Rev Esp Nutr Hum Diet. 2020; 24(3).
doi: 10.14306/renhyd.24.3.1017 [ahead of print]

Freely available online - OPEN ACCESS

Revista Española de Nutrición Humana y Dietética

Spanish Journal of Human Nutrition and Dietetics

RESEARCH – *post-print* version

This is the accepted peer-reviewed version for publication. The article can receive style and format modifications.

Sleep Quality and Associated Factors among Adolescents

Calidad del sueño y factores asociados entre los adolescentes

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Received: 08/03/2020; Accepted: 01/06/2020; Published: 03/07/20 20

CITATION: Ozkan AR, Kucukerdonmez O, Kaner G. Sleep Quality and Associated Factors among Adolescents. Rev Esp Nutr Hum Diet. 2020; 24(3). doi: 10.14306/renhyd.24.3.1017 [ahead of print]

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ABSTRACT

Introduction: This study aimed to investigate sleep quality and sleep patterns in adolescents. The second aim was to find out whether there was an association between sleep quality, sleep patterns, dietary habits, food consumptions, and anthropometric measurements in an adolescent population.

Material and methods: This cross-sectional study was conducted on 346 adolescents. Data was recorded with a questionnaire form. The questionnaire form included items on adolescents' characteristics, sleep patterns, dietary habits, food consumptions, and anthropometric measurements. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results: Sleep duration of >8 hours (67.6%) and sleep latency of 15 minutes (53.8%) were the most commonly identified sleeping patterns. The mean PSQI score was 3.07±2.54. PSQI scores revealed poor sleep quality in 13.6% of participants. A significant difference was observed between age, disease diagnosed by physician, skipping main meals, having regular breakfast, and PSQI score ($p<0.05$). PSQI score was found to be significantly associated with spending time in front of the computer and regular sleep. The amount of daily saturated fatty acid was statistically significantly lower ($p=0.040$) in individuals in the good PSQI.

Conclusions: The vast majority of adolescents had good sleep quality. Sleep duration of adolescents was consistent with the recommended need. Individual factors, dietary habits, food consumption, and screen times were factors associated with sleep quality. This current study results support the development of interventions to help adolescents improve sleep quality. We recommend further investigation to clarify this finding.

Keywords: Adolescent; Feeding Behavior; Sleep; Sleep Hygiene; Anthropometry.

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RESUMEN

Introducción: Este estudio tuvo como objetivo investigar la calidad del sueño y los patrones de sueño en los adolescentes. El segundo objetivo fue averiguar si había una asociación entre la calidad del sueño, los patrones de sueño, los hábitos alimenticios, el consumo de alimentos y las mediciones antropométricas en una población adolescente.

Material y métodos: este estudio transversal se realizó en 346 adolescentes. Los datos se registraron con un formulario de cuestionario. El formulario del cuestionario incluía elementos sobre las características de los adolescentes, los patrones de sueño, los hábitos alimenticios, el consumo de alimentos y las mediciones antropométricas. La calidad del sueño se midió utilizando el Índice de calidad del sueño de Pittsburgh (PSQI).

Resultados: la duración del sueño> 8 horas (67,6%) y la latencia del sueño de 15 minutos (53,8%) fueron los patrones de sueño más comúnmente identificados. La puntuación media de PSQI fue de 3,07 ± 2,54. Las puntuaciones del PSQI revelaron una mala calidad del sueño en el 13,6% de los participantes. Se observó una diferencia significativa entre la edad, la enfermedad diagnosticada por el médico, la omisión de las comidas principales, el desayuno regular y el puntaje PSQI ($p < 0,05$). Se encontró que el puntaje del PSQI estaba significativamente asociado con pasar tiempo frente a la computadora y dormir regularmente. La cantidad de ácido graso saturado diario fue menor estadísticamente significativa ($p = 0,040$) en individuos con buen PSQI.

Conclusiones: La gran mayoría de los adolescentes tenían buena calidad del sueño. La duración del sueño de los adolescentes fue consistente con la necesidad recomendada. Los factores individuales, los hábitos alimenticios, el consumo de alimentos y los tiempos de pantalla fueron factores asociados con la calidad del sueño. Los resultados de este estudio actual apoyan el desarrollo de intervenciones para ayudar a los adolescentes a mejorar la calidad del sueño. Recomendamos una mayor investigación para aclarar este hallazgo.

Palabras clave: Adolescente; Conducta Alimentaria; Sueño; Higiene del Sueño; Antropometría.

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INTRODUCTION

A regular sleep is one of the basic elements of a healthy life for both children and adults. Many somatic, cognitive and psychological processes are strongly influenced by good sleep, and good sleep contributes to improving health (1). It has been shown in many meta-analysis that chronic insufficient sleep (<6 hours) has negative effects on metabolism and it increases the risk of type 2 diabetes, obesity, hypertension, cardiovascular disease and mortality (2-7). Despite the fact that adolescents need 8 to 10 hours of sleep (8), the National Sleep Foundation has reported that they tend to have irregular sleep patterns across the week and only the 15% of them have an optimal sleep duration (9). Sleep has an important role in brain development, and inadequate amount of sleep in adolescence may affect hypothalamic mechanisms that regulate appetite and energy metabolism (10).

Studies have reported that short sleep duration is associated with the risk of obesity (11,12). Adequate sleep duration is critical for preventing obesity. Overweight and obesity in adolescents not only increase the risk of chronic diseases and psychosocial problems such as decreased self-esteem, poor body image, and social exclusion, but also neuropsychological dysfunctions such as depression (13). Furthermore, short sleep duration may have an impact on food intake and appetite. Changes in lifestyle and unhealthy habits such as following a high-calorie diet are often associated with altered sleep patterns and sleep efficiency (14). In addition to this, it has been generally demonstrated that the habit of snacking is related to the shortness of sleep duration; nevertheless, it is not clear whether this is due to frequent eating during the day or the high energy and low nutrient content of snacks. However, it is certain that there is a positive relationship between short and irregular sleep patterns and an unhealthy diet (15).

Daily activities, individual factors, and environmental changes can have an impact on the sleep patterns of adolescents. Since sleep duration and quality are of great importance in adolescents, the aim of this study was to determine sleep quality and sleep patterns among 11-13 year old adolescents. The second aim of the present study was to find out whether there was an association between sleep quality, sleep patterns, dietary habits, food consumptions, and anthropometric measurements in an adolescent population.

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MATERIAL AND METHODS

Study design

This study conducted on adolescents between the ages of 11-13 from two public schools between September and December 2017. For this research, approval from Ethics Committee of İzmir Katip Çelebi University were obtained (Decision No. 22.06.2017-95). All participants gave their assent in writing and necessary permissions were obtained from their parents.

Participants and sample

There were 3484 students in the city center of Muğla. A cross-sectional study was carried out in a random sample of adolescents who were attending two public schools in Mugla. The participants were selected using a stratified proportional sampling method according to the number of sampling calculated by the known population with a 95% confidence interval. The sample group included 346 participants. Within this group, the 11-year age group consisted of 65 girls and 70 boys; the age group of 12 consisted of 51 girls, 53 boys; and the age group of 13 consisted of 56 girls and 53 boys.

Questionnaire form

Data was recorded with a questionnaire form applied via face-to face method. The questionnaire form included items on adolescents' characteristics (age, gender, disease diagnosed by physician), screen times (spending time in front of computer and television in leisure time) dietary habits (regular breakfast, skipping main meals), sleep patterns (sleep duration, sleep latency, habitual sleep efficiency), sleep quality, anthropometric measurements, and food consumptions.

Sleep quality

Pittsburgh sleep quality index (PSQI) was applied to determine the sleep quality. In the form consisting of 18 questions, each question is evaluated with a number from 0 to 3. The sum of the scores gives the total PSQI score. The sleep quality of those with less than 5 points in total is "good" whereas that of those 5 points or above is considered as "poor" (16,17).

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Anthropometric measurements

The body weight, height, waist circumference, and hip circumference were evaluated by previously standardized nutritionists who used conventional anthropometric techniques. In addition, their waist/hip and waist/height ratios were calculated. A portable scale was used to measure body weight. Height measurement was performed using a 2 m long inflexible steel Waist circumference was measured with a flexible tape (18). The anthropometric measurements were assessed using the WHO Growth Reference for 5-19 Years-2007 (19). Gender and age specific z-scores were calculated using the WHO AnthroPlus software (20). The children were classified into five categories of BMI for age Z score (BAZ): underweight, at risk of underweight, normal weight, overweight and obese, in accordance with the cut-off points of < (-2SD), (-2SD) to (-1SD), (-1SD) to (1SD), 1SD, 1SD to 2SD and ≥2SD Z-scores, respectively (19).

Food consumptions

The dietary intake was evaluated based on 24-hour food recall. The 24-hour recall was undertaken in chronological order of consumption (from morning to night). Participants were asked to record all the foods and beverages during the previous day. The portion contents of the meals consumed were calculated by using the book called Standard Recipes for Institutions (21). The number of grams of the foods specified in the records as a standard was calculated by using the book called "Foods and Meals Photo Catalog: Standards and Quantities" (22). Daily food consumption was noted, and daily energy, micro and macronutrient intakes were identified by the Nutrition Information System Software (BEBİS)" (23).

Statistical analysis

All analyses were done using Statistical Package for the Social Sciences version 24.0 (SPSS Inc. Chicago, IL, USA) (24). Frequency tables and descriptive statistics were used to interpret the results. Following the parametric methods, t-test was used to compare the independent groups. Following the non-parametric methods, the Mann-Whitney U test was used to compare the two independent groups, and the Kruskal-Wallis H test was used to compare the three or more independent groups.

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RESULTS

Adolescent's characteristics

Of the 346 adolescents included in the study, 50.9% were boys, 49.1% were girls, and the mean age was 11.9± 0.8 years. It was determined that 86.1% of the individuals did not have a disease diagnosed by the physician. The most common diseases diagnosed by the physician were respiratory system diseases (25.0%) and cardiovascular diseases (18.8%) (Table 1).

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Table 1. Adolescent characteristics and sleep patterns (n=346).

Age (year), mean (SD)	11.9 (0.8)
Age group (year), n (%)	
11	135 (39.0)
12	104 (30.0)
13	107 (30.9)
Gender, n (%)	
Female	170 (49.1)
Male	176 (50.9)
Disease diagnosed by physician, n (%)	
Yes	48 (13.9)
No	298 (86.1)
Diseases, n (%)	
Cardiovascular diseases	9 (18.8)
Diabetes	3 (6.3)
Mental health problems	7 (14.6)
Respiratory diseases	12 (25.0)
Muscular system problems	3 (6.3)
Endocrine diseases	7 (14.5)
Vitamin-mineral deficiencies	7 (14.5)
Spending time in front of computer	
Never	92 (26.7)
<1	88 (25.4)
1	63 (18.2)
2-3	76 (21.9)
>3	27 (7.8)
Spending time in front of television	
Never	27 (7.8)
<1	64 (18.5)
1	97 (28.0)
2-3	125 (36.1)
>3	33 (9.6)
Skipping main meal	
Yes	35 (10.1%)
No	217 (62.8%)
Sometimes	94 (27.1%)
Regular breakfast	
Yes	203 (58.7%)
No	31 (9.0%)
Sometimes	112 (32.3%)
Sleep duration (hour), n (%)	
3-5	11 (3.2)
6-8	101 (29.2)
>8	234 (67.6)
Sleep latency, n (%)	
0-15 minimum	186 (53.8)

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15-30 minimum	107 (30.9)
31-60 minimum	35 (10.1)
>60 minimum	18 (5.2)
Habitual sleep efficiency, n (%)[a]	
≥85%	334 (96.5)
75-84%	6 (1.7)
65-74%	4 (1.2)
<65%	2 (0.6)
PSQI total score, n (%)	
Good (<5)	299 (86.4)
Poor (≥5)	47 (13.6)

SD: Standard deviation

a (total of hours asleep)/(total of hours in bed) x100

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Screen times

Spending 2-3 hour in front of computer and television in leisure time was 21.9% and 36.1%, respectively (Table 1).

Dietary habits

More than half (58.7%) of the adolescents eat breakfast regularly and 27.1% of them declared that they sometimes skipped main meals (Table 1).

Sleep patterns and sleep quality

Sleep duration of >8 hours (67.6%), sleep latency of 15 minutes (53.8%) were the most commonly identified sleeping patterns. The mean PSQI score was 3.07±2.54. PSQI scores revealed poor sleep quality in 13.6% of participants. Habitual sleep efficiency was ≥85% in 96.5% of subjects (Table 1).

Anthropometric measurements

The mean of body weight, height, waist circumference, hip circumference, waist to hip and waist to height ratio of adolescents were 46.2±11.7 kg, 153.8±8.5 cm, 69.4±9.6 cm, 84.0±9.4 cm, 0.8±0.0, 0.4±0.0, respectively. In the evaluation of BAZ, the prevalence of overweight and obesity was found to be 10.4% and 8.4%, respectively (Table 2).

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Table 2. Anthropometric measurements of adolescents.

	Boys (n=176)	Girls (n=170)	Total
	Mean±SD	Mean±SD	Mean±SD
Body weight (kg)	46.2±12.0	46.2±11.4	46.2±11.7
Height (cm)	153.4±8.9	154.2±8.0	153.8±8.5
WC (cm)	71.4±9.8	67.4±8.9	69.4±9.6
HC (cm)	83.1±9.2	84.9±9.4	84.0±9.4
WC/HC	0.8±0.0	0.7±0.0	0.8±0.0
WC/height	0.4±0.0	0.4±0.0	0.4±0.0

WC: Waist circumference, HC: hip circumference, NC: Neck circumference.

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Food consumptions

On average, adolescents consumed 1875.6 calories, with caloric intake comprised of 49.3% carbohydrates, 34.8% fat, and 15.8% protein. Intakes of energy, carbohydrate, protein, fat, vitamin A, riboflavin, niacin, vitamin B6, vitamin B12, sodium, zinc, and iron were higher in boys ($p<0.05$) (Table 3).

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Table 3. Daily energy and nutrient intakes of adolescents.

	Boys (n=176)	Girls (n=170)	Total	p
	Mean±SD	Mean±SD	Mean±SD	
Energy (kcal/day)	1956.8±228.6	1791.1±276.9	1875.6±266.3	<0.001
Carbohydrate (%)	50.3±6.9	48.2±7.9	49.3±7.5	0.010
Protein (%)	16.6±4.0	15.0±3.3	15.8±3.8	<0.001
Fat (%)	33.0±5.4	36.6±7.3	34.8±6.6	<0.001
SFA (g)	25.9±8.0	27.5±10.1	26.7±9.1	0.362
Fiber (g)	19.9±6.6	20.6±7.4	20.3±7.0	0.414
Vitamin A (µg)	732.2±550.5	917.6±346.3	898.9±897.3	<0.001
Vitamin E (mg)	13.1±5.6	10.20±2.9	13.2±5.7	0.977
Vitamin C (mg)	99.6±84.0	10.8±2.5	104.8±80.8	0.116
Thiamine (mg)	0.8±0.2	917.6±346.3	0.8±0.2	0.446
Riboflavin (mg)	1.5±0.5	1.2±2.9	1.4±0.4	0.011
Niacin (mg)	11.0±5.0	10.8±2.5	10.1±4.5	<0.001
Vitamin B6 (mg)	1.2±0.3	1.1±0.3	1.2±0.3	0.010
Folate (µg)	114.7±33.6	115.1±34.4	114.9±34.0	0.903
Vitamin B12 (µg)	5.2±8.3	3.6±2.3	4.4±6.1	0.001
Sodium (mg)	4408.1±1070.2	3783.3±1589.0	4101.1±1384.1	<0.001
Potassium (mg)	2305.0±588.0	2331.5±650.4	2318.0±618.7	0.558
Magnesium (mg)	253.1±58.0	249.9±65.2	251.6±61.6	0.428
Calcium (mg)	917.6±346.3	869.1±318.3	893.8±333.2	0.238
Zinc (mg)	10.2±2.9	8.9±2.7	9.5±2.9	<0.001
Iron (mg)	10.8±2.5	10.3±2.8	10.6±2.7	0.049

SFA: Saturated fatty acid

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Factors Associated with Sleep Quality

Adolescent's characteristics

Individuals in the age group of 13 and 12 had poorer sleep quality compared to the age group of 11. Moreover, individuals in the age group of 13 had poorer sleep quality compared to the age group of 12. Individuals with a disease had poorer sleep quality than those without a disease ($p<0.05$).

Screen times

A statistically significant difference was found between those who spent 2-3 hours, those who spent 1 or less than 1 hour, and those who spent no time in front of a computer, in terms of PSQI score ($p = 0.001$).

Dietary habits

Individuals who did not have regular breakfast had poorer sleep quality compared to those who regularly and sometimes had breakfast. Those who skipped meals had poorer sleep quality than those who did not. It was determined that individuals who slept 3-5 hours a day had poorer sleep quality compared to those who slept more than 6-8 and 8 hours ($p<0.05$) (Table 4).

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Table 4. Comparison of some characteristics of individuals with PSQI score.

	n	Total PSQI		p
		Mean±SD	Median	
Gender				
Male	176	2.88±2.3	2.0	0.267
Female	170	3.28±2.7	3.0	
Age (year)				
11 [a]	135	2.30±2.1	2.0	<0.01
12 [b]	104	3.29±2.3	2.5	[a-b,c] [b-c]
13 [c]	107	3.84±2.9	3.0	
BMI classification				
At risk of underweight	45	3.09±2.6	2.0	0.765
Normal weight	236	3.17±2.6	3.0	
Overweight	36	2.81±2.4	2.0	
Obese	29	2.57±1.6	2.0	
Disease diagnosed by physician				
Yes	48	4.08±3.2	3.5	0.023
No	298	2.92±2.3	2.0	
Skipping main meal				
Yes [a]	35	4.86±3.6	4.0	<0.01
No [b]	217	2.39±1.9	2.0	[b-a,c]
Sometimes [c]	94	4.01±2.5	4.0	
Regular breakfast				
Yes [a]	203	2.54±1.9	2.0	<0.01
No [b]	31	5.19±3.7	4.0	[b-a,c]
Sometimes [c]	112	3.47±2.6	3.0	
Spending time in front of computer in leisure time				
Never [a]	92	2.72±2.5	2.0	<0.01
<1 [b]	88	2.45±1.8	2.0	[a,b,c-d]
1 [c]	63	2.73±2.2	2.0	
2-3 [d]	76	4.22±2.9	4.0	
>3 [e]	27	3.89±2.8	3.0	
Spending time in front of television in leisure time				
Never	27	3.81±2.7	3.0	0.200
<1	64	2.94±2.7	2.0	
1	97	2.77±2.2	2.0	
2-3	125	3.09±2.6	2.0	
>3	33	3.55±2.5	3.0	
Daily sleep duration (hour)				
3-5 [a]	11	9.82±2.7	10.0	<0.01
6-8 [b]	101	4.32±2.6	4.0	[a-b,c][b-c]
>8 [c]	234	2.22±1.6	2.0	

Mann-*Whitney U" test* and Kruskal-Wallis H test were used.

Multiple significant differences between groups were shown by using the a,b,c,d,e characters.

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Anthropometric measurements

There was no statistically significant relationship between PSQI score and body weight, BMI classification, waist circumference, hip circumference, and waist/height ratio ($p>0.05$) (Table 5).

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Table 5. Comparison of anthropometric measurements of individuals by gender in terms of PSQI score.

	Boys (n=176)			Girls (n=170)		
	Good PSQI (≤5)	Poor PSQI (>5)	p	Good PSQI (≤5)	Poor PSQI (>5)	p
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Body weight (kg)	46.4±12.3	44.6±9.7	0.582	45.6±11.3	49.4±11.7	0.089
Height (cm)	153.2±8.8	155.7±9.5	0.237	153.7±8.3	156.5±6.0	0.044
WC (cm)	71.7±10.1	69.1±7.1	0.330	67.1±8.9	68.6±8.8	0.328
HC (cm)	83.4±9.4	80.4±7.1	0.188	84.3±9.3	88.1±9.4	0.030
WC/HC	0.8±0.0	0.8±0.0	0.696	0.8±0.0	0.7±0.0	0.089
WC/height	0.4±0.0	0.4±0.0	0.097	0.4±0.0	0.4±0.0	0.664

WC: Waist circumference, HC: Hip circumference, NC: Neck circumference.

"Mann-Whitney U" test and *"Student's t-test" were used.*

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There was a weak negative relationship between PSQI and the sleep duration (r=0.499; p=0.000), a weak positive relationship between PSQI and height (r=0.185; p=0.001), and a weak negative relationship between PSQI and waist/hip ratio (r=-0.164; p=0.002) (Table 6).

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Table 6. Correlation of PSQI scores with some parameters.

	PSQI	
	r	p
Sleep duration (hour)	-0.499	0.000
Energy (kcal)	-0.008	0.887
BMI for age Z score	0.015	0.776
Body weight (kg)	0.099	0.065
Height (cm)	0.185	0.001
WC (cm)	-0.003	0.957
HC (cm)	0.102	0.058
WC/HC	-0.164	0.002
WC/height	-0.086	0.109

WC: Waist circumference, HC: Hip circumference, NC: Neck circumference

*In cases where at least one of the two quantitative variables does not have distribution, "*Spearman*" correlation coefficient was used in evaluating the relationship between the variables.

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Food consumptions

When the daily energy and nutrient intake values of individuals were compared to PSQI, only the amount of saturated fatty acid taken daily was statistically significantly lower (p=0.040) in individuals in the good PSQI class compared to those in the poor PSQI class (Table 7).

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Table 7. Comparison of daily energy and nutrients in terms of PSQI classification.

	Good PSQI **(≤5)**		Poor PSQI (>5)		p
	Mean±SD	Median	Mean±SD	Median	
Energy (kcal/day)	1876.6±268.2	1904.0	1867.8±257.0	1879.0	0.594
Carbohydrate (%)	49.3±7.7	49.0	48.9±6.3	50.0	0.716
Protein (%)	15.8±3.8	15.0	16.2±3.7	15.0	0.506
Fat (%)	34.8±6.8	34.0	34.8±5.7	33.0	0.884
SFA (g)	26.3±9.1	24.9	29.0±8.9	27.5	0.040
SFA (%)	12.7±4.0	12.02	13.6±3.7	12.69	0.027
Fiber (g)	20.6±7.1	20.0	18.5±6.5	18.5	0.083
Vitamin A (µg)	909.9±889.4	691.4	829.4±953.0	631.7	0.533
Vitamin E (mg)	13.3±5.7	12.1	12.5±5.2	11.9	0.566
Vitamin C (mg)	106.8±80.6	81.7	92.5±82.0	56.2	0.135
Thiamine (mg)	0.8±0.2	0.8	0.7±0.1	0.8	0.271
Riboflavin (mg)	1.4±0.5	1.4	1.6±0.4	1.5	0.065
Niacin (mg)	10.2±4.6	9.6	9.5±3.8	8.3	0.309
Vitamin B6 (mg)	1.2±0.3	1.2	1.1±0.3	1.1	0.707
Folate (µg)	114.9±33.6	114.1	114.7±36.7	116.7	0.964
Vitamin B12 (µg)	4.4±6.5	3.6	4.42±2.1	4.6	0.147
Sodium (mg)	4057.1±1381.	3918.9	4380.9±1384.7	4123.8	0.102
Potassium (mg)	2323.6±630.8	2271.1	2282.6±539.9	2221.8	0.771
Magnesium (mg)	252.5±63.5	241.3	245.9±47.3	240.3	0.754
Zinc (mg)	9.5±3.0	9.2	9.7±2.2	9.9	0.221
Iron (mg)	10.7±2.8	10.5	10.1±1.9	9.8	0.347

SFA: Saturated fatty acid, PUFA: Polyunsaturated fatty acid, MUFA: Monounsaturated fatty acid

"Mann-Whitney U" test and "Student's t test were used.

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DISCUSSION

The need for sleep may vary depending on individual and environmental factors such as age, gender, disease history, and lifestyle habits (25). In this study, 13.6% of adolescents had poor sleep quality. The poor sleep quality rate in adolescents was 20% in the Xu et al.'s study (26) and 54.7% in Şenol et al.'s study (27). Studies have reported that prolonged sleep latency and increased sleep problems in adolescents (28,29). Sleep latency was >30 minutes in 15.3% of adolescents in our cohort, which seem lower than previously reported rates (28,29). Habitual sleep efficiency was ≥85% in 96.5% of subjects in our cohort, which seems also higher than previously reported rates for ≥85% habitual sleep efficiency in Turkish adolescents (27,28). The results are considered to be incompatible due to different measurement methods, different demographic, cultural characteristics and differences in the mean age. National Sleep Foundation states that adolescents should sleep 8-10 hours (9). In our study, more than half of adolescents slept 8 hours or more. In our cohort, since the mean age of the students was 11.9 ± 0.8 years, the daily sleep duration may be found to be 8 hours or more. The sleep duration detected was consistent with the recommendation of the National Sleep Foundation. However, it was determined in our cohort that there was a significant relationship between age and daily sleep duration, and that as the age increased, daily sleep duration decreased. Similarly, Felden et al. identified that the risk of poor sleep quality increased with age (30). This association may be explained by the fact that, while there is a cumulative increase of academic and recreational activities, there is also a reduction of time of sleep throughout the years (31). Besides, the delay in the biological process of melatonin secretion is related with the advancement of puberty and with the reduced sleep hours among adolescents (32).

This study has found that age does but gender does not affect sleep quality. Results of various studies report contradictory findings about whether boys or girls obtain more sleep. For example, one study found that girls obtained less sleep than boys and reported greater sleep disturbances (33). Another study showed that girls reported longer ideal sleep duration (34).

In the current study, a negative relation was detected between the amount of time the adolescents spent in front of a computer and sleep quality. Similar to our results, Akçay et al. showed that as the adolescents spent more time with their media products, their sleep quality deteriorated (35). The daily watch on the screen has increased significantly among adolescents. Excessive technology use may contribute to the adolescent insufficient sleep (36). A correlation

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was found between sleep deprivation and spending more than 2 hours in front of a TV or computer (37). Watching too much TV has been found to be associated with sleep disorders in adolescence, and the presence of a TV or a computer in the child's room has been shown to cause changes in sleep parameters (38). It has been emphasized by experts that children over the age of two should be limited to a maximum of two hours in front of the screen (39).

It has been identified that adolescents with good and bad sleep quality generally have high dietary fat and saturated fat intake, and low fiber intake in our study. However, no statistically significant difference was identified in terms of energy, macro and micronutrient intake, except for saturated fat intake. Studies have shown that short sleepers have higher energy intakes, notably from fat and snacks, than do normal sleepers (40,41). Insufficient sleep duration has been found to increase the rate of preferring high energy foods (42). A negative relationship was found between amount of sleep and unhealthy eating habits (43). According to previous studies, the intake of fruits, vegetables and milk has a positive association, and the intake of sweets, snacks and fast food has negative association with sleep duration (44-46). On the other hand, studies suggest that short sleep duration was related to increased fat intake (47,48). Poor sleep quality was associated with a lower intake of fruits, vegetables and milk and higher intake of soda, soft drinks, fast food, instant noodle and confectionaries (49). Similar to our result, in a study conducted on Iranian adolescents, there was no relationship between sleep quality and consumption of micronutrients and macronutrients. The mean intake of omega-3 fatty acids in subjects with good-quality sleep was higher than that in the subjects with low-quality sleep (50).

In our study, it was observed that individuals who did not have regular breakfast had poorer sleep quality. However, not many studies have examined the association of sleep duration with skipping breakfast among adolescents (51-53). Among a large sample of Greek children and adolescents, insufficient sleep duration was associated with unhealthy dietary habits including skipping breakfast (51). One study showed that skipping breakfast were significantly higher in children who reported poor sleep (52). Skipping breakfast was associated with total and abdominal obesity in adolescents independent of sleep duration (54).

Prevalence of obesity has reached epidemic proportions across all gender, age and ethnic groups (55). Research to date in young children and adults shows a strong, inverse relationship between sleep duration and risk for overweight and obesity. Fewer studies examining this relationship have been conducted in adolescents (56). In this study, the prevalence of overweight and obesity

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was found to be 10.4% and 8.4%, respectively. Also, although statistical significance was not found, obese adolescents were shown to have less sleep duration averages than adolescents with normal body weight. In current study, BAZ of adolescents was also evaluated according to their sleep quality and no significant difference was found. It is thought that this result was obtained because more than half of the adolescents had normal body weight. In addition, a negative correlation was determined between the waist/hip ratio of students and the PSQI score. Sleep duration and quality have recently been described among obesity risk factors. Many epidemiological studies have shown that there is a relationship between less than 6-7 hours of sleep and obesity (57). However, causation is difficult to determine because of the fact that most of the epidemiological studies are observational (58). HELENA study results showed that European adolescents who slept 6 hours or less had a higher average BMI of 1.7 kg/m^2 and 3.4 cm larger waist circumference than those who slept 10 hours or more (59). In a study on adolescents who less than 8 hours had significantly higher body fat, waist and hip circumference, and BMI (60). Similar to our results, the findings of the Babu et al's study showed a nonmonotonic relationship between sleep quality and anthropometric parameters (61).

There are some strengths and limitations of this study. To date, very few studies have investigated the relationship between dietary habits, food consumption, screen times, anthropometric measurements, and sleep quality in adolescents. We considered sleep duration and sleep quality in explaining sleep status. We considered numerous variables to investigate the association.

This was designed as a pilot study and therefore the sample chosen is not representative and the conclusions cannot be generalized. A single 24-hour recall is not considered to be representative of habitual diet. Further investigations should consider the relationship between sleep and related factors by using objective sleep measures such as polysomnography.

CONCLUSION

It was determined that most of the adolescents had good sleep quality and sleep duration is consistent with the recommended need. Sleep quality is affected by many factors such as dietary habits, food consumption, screen times, and individual factors. This study results support the development of interventions to help adolescents improve sleep quality. Further studies are

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needed to clarify the multiple mechanisms involved between individual factors, dietary habits, food consumption, anthropometric measurements, screen times, and sleep patterns in adolescents.

AUTHORSHIP CONTRIBUTIONS

ÖK and GK designed the study, ARÖ collected the data, GK, ÖK, and ARÖ prepared the paper.

FINANCIAL DISCLOSURE

The authors have no financial relationships relevant to this article to disclose.

ACKNOWLEDGMENTS

We would like to thank the adolescents and their parents who devoted their time to the data collection.

CONFLICT OF INTEREST

Authors state that there are no conflicts of interest in preparing the manuscript.

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