, there have been numerous experiments conducted at the provincial level [7]. However, there are no trials conducted at the national level except from TBSA. In a study conducted in a high school in Kastamonu, according to the BMI values of the students, 16.6% were overweight (F: 14.4%, M: 17.9%) and 9.3% were obese (F: 8.4%, M: 9.8%) was reported [8]. An investigation carried out at a high school in Istanbul revealed that 29.7% of students were classified as overweight, while 4.2% were categorized as obese [9]. In a survey conducted in Ankara, it was shown that 25.8% of teens between the ages of 15 and 18 were classified as overweight. Among them, 19.2% were classified as overweight in boys, while 33.3% were classified as overweight in girls [10]. Additionally, 10.4% of teenagers were classified as obese, with 3.9% being obese in boys and 6.7% being obese in girls. A research conducted on high school pupils in the province of Gaziantep revealed that 21.4 percent of them were overweight, while 0.9 percent were classified as

obese [11]. The prevalence of overweight and obesity fluctuates annually. The prevalence of obesity has increased to 10%, although in others countries it has remained at a rate of 0.9%.

Obesity is a hereditary illness, however, its fundamental cause is dietary choices [12]. The implementation of street restrictions in response to the pandemic has had an adverse impact on the nutrition and physical activity patterns of teenagers, leading to an elevated susceptibility to obesity during this timeframe [13]. Adolescents have experienced a notable rise in the amount of time they spend sitting, compared to before the pandemic. This has resulted in an increase in the percentage of overweight or obese individuals, with males seeing an increase from 24.3% to 30.8% and females seeing an increase from 12.9% to 14.1% [14]. During adolescence, individuals have an increase in autonomy, which leads to a greater likelihood of consuming food outside of their family in a social setting. Indulging in these foods is recognized as an unhealthy eating pattern, as the majority of them have limited nutritional value, include a large number of calories, and are rich in unsaturated fats.

The World Health Organization (WHO) advises that individuals aged 5 to 17 engage in physical activity for a minimum of 60 minutes per day, at a moderate degree of intensity [15]. Nevertheless, contemporary research indicates that a significant majority of teenagers fail to achieve the necessary levels of physical exercise that are considered to be most beneficial. As per the Turkish Guide to Physical Activity, 44.6% of males aged 15-18 do not engage in any form of exercise, while the corresponding figure for females is 72.5% [16]. Based on the TBSA 2017 International Physical Activity Survey (GPAQ) recommendations, the proportion of 15-17-year-old males engaging in high physical activity is just 42.3%, while for females it is only 11.7% [6]. A study conducted among Turkish adolescents aged 14-18 revealed insufficient allocation of time for physical exercise, resulting in lower levels of activity compared to the moderate range [17]. The study examined the physical activity levels of individuals aged 14-17. Participants were categorized as having "low, medium, or high" physical activity based on their overall physical activity score, which was determined using the International Physical Activity Short Form (IPAQ). 51.9 percent of the population engaged in low levels of physical activity, whereas 30.4 percent engaged in moderate levels and 17.8 percent engaged in high levels [18]. Studies conducted in Trabzon and Aksaray areas in our country indicate that globally, only 20% of workers meet the criteria for being considered active [19]. Based on the TBSA 2017 data, the level of physical activity in Turkey is consistently low across all age groups [20].

Understanding nutrition and ensuring high nutritional standards are crucial in safeguarding persons from health issues and promoting well-being [4]. The Healthy Eating Index-2015 (HEI-2015) is a quantitative measure used to assess the nutritional quality of a diet. It calculates the quality of foods ingested and considers the daily intake of essential nutrients [21]. The SYI-2015 [22, 23], a measure to assess how much Americans comply with the Nutrition Guidelines, has been updated in the form of the Healthy Eating Index-2015 (SYI-2015) with every update of the Food Guides for Americans since 2005, to ensure compliance with the most up-to-date guidelines [24].

The study assessed the nutritional quality of teenage high school pupils aged 15 to 17 by quantifying their daily dietary intake and evaluating their healthy eating index scores.

## **II. MATERIAL AND METHOD**

The study was conducted using a sample of 104 high school students, aged between 15 and 17, who were enrolled in a school located in Istanbul's Pendik area. Individuals willingly offered their services to partake in our project. The data was gathered by the process of conducting interviews in person. The participants were asked questions in a questionnaire titled "General Characteristics, Physical Activity Information, Nutrition Frequency, and 24 Hour Nutritional Consumption Record."

The participants were queried regarding their gender, age, and the specific class they were enrolled in. Additionally, the researchers collected anthropometric measurements of the subjects, including height, weight, waist and thigh circumference, and body mass index (BMI). Measurement of weight The Tanita BC-601 was utilized in conjunction with a strip meter, when the individual was barefoot and wearing lightweight attire.

Participants were queried regarding their habitual physical activity and its frequency. The nutritional intake frequency and quantity of the subjects from the previous month were assessed using the "All Consumption Frequency Form". Participants were queried regarding the nature, frequency, and amount of nutrients they ingested in this survey. Participants received a detailed explanation of the food and drinks they had taken over the past 24 hours, including information about the size, amount, and composition of their intake. The citation is from [25].

The acquired data is stored in an Excel file. The individual's nutritional intake was assessed by analyzing the daily amounts consumed over the past month using the BEBIS 9 application and calculating the Diet Quality Index 2015. The statistical analyses were conducted using the SPSS 22.0 software program [26].

The Healthy Eating Index-2015 (HEI-2015) is a metric employed to evaluate the nutritional value of an individual's diet. The calculation of SYI-2015 is based on the amounts of consumption of macronutrients and

micronutrients. The SYI-2015 scores have a range of 0 to 100. Diet quality scores below 50 and 50 are categorized as "poor diet quality," scores ranging from 51 to 80 are classified as "diet quality in need of improvement," and scores above 80 are considered "excellent diet quality." [27].

**Ethics Notice:** Prior to the start of the research, the Ethics Board's permission was obtained by the Clinical Research Ethics Council of Aydın University of Istanbul by decision No. 2022/163 dated 19.12.2022.

### III. RESULTS

The gender distribution of the students is shown in Figure 1.

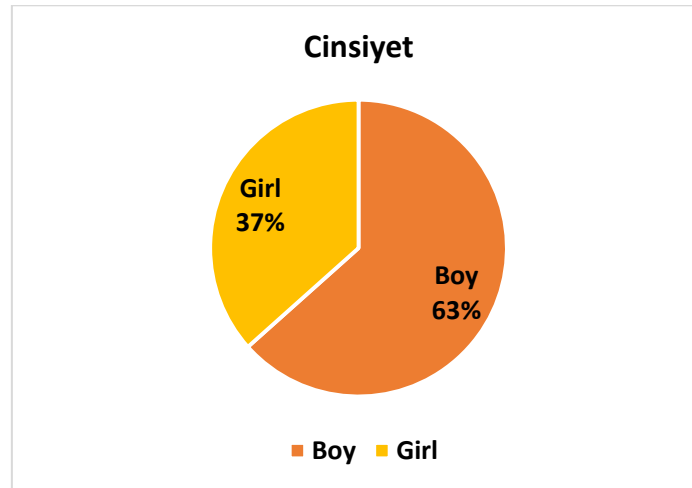


Figure 1. Distribution of students by sex (%)

The distribution of the age groups of the students by sex is shown in Figure 2.

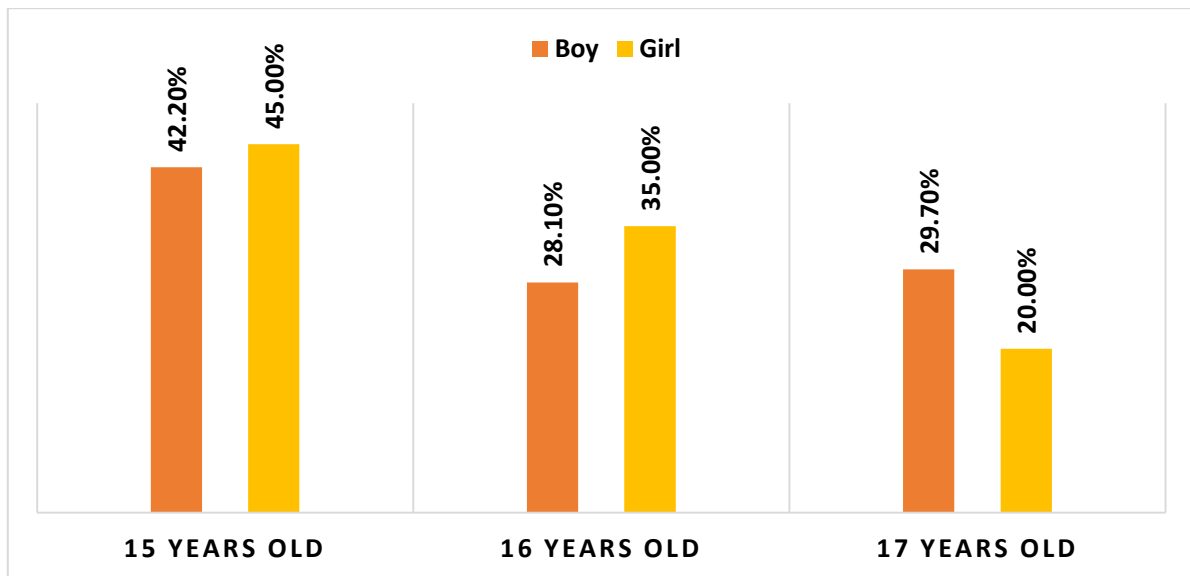


Figure 2. Distribution of age groups of students by sex (%)

The percentage distribution of the BKI of the students by sex is shown in Figure 3.

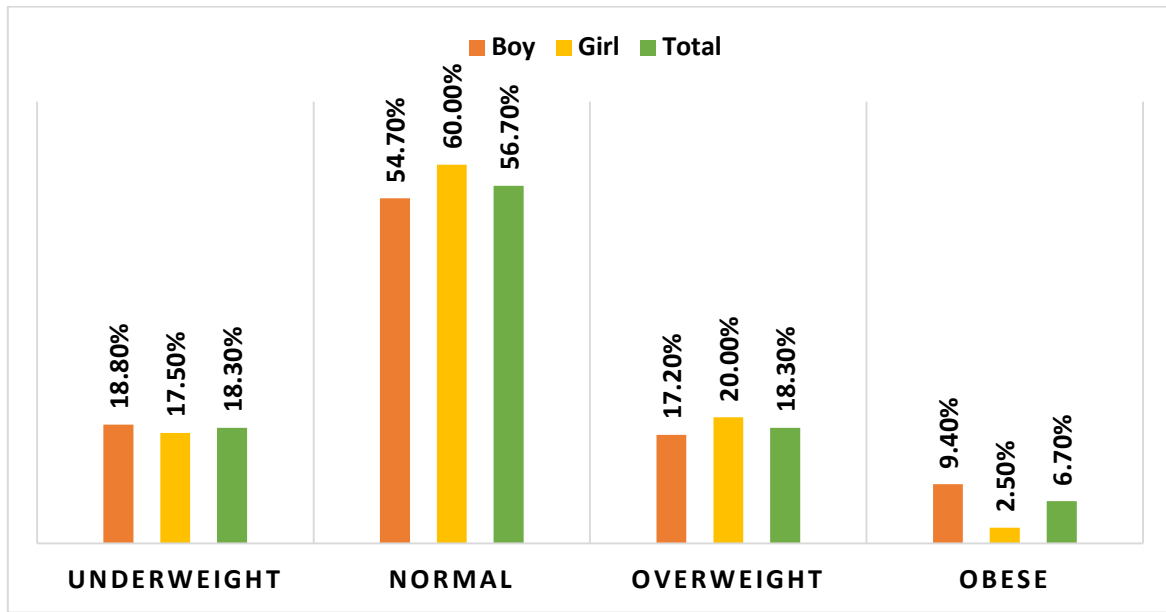


Figure 3. Gender distribution of BKI among students

The distribution of the students' physical activity by gender is shown in Figure 4.

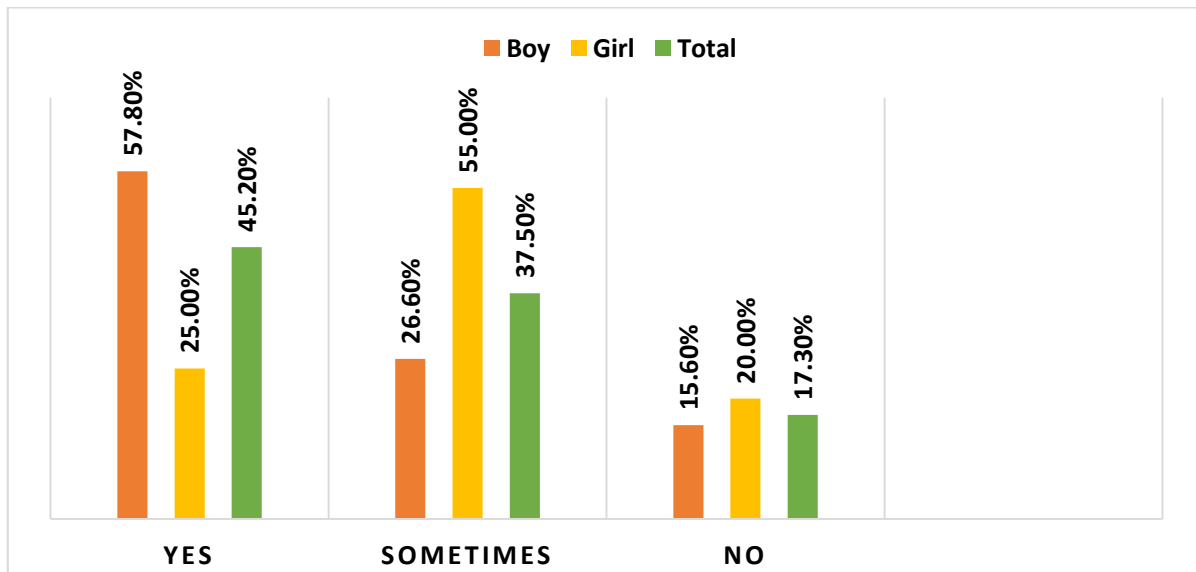


Figure 4. Distribution of students' physical activity by gender (%)

Gender distribution of the type of restaurant the students prefer according to their eating habits is shown in Figure 5.

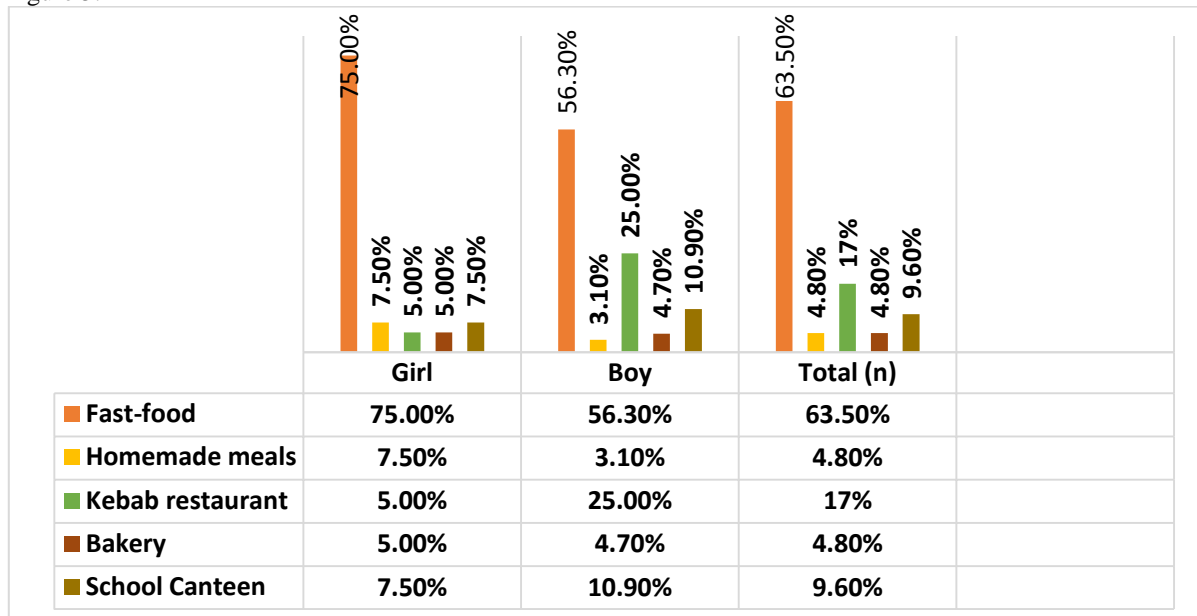


Figure 5. Distribution by gender of the type of restaurant students prefer as their eating habits

Dietetic qualities are shown in Graph 6 as the average score for SYI-2015. As shown in Figure 6, 95.3 per cent of men and 90% of girls have poor nutritional quality.

Figure 6. Students' diet quality score category (%) as of SYI- 2015

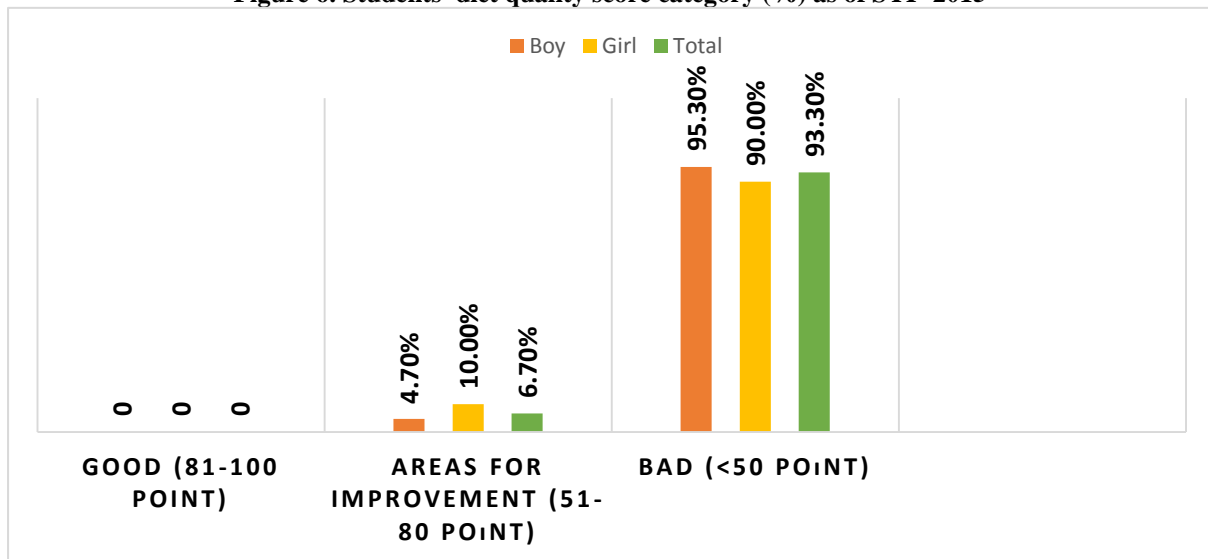


Table 1 displays the student's daily consumption of energy, macronutrients, and micronutrients. Table 1 demonstrates that male students had a higher nutritional intake compared to female students, resulting in a greater consumption of critical vitamins and minerals for their bodies than females. Women have a lower energy, protein, and carbohydrate intake compared to men, resulting in undernourishment due to insufficient energy supply.

**Table 1. Daily intake of energy, macro and micro nutrients by students**

Energy, Macro and Micro Nutrients	Daily intake amount		p*
	Girl (n=40) Mean±SD	Boy (n=64) Mean±SD	
Energy (kcal)	1377.27±514.27	2279.01±839.36	<0.001
Carbohydrate (g)	154.04±73.01	252.52±109.75	<0.001
Protein (g)	54.99±25.67	91.67±43.85	<0.001
Fiber (g)	14.49±9.00	19.43±9.07	0.008
Fat (g)	58.59±25.36	98.21±41.92	<0.001
Cholesterol (g)	319.83±256.95	503.98±382.45	0.004
PUFA (g)	12.44±8.83	19.82±11.63	0.001
Vitamin A (mcg)	677.06±371.51	1196.29±2612.11	0.215
Vitamin E (mg)	8.75±6.33	13.78±7.70	0.001
Vitamin C (mg)	70.01±61.38	76.11±135.83	0.790
Vitamin B <sub>1</sub> (mg)	0.71±0.40	1.07±0.56	<0.001
Vitamin B <sub>2</sub> (mg)	1.03±0.49	1.60±1.01	<0.001
Vitamin B <sub>6</sub> (mg)	0.96±0.47	1.52±0.79	<0.001
Folate (mcg)	208.37±122.69	298.32±174.82	0.005
Iron (mg)	8.30±4.29	12.47±6.65	<0.001
Zinc (mg)	7.75±3.45	12.55±5.86	<0.001
Sodium (mg)	2499.66±1306.82	3988.02±2292.56	<0.001
Potassium (mg)	1664.03±763.21	2340.45±1044.67	<0.001
Calcium (mg)	493.06±237.89	733.05±457.86	0.001
Magnesium (mg)	204.28±94.99	292.19±127.25	<0.001
Phosphor (mg)	857.68±379.10	1334.59±597.79	<0.001

#### IV. DISCUSSION

The prevalence of obesity during adolescence is a worrisome issue that has detrimental effects on the health of teenagers. The heightened nutritional consciousness among young individuals and their emphasis on maintaining a well-rounded diet significantly contribute to safeguarding them against obesity and chronic ailments in the future. According to a study conducted on adolescents between the ages of 15 and 18, the prevalence of overweight among girls was 19.2%, while the prevalence of obesity was 3.9%. Among men, the rates of overweight and obesity were 33.3% and 6.7% respectively [10]. The prevalence of overweight among high school students aged 14-18 was 3.8% for females, 12% for boys, 1.3% for obese girls, and 4% for males [28]. Based on our study findings, the prevalence of overweight and obesity among students is 20.0% for girls and 17.2% for boys, while the corresponding rates for students with a higher Gross National Income (GNI) are 2.5% for girls and 9.4% for boys. The findings were broadly congruent with other research in the literature. Adolescents had varying rates of obesity and overweight, which were contingent upon gender and age groups.

Engaging in physical exercise is essential for promoting a healthy childhood and adolescence, as stated in a publication by The Lancet Child & Adolescent Health [29]. According to the WHO, individuals aged 11-17 should engage in a minimum of 60 minutes of moderate physical activity each week or 30 minutes of high-

intensity physical activity. Nevertheless, studies indicate that a significant fraction of teenagers fail to exceed the prescribed thresholds of physical activity [15]. A study conducted in Turkey revealed that 72.55% of female high school students exhibited a sedentary or low level of physical activity, in contrast to 56.25% of male students [30]. This investigation has yielded a comparable result. The proportion of female students engaging in regular physical activity was 25.0%, while the proportion of male students was 57.8%. Similar to previous research, it has been noted that females in our nation exhibit lower levels of physical activity compared to males.

The global prevalence of fast food consumption among adolescents is a pervasive issue [31,32]. Research conducted in Turkey also corroborates this phenomenon. According to a study, 39.3% of adolescents regularly consume fast food, while 50.7% do so occasionally [19]. Another research revealed that 64.44% of students consume meals outside of their homes, with a notable preference for fast-food establishments [33]. Young people's dietary choices can be strongly impacted by their preferences for fast food in both school canteens and outside of school. Based on a survey, the consumption of fast food among high school students has shown an upward trend as they progress through different grades [34]. Within this investigation, mirroring the findings of previous studies, a cohort of high school students aged 15-17 were posed the query, "Which type of dining establishment do you typically favor?" and a notable 63.5% of respondents indicated a preference for fast-food establishments. This finding corroborates the prevalent consumption of fast food among adolescents in Turkey. The popularity of fast food intake during adolescence can be attributed to several factors, including the pursuit of freedom, the inclination to make autonomous choices, and the eagerness to explore novel flavors. These characteristics can influence adolescents' inclination towards fast food [35].

Optimal nutrition is crucial during the period of transitioning into adulthood, characterized by rapid development and sexual maturity [36]. Nevertheless, studies have indicated that individuals in the adolescent age range of 14 to 18 exhibit the poorest dietary habits, as they consume the highest amount of fast food compared to other age cohorts [37]. A 2022 study conducted in the United States evaluated the nutritional value of high school kids between the ages of 14 and 18. Out of the 200 pupils that participated in the study, 82.9% were categorized as having a low quality diet, while 17.1% were identified as needing improvement. The source cited is [38]. The study found that children ages 15, 16, and 17 had average scores of  $36.08 \pm 11.79$ ,  $35.52 \pm 10.38$ , and  $35.63 \pm 9.13$ , respectively. 93.3% of students exhibit inadequate diet quality, whereas 6.7% possess diet quality that requires enhancement. The survey revealed that a significant proportion of students expressed a preference for white bread over whole-grain bread. This societal inclination towards white bread has also influenced young individuals. The affordability of white bread, particularly in the context of hamburgers, fast food, and other food items, seems to be the primary factor driving this trend. Moreover, the results indicate that the insufficient intake of fish, vegetables, and fruits among students significantly contributes to their lower score on the healthy nutrition index. Despite the elevated findings in this study, they align well with the existing body of research.

It is essential to ensure that adolescents have adequate nutrition to facilitate their typical growth and development [39]. Based on the TBSA 2017 data, the average daily energy consumption of male students aged 15-18 is  $2359.0 \pm 810.45$  kcal, with a carbohydrate intake of 309 grams. The weight is around  $5 \pm 109.36$  grams, protein intake is approximately  $81.9 \pm 32.71$  grams, and fat intake is approximately  $85.3 \pm 40.86$  grams. The energy intake of females in the same age group is  $1713.9 \pm 587.74$  kcal, the carbohydrate intake is  $217.9 \pm 80.63$  grams, the protein intake is  $57.9 \pm 22.12$  grams, and the fat intake is  $66.3 \pm 30.08$  grams [6]. Based on this survey, male students consume an average of  $2279.01 \pm 839$  calories each day. The number of girls is 1377, whereas the number of students is 36 kcal. The value for kcal is  $27 \pm 514.27$  kcal. It has been observed that girls exhibit lower levels of energy usage in this particular scenario. The study found that male students had a daily carbohydrate intake of  $252.52 \pm 109.75$  g, protein intake of  $91.67 \pm 43.85$  g, and fat intake of  $98.21 \pm 41.92$  g. Additionally, the average intake of carbohydrates, proteins, and fats was  $154.04 \pm 73.01$  g,  $54.99 \pm 25.67$  g, and  $58.59 \pm 25.36$  g, respectively. The findings presented suggest that the aforementioned studies provide support for this investigation. It proposed that adolescent boys require a greater amount of energy, carbs, protein, and fat compared to adolescent females, attributing these disparities to the accelerated growth and maturation of teenage males [40].

## **V. Result and Suggestions**

- Based on the findings, the uneven and inadequate diet among teenagers has made it certain that certain nutrition-dependent illnesses would develop in the future. The study did not identify students who adhered to a high-quality diet. The mean score was 35.7, suggesting a limited level of nutritional consciousness among the youth. Based on data from comparable research conducted in our nation, there is a significant prevalence of fast food intake and a low level of physical activity. Insufficient intake of fruit, vegetables, and whole grains, particularly among adolescents, has been observed, but the consumption of white bread, fast food, and sugary beverages has been very high. The pandemic has exacerbated these issues; the closure

of educational institutions and social isolation have heightened the intake of fast food among young individuals and diminished their engagement in physical exercise. It is crucial to educate parents in order to address this challenging circumstance. Parents should cultivate their children's awareness by emphasizing the significance of nutritious nutrition and regular physical exercise. Simultaneously, teachers should prioritize educating children on matters pertaining to healthy living. Healthcare professionals could moreover offer counsel on nutritious eating and regular exercise for teenagers through community-wide awareness campaigns.

- Inadequate nutritional awareness during adolescence is a significant issue that profoundly impacts the overall quality of life. In order to surmount this obstacle, it is crucial to develop a comprehensive understanding of nutrition from a young age. Nevertheless, our country has not achieved the necessary improvement. Implementing dieticians in schools and incorporating nutrition lessons are crucial measures to address this issue, as they play a significant role in fostering the younger generation's adoption of nutritious dietary practices. Thus, the well-being and standard of living of the community can be enhanced in a beneficial manner.
- The study revealed that girls exhibited signs of energy deficiency and engaged in less physical activity compared to boys. Girls' inclination towards inadequate nutrition and reduced physical activity might result in future health complications, including osteoporosis, anemia, and menstrual abnormalities. Hence, instilling young girls with nutritious dietary practices and consistent physical activity might mitigate potential hazards. Providing deliberate education and assistance will enable adolescent girls to uphold their holistic well-being and live purposeful and healthful lives.

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