Original Article

Sleep Quality in Adolescents in Relation to Age and Sleep-related Habitual and Environmental Factors

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ABSTRACT

Aim: Our objective is to evaluate the sleep quality in adolescents in relation to age and sleep-related habitual and environmental factors.

Materials and Methods: A total of 150 adolescents aged 12-20 years [mean (standard deviation) age: 15.5 (1.9) years; 65.3% were female] were included on a voluntary basis in this cross-sectional questionnaire survey. The questionnaire form included items on subject demographics (age, gender), before sleep activities (tea/coffee consumption, reading, use of social media), presence and of electronic devices (computer, television, cell phone) in the bedroom and presence of roommate, as well as items on Pittsburgh Sleep Quality Index (PSQI).

Results: Usual bedtime between 23.00-24.00 p.m. (38.0%), sleep latency of 15 minutes (38.0%), sleep duration of ≥7 hours (79.0%) and usual wake up time between 6.00-7.00 am (41.7%) were the most commonly identified sleeping patterns. PSQI total scores revealed poor sleep quality (scores ≥5) in 82.0% of participants, while 40.0% of participants rated their sleep quality to be poor. Later bedtime (≥24.00) was more likely in late-adolescents (64.7%) than earlier age groups (p=0.009). Sleep latency >30 minutes, difficulty in breathing and bad dreams during sleep, presence of electronic device in the bedroom and use of social media before sleep and difficulty in performing daily activities were associated with higher likelihood of PSQI-based poor sleep quality (p<0.05 for each).

Conclusion: Our findings revealed poor sleep quality (PSQI scores >5) in 82.0% of adolescents, regardless of adolescence period, and association sleep latency >30 minutes, difficulty in breathing and bad dreams during sleep, presence of electronic device in the bedroom and use of social media near bedtime with higher likelihood PSQI-based poor sleep quality.

Keywords: Adolescence, sleep quality, PSQ, media devices, sleep latency

Introduction

Sleep is an essential component of mental and physical development in children and adolescents (1-4). However, insufficient sleep and disturbed sleep patterns are common in the pediatric age, with a rising prevalence throughout adolescence (2,5-7).

Adolescence is considered a period with considerable alterations in sleep pattern in terms of amount and quality (7-10) in relation to physiological, environmental, social and behavioral changes specific to this life period (10-12). The trend of insufficient and deteriorating sleep and poor sleep hygiene among adolescents is considered a public health concern given the short and long term detrimental health outcomes including poor diet; sedative behavior; obesity; reduced immunity; stunted growth; cognitive impairment, poor academic performance and mental health problems

such as depression, anxiety and suicidal tendencies and substance abuse (2,13-18).

Hence, assessment of sleep quality is considered important for health and well-being of adolescents given the increased risk of alterations in sleep patterns and detrimental sleep hygiene in this period as a potential indicator of poor physical and mental health status (8-10, 18,19).

This study was therefore designed to evaluate the sleep quality in adolescents in relation to age and sleep-related habitual and environmental factors.

Materials and Methods

Study Population

A total of 150 adolescents aged 12-20 years [mean (standard deviation (SD) age: 15.5 (1.9) years; 65.3% were female] were included on a voluntary basis in this cross-sectional questionnaire survey conducted at a tertiary care auditory assessment adolescence center between March 2016 and May 2016.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with the ethical principles stated in the "Declaration of Helsinki" and approved by the University of Health Sciences, İzmir Tepecik Training and Research Hospital Ethics Committee (approval number: 19/10, date: 15.03.2016).

Study Parameters

Data on patient demographics, sleep-related habitual and environmental factors and sleep quality scores were recorded in each subject using a questionnaire form applied via face-to-face method.

Questionnaire From

The questionnaire form included items on subject demographics (age, gender), before sleep activities (tea/coffee consumption, reading, use of social media), presence and of electronic devices [computer, television (TV), cell phone] in the bedroom and presence of roommate, as well as items on Pittsburgh Sleep Quality Index (PSQI).

Pittsburgh Sleep Quality Index

The PSQI was developed by Buysse et al. (20) as a self-rated questionnaire which assesses several dimensions of sleep quality over a one-month time period. Turkish validation of PSQI was performed by Agargun et al. (21). The scale consists of 18 items, that yield seven component scores including subjective sleep quality, sleep latency,

sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction. Each component is scored between 0 and 3 and the sum of the component scores yields a global score (range= 0-21) that reflects the composite severity of sleep disturbance. Higher scores indicate a lower quality of sleep. A total score under 5 indicates "good sleep quality", while a score above 5 shows "poor sleep quality".

Statistical Analysis

Statistical analysis was made using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY). Chi-square (χ^2) test was used for the comparison of categorical data. Data were expressed as mean (SD) and n (%) where appropriate. P<0.05 was considered statistically significant.

Results

Patient Characteristics and Sleep Patterns

Most of participants (60.0%) were in the late-adolescence period. Usual bedtime between 23.00-24.00 p.m. (38.0%), sleep latency of 15 minutes (38.0%), sleep duration of ≥7 hours (79.0%) and usual wake up time between 6.00-7.00 a.m. (41.7%) were the most commonly identified sleeping patterns (Table I).

PSQI total scores revealed poor sleep quality (scores ≥5) in 82.0% of participants, while 40.0% of participants rated their sleep quality to be poor. Habitual sleep efficiency was ≥85% in 61.3% of subjects (Table I).

Pain and bad dreams during sleep were evident in 34.0% and 68.0% of subjects respectively. Before sleep activities comprised tea/coffee consumption in 36.0% of subjects, reading in 46.0% and use of social media in 48.0%. Presence of roommate and electronic devices in the bedroom was identified in 42.0% and 47.3% of subjects, respectively, while 54.7% of subjects identified to have difficulty in performing daily activities, 42.0% to have difficulty in breathing and 66.7% to wake up in the middle of the night or early morning (Table I).

Sleep Characteristics According to Age Groups

No significant difference was noted in gender distribution, sleep duration, self-rated sleep quality and PSQI sleep quality between early, mid- and late-adolescence groups. Later bedtime (≥24.00) was more likely in late-adolescents (64.7%) than earlier age groups (p=0.009) (Table II).

Factors Associated with Poor Sleep Quality

Sleep latency >30 minutes, difficulty in breathing and bad dreams during sleep and difficulty in performing daily

Table I. Patient characteristics and sleep patterns (n=150)	
Age (year), mean (SD)	15.5 (1.9)
Age group, n (%)	
Early-adolescence (12-14 y)	43 (28.7)
Mid-adolescence (15-17 y)	90 (60.0)
Late-adolescence (18-20 y)	17 (11.3)
Gender, n (%)	
Female	98 (65.3)
Male	52 (34.7)
Sleep duration, n (%)	
≥7 h	119 (79.0)
6-7 h	23 (15.0)
5-6 h	6 (4.0)
<5 h	2 (1.0)
Usual bedtime, n (%)	
≤22.00	30 (20.0)
22.00-23.00	19 (12.7)
23.00-24.00	57 (38.0)
≥24.00	44 (29.3)
Sleep latency, n (%)	
0-15 minimum	57 (38.0)
15-30 minimum	31 (20.7)
31-60 minimum	34 (22.7)
>60 minimum	28 (18.7)
Usual wake up time, n (%)	
<6.00 am	18 (12.0)
6.00-7.00 am	61 (41.7)
07.00-08.00 am	41 (27.3)
08.00-09.00 am	11 (7.3)
>9.00 am	19 (12.7)
Self-rated sleep quality (last month), n (%)	
Very good (0)	24 (16.0)
Fairly good (1)	66 (44.0)
Fairly bad (2)	47 (31.3)
Very bad (3)	13 (8.7)
Habitual sleep efficiency, n (%)[a]	
≥85%	92 (61.3)
75-84%	36 (24.0)
65-74%	14 (9.3)
<65%	8 (5.3)

Table I. Continued		
PSQI total score, n (%)		
Good (<5)		27 (18.0)
Poor (≥5)		123 (82.0)
Before sleep activities, n (%)		
Tea/coffee consumption	Yes	54 (36.0)
	No	96 (64.0)
Reading	Yes	69 (46.0)
	No	45 (30.0)
Use of social media	Yes	72 (48.0)
	No	78 (52.0)
Electronic device in the bedroom, n (%)		
Present		71 (47.3)
Absent		79 (52.7)
Roommate, n (%)		
Yes		63 (42.0)
No		87 (58.0)
Difficulty in performing daily activities, n (%)		
Yes		82 (54.7)
No		68 (45.3)
Difficulty in breathing, n (%)		
Yes		63 (42.0)
No		87 (58.0)
Pain during sleep, n (%)		
Yes		51 (34.0)
No		99 (66.0)
Bad dreams, n (%)		
Yes		102 (68.0)
No		48 (32.0)
Waking up in the middle of the night or early morning, n (%)		
Yes		100 (66.7)
No		50 (33.3)

[a](total # of hours asleep)/(total # of hours in bed) x100
SD: Standard deviation, PSQI: Pittsburgh Sleep Quality Index

activities were associated with higher likelihood of poor sleep quality in terms of both self-rated and PSQI-based scores (Table III).

Experience of pain during sleep and tea/coffee consumption before sleep were associated higher likelihood of self-rated poor sleep quality, while waking up in the middle of the night or early morning, presence of electronic device in the bedroom and use of social media before sleep

were associated with higher likelihood PSQI-based poor sleep quality (Table III).

Discussion

Our findings revealed poor sleep quality (PSQI scores >5) in 82.0% of adolescents, regardless of adolescence period, while 40.0% of adolescents self-rated their sleep quality to be poor. Sleep latency >30 minutes, difficulty in breathing and bad dreams during sleep and difficulty in performing daily activities were highly prevalent in our cohort, which seems to be in accordance with their association with poorer sleep quality based on both self-rated and PSQI-based scores. Presence of electronic device in the bedroom and use of social media near bedtime were also associated with higher likelihood PSQI-based poor sleep quality.

Our findings support the high prevalence of altered sleep patterns in adolescents including poor sleep quality rates of 60-80% based on subjective assessment methods including

PSQI, and negative self-perception of sleep quality with self-rated poor quality by nearly half of adolescents (2,11,19,22). Hence, increase in awareness of the problem seems crucial given the consistently reported trend of insufficient and deteriorating sleep among adolescents along with somatic and psychological adverse impacts on health (3,4,23).

Sleep duration (≥7 h in 79.0%) of adolescents in our cohort is consistent with the recommended need for at least 8-10 hours of sleep per night by adolescents (24), while together with usual bedtime (after 23.00 o'clock in 67.3%) and wake up time (6.00-7.00 a.m. in 41.7%) data, sleep patterns in our cohort of adolescents fit in line with previous studies in adolescents (mean age of: 15.2 to 16.4 years) that reported an average bedtime of 23.30-24.00 o'clock, sleep duration of 7.0 to 8.1 hours and wakeup time of 6.75-7.55 o'clock (19,25,26).

Our findings revealed no significant difference between early, mid- and late-adolescence in terms of sleep duration,

Table II. Sleep characteristics according to age groups

	Adolescence period			
	12-14 y (n=43)	15-17 y (n=90)	18-20 y (n=17)	p value
Gender, n (%)				
Female	31 (72.1)	53 (58.9)	14 (82.4)	>0.05
Male	12 (27.9)	37 (41.1)	3 (17.6)	
Sleep duration, n (%)				
≥7 h	36 (83.8)	69 (76.0)	14 (82.0)	0.220
6-7 h	6 (13.9)	16 (17.0)	1 (5.0)	
5-6 h	0 (0.0)	5 (5.0)	1 (5.0)	
<5 h	1 (5.0)	0 (0.0)	1 (5.0)	
Bedtime, n (%)				
≤22.00	11 (25.6)	18 (20)	1 (5.9)	**0.009**
22.00-23.00	5 (11.6)	13 (14.4)	1 (5.9)	
23.00-24.00	12 (27.9)	41 (45.6)	4 (23.5)	
≥24.00	15 (34.9)	18 (20.0)	11 (64.7)	
Self-rated sleep quality, n (%)				
Very good (0)	5 (11.6)	16 (17.7)	3 (17.6)	0.550
Fairly good (1)	17 (39.5)	44 (48.8)	5 (29.4)	
Fairly bad (2)	17 (39.5)	23 (25.5)	7 (41.1)	
Very bad (3)	4 (9.0)	7 (7.0)	2 (7.0)	
PSQI total score				
Good (<5)	7 (16.2)	18 (20.0)	2 (11.8)	>0.05
Poor (≥5)	36 (83.7)	72 (80.0)	15 (88.2)	

PSQI: Pittsburgh Sleep Quality Index

self-rated sleep quality and PSQI sleep quality scores, while late-adolescence was associated with higher likelihood of later bedtimes (after 24.00 o'clock). Similarly, a trend towards later bed times with overall 1 h per night reduction in sleep duration has been reported in late-adolescence, while lack of parent supervision, variability of sleeping hours and more frequent after-school activities are considered amongst the factors contributing to this delay (7,27-29).

In addition, certain factors such as electronic media device use, early school start times and increasing caffeine consumption have also been considered to contribute substantially to the trend of poor sleep quality among adolescents (2,6).

Notably, in our cohort, half of adolescents confirmed to have an electronic device (computer, TV, cell phone) in the bedroom and to use social media before sleep, both of which were also determined to be associated with poorer PSQI scores. This supports the high frequency of having at least one media device in the sleeping environment in the adolescence period, and increased odds of poor sleep quality with presence of media devices (even without use) in the bedroom (2,22,30).

Specifically, presence of electronic devices in the bedroom was reported to be associated with increased likelihood of prolongation of sleep latency, shortening of sleep duration, abnormal catch-up sleep and worse health related quality of life among adolescents (6,18,19,31).

Table III. Factors associated with poor sleep quality		
	Poor sleep quality	
	Self-rated	PSQI-based
Risk factors	p value	p value
Sleep latency >30 minutes	<0.05	<0.05
Difficulty in breathing	<0.05	<0.05
Bad dreams	<0.05	<0.05
Difficulty in performing daily activities	<0.05	<0.05
Pain	<0.05	>0.05
Tea/coffee consumption before sleep	<0.05	>0.05
Electronic device in the sleeping room	>0.05	<0.05
Use of social media before sleep	>0.05	<0.05
Waking up in the middle of the night or early morning	>0.05	<0.05
Reading before sleep	>0.05	>0.05

PSQI: Pittsburgh Sleep Quality Index

Authors also noted the consistency for adverse sleep outcomes related to access to media devices on weekdays and weekends (18), while an increase in magnitude of the adverse impact has been suggested with use of screen-based media devices in the dark owing to potential role of disrupted circadian rhythms and diminished melatonin secretion (18,32).

Indeed, given the rising access to and use of screen-based media devices, increased awareness of parents, teachers, health professionals and adolescents about the associated adverse sleep outcomes is considered crucial (2,18,19). Accordingly, training and intervention studies targeting sleep hygiene promotion in this group are recommended to improve sleep patterns, cognitive function and educational attainment (2,18,19). In fact, a recent pilot cluster-randomized study has addressed the impact of brief school-based psycho-educative intervention on increase in sleep duration by decreasing electronic media use at night and caffeine consumption in adolescents (33). However, authors noted that the intervention was associated with a significant but modest decrease in electronic media use, but showed no effect on sleep duration, sleep quality, daytime tiredness, and mental wellbeing (33).

Overall, sleep latency was >30 minutes in 41.4% of adolescents in our cohort, while prolonged sleep latency was associated with higher likelihood of self-rated and PSQI-based poorer sleep quality. This seems notable given the 20-26% prevalence of sleep latency of >30 min reported among adolescents and the association of prolonged sleep latency with poorer sleep quality (34). Habitual sleep efficiency was ≥85% in 61.3% of subjects in our cohort, which seems also lower than previously reported rates (83.3%) for ≥85% habitual sleep efficiency in Turkish adolescents (35).

Moreover, difficulty in performing daily activities was highly prevalent in our cohort, while it was also associated with poorer sleep quality scores. This seems in accordance with data from a past study among adolescents indicating significant role of poorer sleep quality on increased likelihood of more negative and less positive affect the next day, along with the predictive role of higher levels of negative and lower levels of positive affect the day before in poorer sleep quality (36). The association of lack of sleep with tiredness, attention deficit, low school performance and difficulty in performing daily activities was also reported in other studies (37,38). Accordingly, strategies on improving sleep quality and daily mood are considered to be useful in terms of adolescent well-being (36).

Study Limitations

Certain limitations to this study should be considered. First, the cross-sectional nature of the study and the relatively small sample size precluded the possibility of drawing extensive causal conclusions. Secondly, our subjects may not represent the general adolescence population due to the recruitment of subjects from a single auditory assessment adolescence center. Third, given the likelihood difference in sleep patterns on weekdays and weekends, lack of data on weekend sleep patterns is another limitation which otherwise would extend the knowledge achieved in the current study.

Conclusion

Our findings revealed poor sleep quality (PSQI scores >5) in 82.0% of adolescents, regardless of adolescence period, and association sleep latency >30 minutes, difficulty in breathing and bad dreams during sleep, presence of electronic device in the bedroom and use of social media near bedtime with higher likelihood PSQI-based poor sleep quality. Future larger scale longitudinal studies in different periods of adolescence are needed to better identify determinants of poor sleep quality, while awareness raising activities for the importance and correlates of sleep quality among adolescents seems crucial for parents, teachers, health professionals and adolescents to improve sleep hygiene and to minimize potential detrimental consequences of poor sleep quality on psychosomatic health, cognitive function and educational attainment among adolescents.

Ethics

Ethics Committee Approval: This study approved by the University of Health Sciences, İzmir Tepecik Training and Research Hospital Ethics Committee (approval number: 19/10, date: 15.03.2016).

Informed Consent: Written informed consent was obtained.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Y.Ş., N.T., Concept: Y.Ş., N.T., Design: Y.Ş., N.T., Data Collection or Processing: Y.Ş., N.T., Analysis or Interpretation: Y.Ş., N.T., Literature Search: Y.Ş., N.T., Writing: Y.Ş., N.T.

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