Original article

Relationship of quality of sleep with cognitive performance and emotional maturity among adolescents

Vizayieno Casavi^a, Sukesh Shetty^a, Jeevitha Alva^b, M. Nalini^{a,*}^a Department of Mental Health (Psychiatric) Nursing, Nitte Usha Institute of Nursing Sciences, Nitte (Deemed to be University), Deralakate, Mangaluru, India^b Department of Paediatric Nursing Nitte Usha Institute of Nursing Sciences, Nitte (Deemed to be University), Deralakate, Mangaluru, India

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ABSTRACT

Introduction: Sleep is a physiological behaviour typical in all animal species. Sound sleep nurtures the adolescent's health and emotions.

Objectives: This study objective was to find the relationship between sleep quality and cognitive performance and emotional maturity among adolescents in selected PU colleges.

Methods: Three hundred and twenty participants were selected by purposive sampling technique for the study. Socio-demographic data were collected, and sleep quality was assessed by Insomnia Severity Index (ISI) scale from all the 320 participants. The study participants who had scored poor sleep as per the ISI scale, i.e., the score between 8–21 were, further assessed for their cognitive and emotional maturity by Montreal Cognitive Assessment (MoCA) and Emotional Maturity Scale (EMS)

Results: Out of 320 participants, 32 had subthreshold insomnia and clinical insomnia (moderate severity). These thirty-two subjects were categorized as poor sleep quality. Out of thirty-two subjects, the majority of those participants, 29 (90.6%), had below normal cognitive performance. A negligible correlation ($r=0.205$, $p=0.261$) was found between sleep quality and cognitive performance but not statistically significant. However, out of thirty-two participants, the majority of the participants (62.5%) exhibited an above-average emotional maturity. Hence, a negligible correlation ($r=0.304$, $p=0.091$) between Quality of Sleep and Emotional Maturity was found but not statistically significant.

Conclusion: Adolescence requires enough sleep to maintain optimal health and wellbeing. A person with chronic sleep-deprivation can have fatigue, daytime sleepiness, clumsiness, and weight loss or weight gain. Sleep deprivation has influenced the cognitive and emotional performance of the adolescence.

1. Introduction

Sleep is the most significant factor for keeping the adolescents healthy and active. Adolescents need 8–10 h of sleep every night.¹ However, most adolescents only get about 6.5–7.5 h of sleep per night or less than that.¹ Sleep deprivation can dramatically affect adolescents lives, impacting their psychological wellness.² It increases their risk of depression, anxiety, and low self-esteem.² It can also affect academic performance at school.² Sleep is essential during adolescents for mental, physical, social, and emotional development.³ Sleep deprivation may cause impairment in cognition and emotions among adolescents.⁴ Studies have revealed that short sleep duration negatively affects adolescents emotional development and reduces attention.^{5,6}

Sleep is necessary to stay alert, boost memory, fight infection, be

active and replenish the body.⁷ Sound sleep nurtures the adolescent's health and emotions.⁸ Quality sleep also influences the social acceptance of adolescents.⁸ Adolescents who fail to sleep at night will experience sleep during daytime. Increase daytime sleep results in automobile or work accidents and leads to other consequences also.^{8–10} Sleep deprivation causes poor school performance, heightened risk of drug and alcohol use, increased irritability, and aggressive behavior, all of which can interfere with relationships with peers, parents, and teachers.⁸ Sleep patterns tended to delay with increasing age, restricting night sleep.⁹ The onset of adolescence is also a time of both physiological and social changes that affect sleep.⁴

A study conducted in Germany among adolescents found that the average sleep duration on weekdays was 8.04 ± 0.89 h and 9.51 ± 1.65 h on weekends, respectively.^{11,12} Another cross-sectional study conducted

* Corresponding author. Tel.: +918095679510.

E-mail addresses: ayiecasavi@yahoo.in (V. Casavi), sukeshm@nitte.edu.in (S. Shetty), jeevithaalva@nitte.edu.in (J. Alva), nalini@nitte.edu.in (M. Nalini).

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in Europe among adolescents reported that the number of hours of sleep per night during school days was 7.7 h.¹³ Sleep is inadequate not only in other parts of the world but also in Indian adolescents. A cross-sectional study on adolescent children in Kerala highlighted that sleep duration was inadequate in 60% of the children.¹⁴ Another cross-sectional survey conducted among school-going adolescents in Tamil Nadu found that over 64% of adolescents sleep <8 h at night.¹⁵ Further, a cross-sectional study was conducted on adolescents in Karnataka in which 53.33% showed high sleep disturbances, whereas 46.67% showed fewer sleep disturbances. The study findings showed a positive correlation ($r = 0.8921$) between excessive smartphone use and sleep disturbances among adolescents.¹⁶ In addition, another cross-sectional survey conducted among adolescents in Udupi, Karnataka, found a 40% prevalence rate of insomnia among adolescents.¹⁷

Sleep research suggests that adolescents need between 8 and 10 h of sleep every night, more than the required sleep hours of a child or an adult.¹⁴ However, most adolescents only get lesser than required amounts of sleep at night.¹⁴ WHO (2019) reported that 16% of the global mental health disease and injury burden accounts for adolescents between 10 and 19 years.¹⁸ The leading cause of disease worldwide is depression.^{30,31} It makes disability among adolescents inadequate sleep pattern influences the adolescent's mood and cognitive performance.¹⁹

Easy availability of mobile phones and other electronic gadgets made easy access for every individual. Nowadays, we are moving towards the nuclear family system, and most of the families both parents are employed, the adolescence left alone. The feeling of loneliness and inadequate monitoring make the adolescents spend much time on mobile phones during night hours. Hence the present study aimed to find the relationship between sleep quality with cognitive performance and emotional maturity among adolescents.

It is evident from the existing studies that adolescents are not getting enough sleep at night as recommended for their age group, which can negatively impact both their physical and mental health. Hence, the present study aimed to find the relationship between sleep quality with cognitive performance and emotional maturity among adolescents.

2. Methods

The research approach was a Quantitative approach, and the research design was cross-sectional design. Before the commencement of the study, all ethical guidelines were followed as per Nitte (Deemed to be University) policy.(IEC reference number: NUINS/CON/NU/IEC/2020-21/1829). The permission was taken from college authorities, assent was taken from student participants, and informed consent was obtained from the parents of student participants. Non-probability purposive sampling technique was used to select the study participants. The sample size was calculated using estimating single proportion formula. The study consisted of 320 Pre-University (PU) adolescents from selected Pre-University College, Nanthoor, Mangaluru. The data were collected from 25/01/2021 to 04/11/2021 in their respective institutions. The tools were self-administered to the participants. The mean age of the study participants was 16.49 years, and it ranged from 16 to 18 years. The adolescents who have diagnosed with any type of acute or chronic medical illnesses and on treatment were excluded from the study. The choice to participate in the study was voluntary.

The adolescence who have scored 8 and above in Insomnia Severity Index (ISI) scale were further assessed for Emotional maturity and cognitive performance.

3. Data collection tool

Socio-demographic data like age, gender, area of residence, educational level were collected from all the study participants. Insomnia Severity Index (ISI) was used to assess the quality of sleep for all 320 participants. The tool was designed by Prof Charles Morin and distributed by Mapi Research Trust on behalf of Prof Charles Morin, the

copyright holder. It has seven questions designed as a brief screening tool for Insomnia.^{20,21} Based on the ISI score, the sleep quality is categorized as 0–7- No clinically significant insomnia, 8–14- Subthreshold Insomnia, 15–21- Clinical Insomnia (moderate severity Insomnia), and 22–28 - Clinical Insomnia (severe).^{20,21}

Montreal Cognitive Assessment (MoCA) and Emotional Maturity Scale (EMS) were administered to the participants who scored between 8 and 28 on the ISI score to assess their cognitive and emotional maturity level.^{22,23}

The MoCA test is a one-page 30-point test administered approximately 10 min. It is used to great lengths as a screening assessment for detecting cognitive impairment. The scores on MoCA range between 0 and 30. A score of 26 or above is regarded as normal. The MoCA assesses several cognitive domains including Visuospatial and executive abilities, naming, memory, attention, language, abstraction, delayed recall, and orientation. The principal investigator has trained and obtained certificate from clinical psychologist before administering the tool to the study participants.

EMS was developed and standardized by Dr. Yashvir Singh and Dr. Mahesh Bhargava (1990). It is a self-reporting five-point scale. The test consists of 48 statements, each having five alternative responses, namely, "very much," "much," "undecided," "probably," and "never." Higher the score on the EMS scale, the greater the degree of emotional immaturity and vice versa. The tool was purchased from National Psychological Corporation, Agra, for use.²³

The principal investigator has obtained permission from all the authors of the tools to use for the present study.

4. Statistical analysis

The statistical analysis was done using the Statistical Package for the Social Sciences (SPSS-version 25). The demographic characteristics of the study were analyzed using frequency and percentage. The relationship between Quality of Sleep and Cognitive Performance and emotional maturity was analyzed using Spearman's Rank Correlation Coefficient. The association between Quality of Sleep with socio-demographic characteristics was analyzed using Fisher's exact test. The p-value less than 0.05 was considered significant.

5. Results

5.1. Socio-demographic characteristics

Table 1 shows the Frequency and Percentage of Socio-demographic Characteristics of the participants. Among the 320 participants, most were males (56.9%) and 16 years of age (58.8%). Most of them were from urban areas (68.1%) and belonged to a nuclear family system (64.1%). A higher percentage of the participants (51.2%) spend 5–8 h on electronic gadgets, and 60% use the gadgets for academic purposes.

5.2. Assessment of quality of sleep

Table 2 depicts that the majority (90%) of the participants experienced no clinically significant insomnia, whereas 8.4% of the participants showed subthreshold insomnia, and 1.6% had exhibited clinical insomnia (moderate severity).

5.3. Relationship between Quality of Sleep and Cognitive Performance

Table 3 depicts that out of thirty-two participants who were in the category of subthreshold Insomnia ($n = 24$) and clinical Insomnia ($n = 5$) 90.6% exhibited below normal cognitive scores i.e., >26 and ($n = 3$) 9.4% were in normal cognitive score (≥ 26) on the MoCA scale.

Table 1

Frequency and percentage of socio-demographic characteristics (n = 320).

Socio-demographic characteristics (n = 320)		Frequency (f)	Percentage (%)
Age	16	188	58.8
	17	106	33.1
	18	26	8.1
Gender	Male	182	56.9
	Female	138	43.1
Area of Residence	Rural	102	31.9
	Urban	218	68.1
Type of Family	Nuclear	205	64.1
	Joint	115	36
Educational Level	Class 11	227	70.9
	Class 12	93	29.1
Stream of studying	Science	170	53.1
	Commerce	150	46.9
Hours of sleep per night	<7	197	61.6
	7–8	101	31.6
	>8	22	6.9
Do you have any accounts on social media?	Yes	291	90.9
	No	29	9.1
The number of hours spent on smartphones, TV, laptops, other electronic gadgets.	1–4	156	48.8
	5–8	164	51.2
Are you spending more time on electronic devices for academic purposes or social media?	Academic purposes	192	60
	Social Media	128	40

Table 2

Frequency and Percentage on Quality of Sleep among adolescents (n = 320).

Quality of Sleep (ISI) (n = 320)	Frequency	Percentage
No clinically significant insomnia (0–7)	288	90
Subthreshold Insomnia ^{8–14}	27	8.4
Clinical Insomnia (moderate severity) ^{15–21}	5	1.6
Clinical Insomnia (severe) ^{22–28}	0	0

Table 3

Distribution of Frequency and Percentage of Cognitive Performance among adolescents (n = 32).

Cognitive Performance (MoCA score)	ISI Score		Percentage
	8-14 (Subthreshold Insomnia)	15-21 (Clinical Insomnia-moderate severity)	
Below Normal <26	24	5	90.6
Normal ≥26	3	0	9.4

5.4. Relationship between quality of sleep and emotional maturity

Table 4 depicts that the majority of the participants (62.5%) exhibited an above-average of Emotional Maturity (Fig. 1).

Table 5 shows that the majority of the participants exhibited an average level of Emotional Stability (40.6%), Social Adjustment (46.9%), Personality Integration (50%), Independence (65.6%), and an above-average level of Emotional progression (59.4%) (Fig. 2).

Table 4

Distribution of Frequency and Percentage of Emotional Maturity of adolescents (n = 32).

	Below Average	Average	Above Average	High
Emotional Maturity	f (%)	f (%)	f (%)	f (%)
	0 (0%)	9 (28.1%)	20 (62.5%)	3 (9.4%)

Fig. 1. Scattered diagram depicting the relationship between Quality of Sleep and Cognitive Performance.**Table 5**

Domain-wise distribution of Frequency and Percentage of Emotional Maturity among adolescents (n = 32).

Emotional Maturity (n = 32)	Below Average	Average	Above Average	High
	f (%)	f (%)	f (%)	f (%)
Emotional Stability	0 (0%)	13 (40.6%)	10 (31.3%)	9 (28.1%)
Emotional Progression	0 (0%)	9 (28.1%)	19 (59.4%)	4 (12.5%)
Social Adjustment	0 (0%)	15 (46.9%)	14 (43.8%)	3 (9.4%)
Personality Integration	1 (3.1%)	16 (50%)	13 (40.6%)	2 (6.3%)
Independence	0 (0%)	21 (65.6%)	11 (34.4%)	0 (0%)

Fig. 2. Scattered diagram depicting the relationship of Quality of Sleep and Emotional Maturity.

5.5. Association between quality of sleep with socio-demographic characteristics

Table 6 shows that Fisher's exact test was used to find the association between quality of sleep and socio-demographic characteristics. The findings revealed that significant association between level of education, hours spent on electronic devices, and type of usage of devices with the severity of insomnia level as the p-value for these variables was less than 0.05 at a 5% significance level.

6. Discussion

In the present study, 90% of the participants experienced no clinically significant insomnia. This finding was a mismatch with the

Table 6

Association between Quality of Sleep with socio-demographic characteristics.

Social Demographic characteristics		Insomnia Severity Level			Fisher's exact test	p value
		No clinically significant insomnia (0–7)	Subthreshold insomnia (8–14)	Clinical insomnia (moderate severity) (15–21)		
Educational Level	Class 11	213	11	3	12.541	0.001
	Class 12	75	16	2		
Number of hours spent on electronic devices	1–4 h	152	4	0	19.696	0.001
	5–8 h	136	23	5		
Are you spending more time on electronic devices for academic purposes or for social media	Academic purposes	164	24	4	12.162	0.001
	Social Medi	124	3	1		

research conducted by Karia SB et al. (2021), showed that 40% of science students and 33% of commerce students experienced no clinically significant insomnia, respectively.²⁴ Another survey conducted by Karki K et al. (2021) highlighted that poor sleep quality was found among 31%.²⁵ A dissimilar findings were reported by An J et al.(2014), that 26.7% of the adolescents had poor quality of sleep²⁶ and Mercer PW et al. (1998), reported that 63% of the adolescents had poor sleep quality.²⁵ These findings were discordant with the previous research because the present study data were collected right after the lockdown period. They had sufficient leisure time at home. In addition, the adolescents were exposed to electronic devices for academic purposes also. Though they had spent more time on electronic devices, they had restricted movement to outside and did not have clinical insomnia.

The current study shows that out of 320 participants, only thirty-two participants (n = 32) were in the category of subthreshold insomnia (n = 27) and clinical insomnia (n = 5). In addition out of that 90.6% (n = 29) of them shown below normal cognitive scores i.e. ≥ 26 and 9.4% were in normal cognitive score (n = 3) (≥ 26) on the MoCA scale. A study conducted by Rossetti HC et al.(2015), showed that 66% of the participants had below normal cognitive level as fell below the suggested cut-off (< 26) on the MoCA scale.^{27,28} Aseem A et al. (2021), in their study, demonstrated a significant correlation between sleep quality and cognitive performance.²⁹ While the present study indicated a weak positive correlation but no statistical significance for the correlation between sleep quality and cognitive performance. The pandemic situation also influenced this finding as adolescents could not move around and enjoy themselves with friends in the daytime. Adolescence with peer interaction can develop constructive interpersonal skills, autonomy, positive mental health, self-confidence, and satisfaction with social support. In addition, interaction with friends helps adolescence learn to make joint decisions, express empathy, and deepen their perspectives.³²

The present study depicts a negligible correlation between the quality of sleep and emotional maturity, which contradicts a study done by Reddy R et al. (2017), where significant effects were observed for poor sleep quality with cognitive performance.³¹

The limitations of the study were that the study was conducted in only one school at Mangaluru. The data were collected from the study participants right after school reopened from Covid-19 lockdown, and the data collection period was constrained as theory classes were taken online. Future studies can be conducted for high school students also a similar study can be conducted for professional courses.

7. Conclusion

The present study showed that the quality of sleep in adolescents could be affected by the level of education, number of hours spent on electronic gadgets, and the type of usage of devices. Because the data was collected after lockdown and the adolescents were exposed to electronic devices for academic purposes, it is important to understand and limit spending unnecessary time on electronic devices as it can adversely affect sleep at night. Sleep deprivation, in turn, may affect cognitive performance and emotional maturity in adolescents. An adolescent should get the recommended hours of sleep every night for

optimum functioning and overall health.

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Declaration of competing interest

None declared.

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