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Araştırma Makalesi/ Research Article

Examining the Relationship Between Schoolchildren's Physical Activity and Nutrition Status

Okul Çocuklarının Fiziksel Aktivitesi ile Beslenme Durumu Arasındaki İlişkinin İncelenmesi

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ABSTRACT

Objective: Nutritional status of school children can be supported through physical activity. However, today, especially in Turkey, the nutritional status of school children is worrying. This study aimed for an inspection of the relationship between the physical activity of school children and their nutrition status.

Methods: The study was planned in a descriptive-correlational manner. The sample of the study constituted 339 students aged 10-14 from a province center located in Turkey's eastern region. The data was collected through the Socio-Demographic Information Form, the Physical Activity Questionnaire for Older Children and the Mediterranean diet quality index.

Results: Of the students participating in the study, 56.9% of them were male and 48.1% were studying in the 8th grade. Male students' physical activity levels (2.21±0.61) and Mediterranean diet adaptation scores (3.44±2.14) were higher than female students. A low statistically significant relationship in the positive direction between Physical Activity and Mediterranean Diet ($r=0.175$, $p<0.001$) was determined.

Conclusion: In the current study, there was a low correlation between physical activity as well as sociodemographic factors and adherence to the Mediterranean diet. Therefore, health education can be given in schools about balanced nutrition to support the physical activities of students.

Keywords: Nutrition, children, physical activity, public health, school nursing

ÖZ

Amaç: Okul çağındaki çocukların beslenme durumları fiziksel aktivite ile desteklenebilir. Ancak günümüzde özellikle Türkiye'de okul çağındaki çocukların beslenme durumu endişe vericidir. Bu çalışmada okul çağındaki çocukların fiziksel aktiviteleri ile beslenme durumları arasındaki ilişkinin incelenmesi amaçlandı.

Yöntem: Araştırma tanımlayıcı-ilişkisel tarzda planlandı. Araştırmanın örneklemini Türkiye'nin doğu bölgesinde yer alan bir il merkezinde öğrenim gören 10-14 yaş arası 339 öğrenci oluşturmuştur. Veriler Sosyo-Demografik Bilgi Formu, Büyük Çocuklar için Fiziksel Aktivite Anketi ve Akdeniz Diyeti Kalite Indeksi kullanılarak toplandı.

Bulgular: Araştırmaya katılan öğrencilerin %56.9'u erkek olup, %48.1'i sekizinci sınıfta okumakta idi. Erkek öğrencilerin fiziksel aktivite düzeyleri (2.21±0.61) ve Akdeniz diyetine uyum puanları (3.44±2.14) kız öğrencilere göre daha yüksekti. Fiziksel Aktivite ile Akdeniz Diyeti arasında pozitif yönde düşük düzeyde istatistiksel açıdan anlamlı bir ilişki ($r=0.175$, $p<0.001$) belirlendi.

Sonuç: Mevcut çalışmada fiziksel aktivitenin yanı sıra sosyodemografik faktörler ile Akdeniz diyetine uyum arasında düşük bir ilişki olduğu görüldü. Bu nedenle öğrencilerin fiziksel aktivitelerini desteklemek amacıyla okullarda dengeli beslenme konusunda sağlık eğitimi verilmesi önerilir.

Anahtar Kelimeler: Beslenme, çocuk, fiziksel aktivite, halk sağlığı, okul hemşireliği

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Introduction

The school-age is a period in which children are faced with both physical growth and the search for a new identity (Akca and Ayaz-Alkaya, 2021). Throughout this stage, the psychomotor and mental development of children directly relates to their healthy lifestyle behaviors. Nutrition, physical activity, and other health-related lifestyle behaviors develop in the early stages of life and progress throughout adulthood (Kabasakal, 2019). Excess weight observed in children was reported to be an indicator of obesity and related illnesses in adulthood. According to the World Health Organization, one in four children worldwide is stunted, one in six is wasted, and one in 12 is underweight. Moreover, malnutrition is not the only problem; Nowadays many school-age children are also obese due to poor lifestyles (van de Kolk et al., 2019). Children in low- and middle-income countries are exposed to high-sugar, high-salt, energy-dense, high-fat, and micronutrient-poor foods, often of lower cost but lower nutritional quality. While these dietary patterns, combined with low levels of physical activity, are causing a sharp rise in childhood obesity, the problems of malnutrition remain unaddressed (Wijtzes et al., 2016).

The World Health Organization makes preventive recommendations to prevent obesity in children, such as reducing the consumption of sugary and sweetened beverages and supporting the habit of physical activity (CDC, 2020). Lifestyle factors such as malnutrition and physical inactivity in children are important risk factors for many chronic health problems that may occur in adulthood (Misra and Bhardwaj, 2014). Despite this, childhood obesity, which includes chronic diseases caused by unhealthy nutrition and physical inactivity, continues to be the biggest public health problem in the 21st century in developed and developing countries (Misra and Bhardwaj, 2014). According to the results of the Türkiye Childhood Obesity (COSI-TUR) 2016 Survey; 9.9% of primary school 2nd grade students are obese and 14.6% are overweight. In addition, in the same research, the rates of stunting due to malnutrition in Turkey were stated to be 3.5% in the Northeastern Anatolia and Central Anatolia regions, while it was 5.4% in the Southeastern Anatolia region (Yardım et al., 2019).

The WHO recommends individuals to eat healthy diets in order to prevent illnesses and develop health (WHO, 2022.). Nutritious foods are defined as "foods that provide healthy nutrients (such as proteins, vitamins, minerals, essential amino acids, essential oil acids or diet fibers) and reduce potential harmful elements (such as sodium, saturated fats, sugars) to a minimum" (Neufeld et al., 2020). The Mediterranean diet, which is high in plant-based foods such as fresh fruits and vegetables, whole grains, legumes, seeds, and nuts, and low in high-fat and processed meats, has become the preferred dietary model in recent years (Cena and Calder, 2020). In the literature, adherence to the principles of the Mediterranean diet was correlated with lower risks of obesity among children and teenagers (Finicelli et al., 2022). The collective assessment conducted in 146 countries demonstrated that less than 20% of children and teenagers suitably and regularly participate in the physical activities expressed in the aforementioned guide (Guthold et al., 2020). Promoting healthy behaviors (lifestyle, nutritional behaviors, and physical activity) in children at an early stage in schools for years to come is an important step toward creating a healthier society (Akgül & Ergün, 2021). School nurses have important roles in planning and conducting health promotion programs in schools (Bay & Ergün, 2020). The healthy eating and physical activity habits to be gained by school nurses will not only be limited to these years but will be permanent throughout the child's life and the foundations of a healthy adulthood will be laid (Akgül & Ergün, 2021). In context, this study was carried out to determine the relationship between nutritional status and physical activity levels of school-age children in Şırnak, located in the Southeastern Anatolia Region. Şırnak province is generally known as one of the socioeconomically disadvantaged regions. Therefore, the current study may provide an important opportunity to understand and improve the health status of children living in this region. In line with this objective, the following questions were investigated: (i) What is the level of adherence to the Mediterranean diet among middle school students? (ii) What are the physical activity levels of middle school students? (iii) Is there a relationship between the Mediterranean diet and the physical activity levels of middle school students?

Methods

The population of this study included students in the 6th, 7th, and 8th grades of three schools in Şırnak, Turkey (N=1212). In the calculation of sample size, correlation analysis was taken into account, and as a result of the maximum sample size calculations; it was determined that a total of 234

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students need to be reached, considering a statistical power of 90%, an alpha error level of 5%, and a medium effect size (0.3) (Yazıcıoğlu and Erdoğan, 2014). For this purpose, the research questionnaire was filled out by 339 volunteer students. Research data were collected by simple random sampling method. Students aged 10 to 14, who did not have any physical disabilities and who were attending 6th, 7th, and 8th grades approved by the school guidance service were included in the study. Students who were absent during the research and were in the fifth grade (due to the request of the school administration) were excluded from the evaluation.

The procedure of ethics committee permission from a state university and institutional permission from the Directorate of National Education were obtained. The Declaration of Helsinki was complied with throughout the study. Verbal consent was obtained from the students who accepted the study. Before conducting the research, an informed consent form was sent to parents through students, requesting written permission. Parents were asked to read and, if they agreed, sign the form, and then return it to the school. At least one parent was required to provide consent. The study was carried out face-to-face, descriptive-relational with students outside of class hours between January and February 2023.

Study data, prepared by researchers in light of the literature information, socio-demographic information form belonging to students, the Physical Activity Metric for Children and the Mediterranean Diet Metric for Children were utilized.

Socio-Demographic Information Form: This form, prepared by researchers utilizing literature and studies on the subject (Cavaliere et al., 2018; Akin, 2021), is made up of 8 questions made to investigate the socio-demographic properties of individuals.

Physical Activity Questionnaire for Older Children (PAQ-C): The scale developed by Kowalski and colleagues has been subjected to Turkish validity and reliability research conducted by Erdim and colleagues (Erdim et al., 2019; Kowalski et al., 2004). PAQ-C this questionnaire aims to study the physical activity levels of Turkish children aged 8-14 studying in years 4-8. PAQ-C is based on the remembrance of physical activity within the last 7 days. It gives a general idea of the physical activity habits of participants. These items are graded in a Likert manner ranging between 1-5 and consist of 9 questions. Nine out of the ten items comprising the physical activity scale contribute to the calculation of activity scores. The tenth item assesses whether the child can maintain normal activities despite illness or other interventions in the preceding week; however, this item is not factored into the activity score calculation. The questionnaire's unambiguous description of the 22 activities serves as a helpful reminder for respondents. The remaining eight questions pertain to assessing activities conducted during the day or at specific time intervals throughout the week (lunch, physical education lesson, recess, after-school, evening, weekend, e.g.). These items are scored on a 5-point scale, with higher scores denoting a greater activity level. The overall PAQ-C score is derived by summing the scores for items 1–9, and the final PAQ-C activity summary score represents the average of these nine items' scores. PAQ-C demonstrates 5 as the highest physical activity level, and 1 as the lowest physical activity level (Erdim et al., 2019). The Cronbach alpha reliability value of is 0.77. The Cronbach alpha reliability value of this study is 0.83.

Mediterranean Diet Quality Index (KIDMED): Diet quality, developed in the year 2004, was measured with the Mediterranean Diet Quality Index for Children and Adolescents (Mediterranean Diet Quality Index - KIDMED), which relies on factors that positively and negatively impact the Mediterranean diet (Serra-Majem et al., 2004). This index was validity, and reliability was confirmed by Sahingöz et al. for Türkiye (Şahingöz et al., 2019). The cut-off points of KIDMED are as shown below; ≥ 8 points: most appropriate diet quality; 4-7 points: average diet quality; ≤ 3 points; very low diet quality. This index, consisting of 16 statements, 12 positive and 4 negatives, regarding personal characteristics, nutritional practices, and behaviors, measures children's nutritional habits. The Cronbach alpha reliability value of this index is 0.72. The Cronbach alpha reliability value of this study is 0.79.

Ethics Committee Approval

In order to conduct the study, Ethical approval from Şırnak University Scientific Publication and Ethics Committee, Ethics Council Permission (2023-E.56391), for the ability to conduct on school grounds, institutional permission from the Ministry of Education E-1543340-604.01.01-71645496) was obtained. Throughout the study, rules stated in the Helsinki Declaration were followed. Before conducting the research, an informed consent form was sent to parents through students, requesting

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written permission. Parents were asked to read and, if they agreed, sign the form, and then return it to the school. At least one parent (mother and/or father) was required to provide consent. Students who accepted to participate in the study provided verbal consent.

Statistical Analysis

Data obtained in the study was evaluated through the SPSS 24 package program. For the visualization of descriptive traits, numerical, average, percentage distributions and standard deviation were utilized.

Normal distribution suitability was determined using the Kolmogorov-Smirnov Z test. The data of the study was inspected through t-testing, Kruskall Wallis Variance analysis, the Mann-Whitney U test, spearman correlation analysis, and ROC analysis. The level of significance was accepted to be $p<0.05$.

Results

This section inspects the distributions of demographic properties, physical activity, and nutrition status of children. Out of the students who participated in the study, it was determined that 44.0% of them were 13 years old, 56.9% of them were male, 48.1% of them were in 8th grade, and 59.9% of them had a medium income level. 84.4% of them walked to school, 61.8% of them used technology such as phones and computers for less than 1 hour (Table 1).

Table 2 depicts a comparison between the socio-demographic properties of children as well as the PAQ-C and KIDMED. The gender variable of the students was determined to have a statistically significant difference with the points students received in the PAQ-C. In other words, the point averages obtained by male students were higher than those of female students ($p<0.05$). A statistically significant difference between the grade levels of students and the points they obtained in the PAQ-C was determined. In other words, the point averages obtained by 7^{th}-grade students were higher than those obtained by 6th and 8th graders ($p<0.01$).

A statistically significant difference between the grade levels of students and the points they obtained in the KIDMED was determined. In other words, the point averages obtained by 7^{th}-grade students were higher than those obtained by 6th and 8th graders ($p<0.01$). A statistically significant difference between the family income status of students and their points obtained in the KIDMED was determined. In other words, children stated to have good economic status had higher point averages ($p<0.01$). A statistically significant difference between students' daily phone, and computer use status and the points they obtained in the PAQ-C was determined. In other words, students who use these devices for 1-2 hours a day had higher point averages ($p<0.05$). A statistically significant difference between the daily phone, and computer use status of children and the points they obtained in the KIDMED was spotted. In other words, students who use these devices for 3-4 hours a day had higher point averages ($p<0.05$) (Table 2).

Table 1. Children's descriptive properties (n=339)

Descriptive Properties	Number (n)	Percentage (%)
Age		
10	15	4.4
11	13	3.8
12	119	35.1
13	149	44.0
14	43	12.7
Gender		
Female	146	43.1
Male	193	56.9
School grade		
6th grade	37	10.9
7th grade	139	41.0
8th grade	163	48.1
Income status of family		
Good	70	20.6
Medium	203	59.9
Bad	66	19.5
School arrival method		
Buses	4	1.2
Cars	18	5.3
Walking	286	84.4
School buses	31	9.1
Daily phone, computer usage duration		
Less than 1 hour	208	61.4
1-2 hours	103	30.4
3-4 hours	23	6.8
5-6 hours and above	5	1.5
	Mean (SD)	**Min±Max**
Age average	12.56±0.92	10-14

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A very weak relationship in the positive direction between the point averages of students in the PAQ-C and their point averages in the KIDMED was determined (r=0.175, p<0.001) (Table 3).

In the investigation, the KIDMED of children and the impact of socio-demographic properties on PAQ-C were inspected with ROC analysis. The data created through continuous variables were evaluated through ROC analysis, illustrating the direction of the relationship. Accordingly, it can be observed that age, gender, the KIDMED, and the PAQ-C share a strong relationship in the positive direction (Figure 1).

Table 2. Comparison of the sociodemographic properties of children as well as the Physical Activity Scale for children and the Mediterranean Diet Scale for Children

Descriptive Properties	Number	Physical Activity Scale for Children	Mediterranean Diet Scale for Children
Gender			
Female	146	2.06±0.54	3.37±2.20
Male	193	2.21±0.61	3.44±2.14
Significance		MW=-2.361	MW=-0.299
		p=0.019	p=0.336
School grade			
6th grade	37	2.24±0.57	3.40±2.02
7th grade	139	2.27±0.63	3.87±2.28
8th grade	163	2.02±0.59	3.03±2.02
Significance		KW =7.197	KW =5.821
		p=0.001	**p=0.003**
Income status of family			
Good	70	2.27±055	3.98±1.95
Medium	203	2.10±0.60	3.50±2.19
Bad	66	2.16±0.56	2.54±2.02
Significance		KW =2.267	KW =8.283
		p=0.105	**p= 0.000**
School arrival method			
Buses	4	2.06±0.83	2.50±2.08
Cars	18	2.03±0.55	4.16±2.09
Walking	286	2.16±0.59	3.30±2.14
School buses	31	2.08±0.58	4.16±2.25
Significance		KW=1.470	KW=7.576
		p=0.689	p= 0.056
Daily phone, computer usage duration			
Less than 1 hour	208	2.05±0.55	3.12±2.13
1-2 hours	103	2.30±0.62	3.91±2.15
3-4 hours	23	2.27±0.59	4.13±2.15
5-6 hours and above	5	2.14±0.46	2.20±0.83
Significance		KW=13.463	KW=13.863
		p=0.004	**p=0.003**
Age	12.56±0.92	t=-0.113	t=-0.011
		p=0.037	p=0.884

p<0.01;p<0.05; t: independent sample t test; KW: Kruskall Wallis Test; MW: Mann Whitney U Test

Table 3. The relationship between the Physical Activity Scale for Children and the Mediterranean Diet Scale for Children

Correlation Test Results	Significance	Mediterranean Diet Scale for Children
Physical Activity Scale for Children	r	0.175**
	p	**0.001**

*** Correlation is significant at the 0.01 level; r: Spearman correlation tes*

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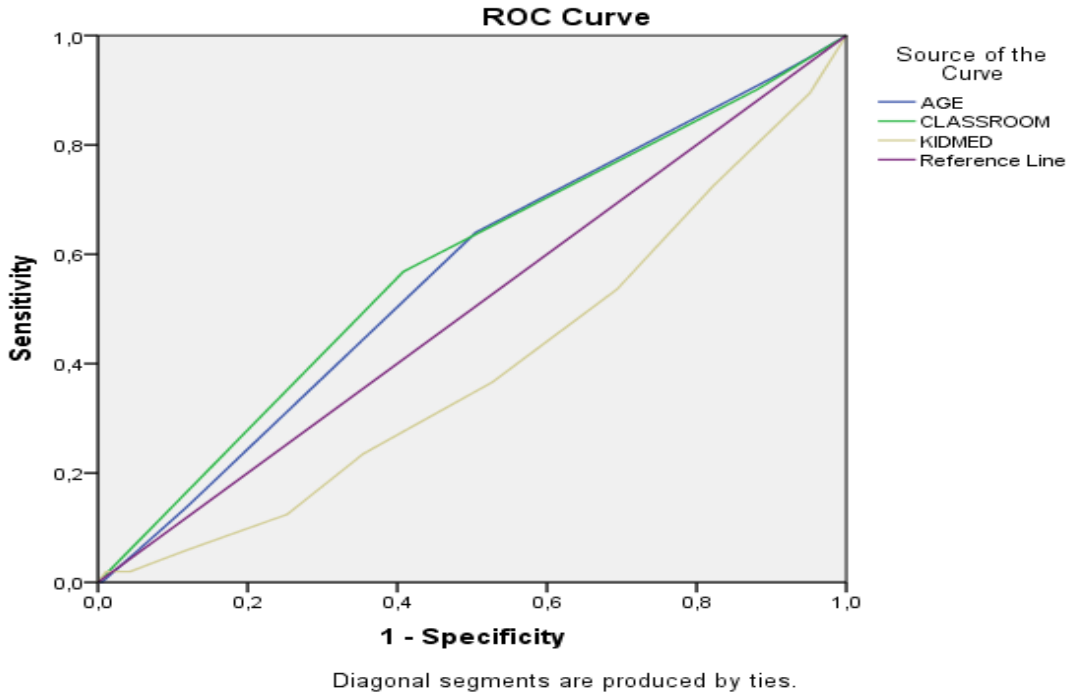

Figure 1. The Mediterranean Diet Scale for Children and the Impact of socio-demographic properties on the Physical Activity Scale

Discussion

Among the conditions of sustainability, healthy nutrition, and physical activity are the foundations of healthy living. İn this study, the physical activity points of male children are higher than those of female children. Among teenagers, the inequality of physical activity between genders, the fact that girls are less active than boys is a permanent finding (Faulkner et al., 2014; Popkin et al., 2017). Gram et al.'s cross-sectional study inspecting adherence to the Mediterranean diet and the impact of physical activity among school children (n=327) stated that; girls have lower physical activity levels and school children demonstrated higher levels of physical activity on weekdays (Grams et al., 2022). Physical activity is impacted by socio-ecological environments and may potentially be altered by activities that could be conducted on a school level (Tourlouki et al., 2013; Pribisalić et al., 2021). The results of this finding are similar to the literature while considering variable school factors and contemplating the fact that children spend most of their time at school, an increase in support given to the physical activity levels of girls may make it possible to reduce the gendered gaps in physical activity.

The literature states that socioeconomic status and adherence to the Mediterranean diet have a positive relationship (Dernini et al., 2017; Affret et al., 2017). Moreover, modernity and improved living conditions have been correlated with increased food preparation variety and purchasing power (Pribisalić et al., 2021). In the current study has determined that students with good income statuses have higher levels of Mediterranean diet adherence. These findings may demonstrate the complicated interactions between different socio-economic descriptive properties and nutrition habits. Alongside this fact, deviation from a traditional Mediterranean diet and lifestyle does not only prevent non-ideal individual and societal health. Simultaneously, it also represents the degradation of sociocultural food values and a lost opportunity in terms of positive economic gains (Dernini et al., 2017). The literature states that individual and contextual socio-economic factors are strong determiners of nutrition habits and that poorer socio-economic groups have a lower probability of following healthy lifestyles (Acar, 2012; Akin, 2021). Foods of lower nutritional value and lower quality diets are generally cheaper per calorie and lower economic status groups have a higher disposition for them (Cabrera et al., 2015). Similar to the study, two studies conducted in Şırnak province reveal that there is a nutritional deficiency

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in the region (Acar, 2012; Akin, 2021). Although the study results are similar to the literature, it can be thought that the ongoing malnutrition in the region is related to education level and socioeconomic factors.

In this study, there was a negative relationship between age and adherence to the Mediterranean diet, but it was not significant. In a study conducted in Italy with 1643 adolescents (11-16 years old), it was emphasized that only 9.1% of the participants showed a high level of compliance with the Mediterranean diet (Misretta et al., 2017). Another study of 1,177 children and adolescents in Spain found that 59% of students had moderate adherence to the Mediterranean diet (Arcila-Agudelo et al., 2019). In a different study conducted in Italy with 1740 children aged 8-9, it was stated that 32.8% of the children had low compliance with the Mediterranean diet (Roccaldo et al., 2014). The conclusions of this finding are similar to the literature.

Another finding in this study is that no statistically significant differences were spotted between school arrival methods alongside physical activity and the Mediterranean diet. In the literature, it is stated that active travel to school by children and teenagers (walking or cycling) and physical activity levels demonstrated differences (Mattavelli et al., 2022; Flieh et al., 2020). The differences in our findings may be due to physical vitality levels and distance from homes to schools. Additionally, the fact that school registration in modern days is conducted based on addresses and that school children are placed into schools close to their homes may be the cause. While there is evidence for the connection between screen time with pediatric obesity (Mattavelli et al., 2022) and other negative health results (Flieh et al., 2020) in the childhood stage, some manuals (for instance, the American Pediatric Association) removed previous suggestions of screen duration suggestions due to the potential weakness of scanning (Moradell et al., 2022). In this study, children whose daily use of technological devices such as phones, and computers was 1-2 hours demonstrated higher physical activity levels than others. Braig et al.'s study on the impact of screen use of children on physical activity and individuality respect (n=519) found that; there is a negative relationship between watching television and self-esteem and that physical activity has a mediating effect (Braig et al., 2018). On the other hand, the literature has determined that it is necessary to limit the time spent in front of screens by primary school children aged 6-11 to at most 2 hours (Cristi-Montero et al., 2019; Svensson et al. 2014). In recent years, it was emphasized that as sedentary activities such as watching television, playing video games, and using the internet become passive entertainment modes, the physical activity levels, especially of teenagers and juveniles, has significantly decreased (O'Brien, et al., 2018).

Physical activity and nutrition statuses, regardless of country, are known to be the most important in reducing a variety of health results (cardio-metabolic risks as well as excess weight and obesity reduction) in teenagers (Cristi-Montero et al., 2019). Moreover, being physically active is correlated with a good quality of life for children and teenagers (Svensson et al., 2014). İn this study, physical activity and the Mediterranean diet demonstrated a strong relationship in the positive direction. The literature emphasizes that weak adherence to the Mediterranean diet is closely correlated to obesity (Moradell et al., 2022; Braig et al., 2018). Moradell et al.'s multi-centered cross-sectional study results demonstrate that teenagers who fulfill physical activity directives and recommended screen time durations consume healthy foods (such as fruits, vegetables, and dairy products) more (Moradell et al., 2022). Similarly, Lopez-Gil et al. emphasized the positive relationship between physical activity levels and Mediterranean diet points (López-Gil et al., 2020). Additionally, Physical activity levels and food choices were correlated, and active children's consumption of healthy foods and drinks in their diets such as grains, fruits, and vegetables were correlated (Grams et al., 2022). The findings of this study are similar to the literature.

Despite the strong results of the current study, there are some limitations. Since the Şırnak region is a rural living area, socioeconomic factors and students' eating habits are based only on subjective judgments. Students may have been influenced by each other while answering the survey questions. In addition, since the generally high number of siblings in the region draws attention, the cause of nutritional and physical activity deficiencies could not be fully questioned through an in-depth interview. Unhealthy nutrition and physical activity can also be caused by inadequate education, social security, inadequate living conditions, and environmental problems. Therefore, family-based randomized controlled, and in-depth studies can be recommended for future studies.

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Conclusion

In conclusion, the study revealed inadequate physical activity levels among children, and these levels showed a weak correlation with adherence to the Mediterranean diet. These findings underscore the importance of transitioning to more sophisticated explanatory models that explore the relationships between sociodemographic factors such as age and gender and the interplay between physical activity and dietary patterns. Such models aim to identify and elucidate potential mechanisms that link these factors, emphasizing the need for a more nuanced understanding. Given that school health nursing is a new field in our country, reliable data on the basic indicators of physical activity and nutritional status of children in rural areas is needed, but research evidence is still lacking. In order to provide accurate estimates of children's physical activity participation, school health nurses must collect robust surveillance data from large and representative samples. Policies and initiatives to encourage physical activity among rural children are also required. Moreover, as the region is seen as disadvantaged, this indicates the existence of a dual burden of child and malnutrition that requires appropriate multisectoral interventions. Children in rural areas may become more physically inactive, sedentary, and exposed to unhealthy diets as a result of opportunities, safe spaces, programs, and investments, as well as malnutrition, putting them at a higher risk for chronic disease in their early adulthood.

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What Did the Study Add to the Literature?

- It is observed that approximately half of school children are under normal weight and have insufficient physical activity.
- Physical activity status, which differed according to age, gender, and grade levels, affected students' adaptation to the Mediterranean diet.
- These results indicate the need for future research to focus on more comprehensive and detailed analyses in order to understand the relationships between physical activity and dietary habits in a more nuanced and meaningful way.

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