

RESEARCH STUDY

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The Effects of Food Intake and Eating Behavior on Sleep Quality in Adolescents

Pengaruh Asupan Makanan dan Perilaku Makan Terhadap Kualitas Tidur Pada Remaja

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ABSTRACT

Background: Food and eating behaviors can be related to nutrition as well as sleep for healthy society.

Objectives: The aim of the study is to examine the eating behaviors of adolescents and the effect of some foods on sleep quality in adolescence.

Methods: The study was carried out as a survey model of 580 adolescents in Konya, Turkey. The questionnaire consists of demographic features and anthropometric measurements, Pittsburg Sleep Quality Index (PSQI), Eating Behavior Scale (EBS), and 24-hour recalled food consumption record used for evaluation of daily nutrient intakes. The SPSS (ver. 22) software was used to analyze the data.

Results: PSQI score was 5.79 ± 0.17 in girls and 5.27 ± 0.15 in boys, with a significant difference ($p=0.022$) and sleep quality was found to be good in 42.4% and poor in 57.6%. Sleep duration ($p=0.011$), sleep disturbances ($p=0.002$), daytime dysfunction ($p=0.000$) were differed by gender. The mean of EBS score was found to be 211.04 ± 61.32 , differed between girls and boys ($p<0.05$). Also, the EBS score differed by night eating ($p=0.000$). Total energy ($p=0.001$), protein ($p=0.001$), carbohydrate ($p=0.003$), B1 ($p=0.028$), B6 ($p=0.006$), niacin ($p=0.000$), folic acid ($p=0.001$), B12 (, Zn, and Fe daily intake changed between girls and boys ($p<0.05$).

Conclusion: Adolescents with poor sleep quality, poor eating behavior should consider night eating is to determine if it may be associated with their sleep.

ABSTRAK

Latar Belakang: Perilaku makan dan makan berkaitan dengan gizi serta tidur bagi masyarakat yang sehat.

Tujuan: Penelitian ini bertujuan untuk mengetahui perilaku makan remaja dan pengaruh beberapa jenis makanan terhadap kualitas tidur remaja.

Metode: Penelitian dilakukan sebagai model survei terhadap 580 remaja di Konya, Turki. Kuesioner terdiri dari fitur demografis dan pengukuran antropometrik, Indeks Kualitas Tidur Pittsburg (PSQI), Skala Perilaku Makan (EBS), dan catatan konsumsi makanan yang diingat 24 jam yang digunakan untuk evaluasi asupan nutrisi. Perangkat lunak SPSS (ver. 22) digunakan untuk menganalisis data.

Hasil: Skor PSQI adalah $5,79 \pm 0,17$ pada anak perempuan dan $5,27 \pm 0,15$ pada anak laki-laki, dengan perbedaan yang signifikan ($p=0,022$) dan kualitas tidur ditemukan baik pada 42,4% dan buruk pada 57,6%. Durasi tidur ($p=0,011$), gangguan tidur ($p=0,002$), disfungsi siang hari ($p=0,000$) berbeda menurut jenis kelamin. Rerata skor EBS ditemukan $211,04 \pm 61,32$, berbeda antara anak perempuan dan laki-laki ($p<0,05$). Juga, skor EBS berbeda dengan makan malam ($p=0,000$). Energi total ($p=0,001$), protein ($p=0,001$), karbohidrat ($p=0,003$), B1 ($p=0,028$), B6 ($p=0,006$), niasin ($p=0,000$), asam folat ($p=0,001$), B12 (, Zn, dan Fe asupan harian berubah antara anak perempuan dan laki-laki ($p<0,05$).

Kesimpulan: Remaja dengan kualitas tidur yang buruk, perilaku makan yang buruk harus mempertimbangkan makan malam untuk menentukan apakah hal itu mungkin berhubungan dengan tidur mereka.

Kata Kunci: Remaja, Kualitas tidur, Perilaku makan, Asupan gizi.

INTRODUCTION

There are many factors in the emergence of nutrition-related diseases such as obesity. High stimulant food and beverages, unhealthy nutritional behaviors and night eating behavior affect sleeping related to obesity¹⁻³. In recent years, there have been serious changes in the body weights and eating behaviors of children and adolescents in Turkey as well as all over the world^{4,5}. In the past few decades children and adolescents have been sleeping less because of many social, demographic, and other numerous factors as food and drinks (e.g., energy drinks, high caffeinated drinks)⁶⁻¹⁰. Recommended nighttime sleeping duration is nine hours for adolescents^{11,12}. Many cross-sectional studies emphasized that shorter sleeping duration or sleeping problems were related to higher BMI, obesity and other unhealthy eating behaviors or eating disorders (e.g., anorexia nervosa)¹³⁻¹⁶. The effect of short sleep duration depends on nutrition, and it can be explained by several factors, including increased sympathetic activity, elevated cortisol and ghrelin levels, decreased leptin and/or impaired glucose tolerance on obesity¹⁷⁻²⁰. In studies²¹⁻²³ among adolescents according to middle and high school education short sleep duration time associated with overweight and obesity and study results have shown that an obesity risk of 6.5% may occur with a shortening of 1 hour of sleep time. All these results once again reveal the importance of sleep quality in adolescents.

When the relationship between sleep duration and quality and nutrition is examined, it is seen that various macro and micronutrients affect the sleep mechanism^{24,25}. Glucose, tryptophan and tyrosine, and essential fatty acids affect sleeping patterns and they should not be forgotten that caffeine is a substance responsible for it²⁶⁻²⁸. Consumption of high-carbohydrate foods leads to an increase in postprandial sleep time²⁹. Tryptophan, which is found in all protein-containing foods and has the feature of being the precursor of serotonin, also has the effect of increasing the tendency to sleep³⁰. It has been shown that milk, which is one of the foods with the most tryptophan, is more effective than drug treatment in the treatment of sleep disorders. Protein-rich foods make it easier to fall asleep. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) synthesized from omega-3 fatty acids, which have a significant effect on the nervous system, are also very important fatty acids in the sleep process^{31,32}. Caffeine, which has a sleep-delaying effect, has a moderate stimulating effect on the central nervous system depending on the amount of consumption.

Sleep quality is closely related to healthy eating behaviors, and adolescents who get insufficient sleep tend to consume more high-energy foods obtained from fat, sugar, and refined carbohydrates³³⁻³⁵. Also, caffeinated drinks or caffeine-rich foods (e.g., coffee, energy drink) negatively affect sleep, delay the process of falling asleep and reduce the sleep duration, thus causing decreases in sleep quality. Caffeinated food consumption use 1 hour before night also reduces falling asleep, sleep duration and restful sleep^{36,37}. It has been seen that adolescents frequently consume caffeinated

drinks to consciously benefit from this effect on sleep and to stay awake at times, such as during the exam period. The aim of the study is to determine the eating behaviors and sleep quality of adolescents, and the daily energy and nutrient intake.

METHODS

Study Population and Data Collection

The research was designed as a survey model to examine the sleep quality, daily energy expenditure and nutrient intake and eating behaviors of 14-18-year-old adolescents. The population of the research consists of eight high schools selected by simple random sampling method in 137 high schools, 90 of which are public and 47 private high schools in city center of Konya, Turkey. Population was calculated as one independent means (one groups) applied by power analysis with G*Power 3.1.9.2 software program³⁸. The parameters were entered in G*Power as 0.15 for effect length, 0.05 for error (α) and 0.95 for power ($1-\beta$) and the sample size was found 580. Using the stratified sampling method, the number of adolescent individuals to be sampled from the three central districts was determined. The layer weight of Selcuklu, Meram and Karatay district is 0.52 (n=300), 0.25 (n=147) and 0.23 (n=133), respectively³⁹. The data were collected with questionnaire by using face-to-face interview with adolescents in their schools.

Measurements

The questionnaire form was performed by researchers, and it was prepared with the help of three experts. The draft was pre-applied to 15 adolescents and the necessary corrections were made to the form by researchers and then the finalized form was performed to participants. Questionnaire consisted of four parts and in the first part were demographic variables and anthropometric measurements (e.g., height, weight), the second part was 24-hour recalled food consumption record, the third part used the Pittsburgh Sleep Quality Index (PSQI) scale to determine sleep quality and the last part, Eating Behavior Scale (EBS), was used to determine eating behaviors. Anthropometric measures calculated Body Mass Index (BMI) (kg/m^2) and categorized with percentiles according to WHO Adolescents' Growth Standards⁴⁰ and Turkey Dietary Guideline (TDG)⁴¹. BMI percentile values of the adolescents participating in the study were determined by <3 the percentile is "weak"; 3-15 percentile range of "weakness risk"; 15-85 percentile range is "normal;" 85-97. percentile is "overweight;" and >97 percentile is stated as "obese."^{40,41} The 24-hour recalled food consumption record method was used and the foods consumed in the last 24 hours were questioned. The PSQI consists of nine questions in total, and it was to evaluate the sleep of adolescents in the last month, and the EBS prepared in the form of a metric scale was applied to determine the eating behaviors by 58 items. Informed consent form was given to the adolescents, and none of them was forced to participate in the study.

Agargun et al.⁴² PSQI containing 28 items was translated to Turkish and evaluated the validity,

reliability, and internal consistency (Cronbach $\alpha=0.80$) of the study of which was carried out by the evaluation made according to the result of the PSQI global score. The 18 questions of the index included in the scoring consist of seven components. They were determined as subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Evaluation for each sub-dimension is made between 0-3 points. In all cases, a score of "0" indicates 'no difficulty', and while a score of "3" was 'difficulty'. Global score between 0-21 points and when the data are evaluated, a score less than 5 is considered as "good," and a score of 5 points or above is as "poor" sleep quality. EBS, which was developed by Ozdogan⁴³ is a metric scale, that indicates reactions to each behavioral expression by placing a mark on a line 0 to 10 points extending from toward the most negative to the positive. Total EBS score between 0-580 points and at the end of the evaluation four attributes as ≤ 145 points are considered "poor," 146-290 points are "moderate," 291-435 points are "good," and ≥ 436 points are "very good." The Cronbach α of the EBS is 0.72.

Statistical Analysis

The data was performed using SPSS (version 22.0) software program. Descriptive statistics like frequency (n), ratio (%), mean (\bar{x}), standard error of mean (SE) was computed for all one group items. Parametric (e.g., F test) and non-parametric statistic tests (e.g., Chi-Square) were used to examine the

differences between predictor variables. The p value was accepted as <0.05 in all statistical analyses. BEBIS (Nutrition Information Systems) software program was used to evaluate the 24-hour recalled food consumption data to calculate the energy and nutrients consumed by adolescents. Only the dinner, snack and night food consumption data were used and calculated of the 24-hour recalled food consumption record. The adequacy of daily energy and nutrients consumption was calculated according to age and gender⁴¹.

RESULTS AND DISCUSSION

Demographic Characteristics and BMI

The study participants included 580 adolescents (mean age 15.5 ± 0.92 years, range 14-18), bearing 47.1 % females and 52.9% males. Adolescents were evaluated according to age groups, and it was determined that 9.5% were 14, 42.8% 15, 30.2% 16, 15.9% 17, and 1.7% 18 years old. Body Mass Index (BMI) (kg/m^2) for ages and for standards followed WHO Child Growth Standards and TDG for girls and boys^{40,41}. In Table 1, according to the anthropometric results, underweight, weakness risk, normal, overweight, and obese were found 1.9%, 11.6%, 65.2%, 16.0% and 5.3%, respectively. BMI percentile value for age was evaluated according to gender, a statistically significant difference was detected ($p < 0.05$). A study⁴⁴ in Turkey, overweight and obese findings obtained similar results. On the other hand, our BMI findings are consistent with other studies carried out in other countries⁴⁵⁻⁴⁹.

Table 1. BMI of adolescents.

BMI	Girls(n=273)		Boys(n=307)		Total	
	n	%	n	%	n	%
Underweight	1	0.4	10	3.3	11	1.9
Weakness Risk	31	11.4	36	11.7	67	11.6
Normal	196	71.8	182	59.3	378	65.2
Overweight	32	11.7	61	19.9	93	16.0
Obese	13	4.8	18	5.9	31	5.3

Among the adolescents, the rate of those who stated that regular main pattern was found 36.0% in girls and 64.0% in boys and significant difference between the gender ($p < 0.05$). Another finding is that 33.4% of the adolescents skip breakfast, 21.2% lunch

and 3.6% skip the evening meal. Breakfast was the most skipped meal in girls (61.8%) and in boys (52.0%). In many studies⁵⁰⁻⁵³, skipping meals especially breakfast of adolescents ranged from 5% to 55% both sexes.

Table 2. Night eating behavior, consumption of caffeinated drinks, and regular meal pattern by gender.

		Girls (n=273)		Boys (n=307)		Total		p*
		n	%	n	%	n	%	
Night Eating	Yes	43	7.4	50	8.6	93	16.0	0.861
	No	230	47.2	257	52.8	487	84.0	
Caffeinated Drink Consumption	Yes	234	40.3	279	48.1	513	88.4	0.052
	No	39	6.7	28	4.8	67	11.6	
Regular Meal Pattern	Always	87	36.0	155	64.0	242	41.8	0.000
	Sometimes	128	50.4	126	49.6	254	43.8	
	Never	58	69.0	26	31.0	84	14.4	

*Chi-square test

Adolescents' night eating was found to be 16.0%, and boys' night eating levels were higher than girls ($p>0.05$). When comparing the consumption of caffeinated drinks, boys have similarly higher consumption levels than girls ($p>0.05$). Especially in recent years, adolescents are turning to caffeinated drinks, e.g., energy drink, coffee for different purposes such as stay awake, work at night. However, a significant difference appears between the groups according to

their regular meal pattern ($p<0.05$). On the other hand, always, sometimes, and never regular meal pattern behavior was found 41.8%, 43.8% and 14.4%, respectively. Girls have higher meal pattern than boys. Hernandez et al.⁵⁴ implied that 21% of adolescents were night eaters. Other studies^{55,56} represented similar results to explain how eating behaviors were affected by the night eating.

Table 3. PSQI and EBS scores of gender and night eating ($\bar{x}\pm SE$).

PSQI Score	Gender			Night Eating		
	Girls (n=273)	Boys (n=307)	p*	Yes (n=93)	No (n=487)	p*
Subjective sleep quality	1.22±0.04	1.14±0.04	0.166	1.30±0.72	1.15±0.34	0.094
Sleep latency	1.16±0.06	1.06±0.05	0.190	1.20±0.10	1.08±0.41	0.276
Sleep duration	0.65±0.05	0.83±0.05	0.011	0.90±0.97	0.71±0.37	0.052
Habitual sleep efficiency	0.27±0.04	0.18±0.03	0.100	0.18±0.57	0.23±0.28	0.468
Sleep disturbances	1.20±0.03	1.08±0.03	0.002	1.24±0.58	1.11±0.21	0.017
Use of sleeping medication	0.04±0.02	0.04±0.01	0.834	0.01±0.10	0.04±0.13	0.248
Daytime dysfunction	1.24±0.06	0.94±0.05	0.000	1.33±0.90	1.03±0.41	0.004
Global Score	5.79±0.17	5.27±0.15	0.022	6.1±0.26	5.3±0.12	0.011
EBS Score	205.7±59.86	215.7±62.31	0.049	243.0±6.33	204.9±2.69	0.000

* Independent Samples T Test

According to Table 3, as a result of the evaluation of the PSQI scores of the adolescents according to the seven sub-dimensions of the scale, sleep duration, sleep disturbances, daytime dysfunction, and global scores were found significant differences ($p<0.05$), and due to the night eating situations, sleep disturbances, daytime dysfunction and global score were differed by gender ($p<0.05$). Raniti et al.⁵⁷ highlighted important covariation between poor sleep

duration, efficiency, and latency. Şimşek and Tekgöl⁵⁸ stated 82.0% of adolescents had poor sleep quality. According to the Tetik and Kar Şen's⁵⁹ study, 50.3% of adolescents had poor sleep quality. When the EBS scores were examined, it was determined that the boys were higher than the girls ($p<0.05$), and the scores of the adolescents with night eating behavior were similar ($p=0.000$).

Table 4. Evaluation of PSQI scores of age, BMI, and night eating behavior.

		Good (< - 5)		Poor (5 - >)		Total		p*
		n	%	n	%	n	%	
Age (year)	14	24	4.1	31	5.3	55	9.5	0.404
	15	116	20.0	132	22.8	248	42.8	
	16	68	11.7	107	18.3	175	30.1	
	17	34	5.9	58	10.0	92	15.9	
	18	4	0.7	6	1.0	10	1.7	
BMI	Underweight	26	4.5	24	4.1	50	8.6	0.683
	Weakness Risk	57	9.8	101	17.4	158	27.2	
	Normal	110	19.0	148	25.5	258	44.5	
	Overweight	45	7.8	48	8.3	93	16.0	
	Obese	8	1.4	13	2.2	21	3.7	
Night Eating	Yes	25	4.3	68	11.7	93	16.0	0.001
	No	221	38.1	266	45.9	487	84.0	

* Chi-square test

As a result of the evaluation of PSQI scores, it is shown in Table 4 that the highest age was 15 in the good ones and that the similarity was also obtained in the poor. It was determined that those with normal BMI had higher good (63.8%) and poor (66.2%) sleep quality than the others, but no difference was found between them ($p>0.05$). Overweight (16.0%) and weakness risk (11.6%)

groups were determined as the higher after the normal BMI group in both groups. Conversely, it was determined that those who did not have night eating behavior were at the highest level compared to both good (38.1%) and poor (45.9%) sleep quality groups ($p<0.05$). Cleator et al.⁶⁰ reported that poor sleep quality is common in obese group, but night eating is rare.

Table 5. Determination of EBS scores of BMI and night eating behavior.

		Poor		Moderate		Good		p*
		n	%	n	%	n	%	
BMI	Underweight	12	2.1	35	6.0	3	0.5	0.069
	Weakness Risk	24	4.1	114	19.7	20	3.4	
	Normal	29	5.0	208	35.9	21	3.6	
	Overweight	10	1.7	68	11.7	15	2.7	
	Obese	3	0.5	14	2.4	4	0.7	
Night Eating	Yes	5	0.9	68	11.7	20	3.4	0.000
	No	73	12.6	371	64.0	43	7.4	
Night Eating (n=93)	Girls	4	4.3	32	34.4	7	7.5	0.189
	Boys	1	1.1	36	38.7	13	14.0	

* Chi-Square Test

In Table 5, when EBS scores are examined, due to the BMI groups no difference is found ($p>0.05$), but good and moderate level of EBS is detected higher in normal than others. The same as BMI, in night eating EBS score was differed ($p<0.05$) and moderate by a long way from poor and good. Unlike PSQI, night eating

behavior was determined to be similarly high, and no difference could be determined according to gender ($p>0.05$). Hunot-Alexander et al.⁶¹ reported girls' higher scores of emotional over-eating, satiety responsiveness, and slowness in eating than boys.

Table 6. The total energy and daily nutrient intake in adolescents ($\bar{x}\pm SE$)

Energy and Nutrients	Girls (n=273)	Boys (n=307)	p*
Total Energy (kcal)	1519±21.3	1660±23.1	0.001
Protein (g)	59.9±1.1	71.0±1.2	0.001
Carbohydrate (g)	186.6±3.4	208.2±3.8	0.003
Lipid (g)	57.5±1.15	58.3±1.07	0.637
Dietary Fiber (g)	16.3±0.4	17.1±0.3	0.228
Vitamin A (µg)	799.9±26.2	783.6±24.3	0.962
Vitamin C (mg)	83.9±3.3	66.6±3.0	0.353
Vitamin D (µg)	7.1±0.2	7.2±0.2	0.242
Vitamin E (mg)	1.7±0.1	2.1±0.2	0.220
Vitamin B1 (mg)	0.6±0.0	0.7±0.0	0.028
Vitamin B2 (mg)	1.0±0.0	1.0±0.0	0.064
Vitamin B6 (mg)	0.9±0.0	1.0±0.0	0.006
Niacin (mg)	10.5±0.3	12.9±0.3	0.000
Folic acid (µg)	206.7±4.8	229.4±5.8	0.001
Vitamin B12 (µg)	3.9±0.1	5.2±0.4	0.002
Ca (mg)	641.7±16.0	645.9±14.1	0.936
P (mg)	942.4±18.8	1027.9±18.7	0.097
K (mg)	1994.2±40.0	1950.1±38.2	0.309
Zn (mg)	8.1±0.1	9.2±0.1	0.012
Fe (mg)	7.7±0.1	8.5±0.1	0.005
Na (mg)	3417.3±95.1	4028.7±94.5	0.586

* Independent Samples T Test

When the daily nutrient intakes of adolescents were evaluated, total energy, protein, carbohydrate, B1, B6, niacin, folic acid, B12, Zn, and Fe differed by gender ($p<0.05$). Protein, carbohydrate, niacin, B12, and Na intakes were higher than the DRI values of Turkey. On the other hand, vitamin D, Ca, K levels were found to be lower than those of Turkey's DRI in both adolescent groups.⁴¹ A study⁵⁴ stated that daily energy intake at night is 25% of adolescents. Bartel et al.⁶² emphasized an adolescents' study showing high consumption of caffeine shortens sleep durations, delays the start of sleep, increases the number of times an individual awakes during the night, and causes sleepiness during the day. Similar findings were obtained in Tetik and Kar Şen's⁵⁹ study. Weiss et al.⁶³ found short sleeping

duration associated with snack consumption and more energy intake at night and similarly our findings overlapped energy, carbohydrates, and lipids. Diethelm et al.⁶⁴ carried out a study on European adolescents in eight cities in Europe and found short fatty acid and salt intake was too high and vitamin D, folate, I and F were less than %55 of recommendations and nutritional quality index score was found moderate. Moreover, our nutrient intake findings are in line with the results other European studies⁶⁵⁻⁶⁷.

CONCLUSIONS

Adequate and balanced diet is essential to be healthy in adolescence. Although nutrition is important in every age group, the importance of nutrition

increases due to the increase in needs with the acceleration of growth in the adolescence period, which is called the transition period from childhood to adulthood. In this period, with the acquisition of eating behaviors, habits that will last a lifetime are obtained. Night eating syndrome, which is a sleep-related eating behavior disorder, is an eating disorder that is also seen in adolescence. Night eating behaviors in adolescents were examined and it was observed that night eating habits were quite rare. Despite the insufficient nutrient intake, it has been determined that most adolescents inadequately consume some nutrients that are important for growth and development. Especially in this period, if the need for these nutrients cannot be met, problems related to nutrition become inevitable. In this regard, it is very important to eat consciously and to gain healthy eating behaviors.

Ethical Consideration

An ethical approval numbered 2018/180 received from the Selcuk University Health Sciences Faculty Ethics Committee of Non-Invasive Research. Written permission was obtained from the institution where the study was conducted. The students who agreed to participate were informed about the study and their written and verbal consents were received. This paper summarized MSc thesis declared to "Determination of Eating Behavior, Sleep Quality and Nutritional Status of Adolescents" written by first author of the study.

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CONFLICT OF INTEREST

All authors have no conflict of interest in this study.

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