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BEDTIME USE OF ELECTRONIC DEVICES AND SLEEP QUALITY AMONG SECONDARY SCHOOL STUDENTS IN 2019, IN TAIF – SAUDI ARABIA

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Abstract:

Background: *Globally, there is a high prevalence of electronic and smart device overuse among high school children with an established negative effect on sleep quality and scholastic academic achievement. Little is known about the prevalence of electronic device overuse and sleep quality among schoolchildren in Saudi Arabia. This study aimed to estimate the prevalence of poor sleep quality among high schoolchildren and its determinants, particularly electronic device use and academic performance.*

Methods*: This was a descriptive questionnaire-based cross-sectional survey of a multistage stratified random sample of High school pupils in Taif and Makkah Governates in Saudi Arabia. We utilized generalized linear modeling to evaluate the impact of background sociodemographic factors on sleep quality.*

Results: *The study included 306 secondary school students, nearly half of them (50.7%) were females and most participants' sleep quality (70.3%) was poor. Prevalence of use of electronic devices prior to sleep was 96.1%, particularly smart mobile (93.2%) and video games (25.5%). The use of the electronic device was associated with a significant reduction in sleep quality (P= 0.002). The presence of any electronic device in the bedroom of students was associated with poorer sleep quality (P= 0.000), particularly smart mobiles (P= 0.016) and video games (P= 0.045).*

Recommendations: *Given the cohesive family values in Saudi culture, strict parental rules regarding electronic device presence and use could help improve their sleep quality.*

Keywords: *Sleep Quality, Academic performance, Schoolchildren, Arabic PSQI, Saudi Arabia*

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INTRODUCTION:

Sleep plays a major role in children and adolescents' physical and mental health [1, 2]. According to the National Sleep Foundation, the recommended sleep duration for adolescents is 9 - 11 hours per night for optimum health and development [3]. However, research studies show that many adolescents get far less than this amount [4-6]. Additionally, adolescents experience a shift in their circadian rhythms, feeling more alert at night [7, 8] and generally wake up for school before 7 AM, thus leaving them with an inadequate amount of sleep. Furthermore, Sleep duration is not the only indicator of sleep outcome. Sleep Quality is also a significant indicator. Sleep quality refers to continuous sleep without any interruption. It can also be characterized by certain conditions such as the early onset of sleep, fewer interruptions, and fewer early awakenings [9]. Numerous studies suggest that inadequate quality and quantity of sleep may be linked to sleepiness, inattention, impaired memory, poor academic performance, poor social skills, and other alterations in cognitive functioning and have possible implications for long-term issues [10-13].

During adolescence, a combination of psychological, social, biological factors and modern lifestyle behavioral factors such as the use of modern electronic devices, e.g., television, smartphone, iPad, computer and video games, interact, resulting in shorter sleep duration and poor quality of the sleep [14]. Likewise, the American Academy of Paediatrics reported that many of these factors contributing to the current "epidemic" of insufficient sleep among adolescents are potentially modifiable such as electronic media use [15].

In the last decade, we have noticed a sharp increase in the availability and use of electronic devices such as smartphones, video game consoles, television, audio players, computers, and tablets. Adolescents today rely heavily on technology to stay connected with the world. Electronic devices have become lightweight and portable, which has led people to use these devices in bed or at bedtime [16]. The National Sleep Foundation reported that more than half of adolescents using electronic media on most evenings during the last hour before they go to bed [17]. Nearly all adolescents reported having at least one electronic device in their bedroom. The use of these devices during bedtime/night-time in children and adolescents was associated with delayed bedtime, sleep onset latency, and reduced sleep quantity and quality [18-22]. Also, a recent study was conducted in Saudi Arabia to assess The Quality of Sleep among Adolescents in Jeddah city and reported that 92% of adolescents had Poor sleep quality, and it was significantly higher in adolescents using electronic devices before sleep [23]. However, a systematic review of 36 research studies investigating technology use in children proposed mechanisms by which electronic use before bed could cause sleep disturbance results suggested that electronic use might displace sleep since there is no fixed start or end time to electronic use [24]. Second, media use before bed has been shown to increase physiological, emotional, or mental arousal. This has been established in video game and cell phone studies [25]. Third, light emissions of screens from electronic devices may be affecting sleep [26].

A lack of data that investigated the quality of sleep among adolescents from Saudi Arabia is limited. There is no sufficient evidence to evaluate the quality of sleep among adolescents or to know the effect of modern technologies on the quality of adolescent sleep as an indicator of well-being. This study explores bedtime electronic use and its impact and sleep's quality among secondary school students in Taif - Saudi Arabia.

Study Objectives

1- To estimate the prevalence of electronic device usage among secondary school students in Taif - Saudi Arabia.

2- To estimate the prevalence of poor quality of sleep among secondary school students in Taif - Saudi Arabia.

3- To assess the association between bedtime electronic device usage and sleep duration and quality.

4- To investigate the association between sleep quality associated with usage of these devices and scholastic performance.

METHODOLOGY:

Study population

All secondary school students residing in Taif and Makkah areas were included. The study was carried out at Secondary governmental schools in Taif city in the Makkah region of western Saudi Arabia.

Study design

The researchers conducted a cross-sectional, questionnaire-based, observational study. The study took place between February 2021 and April 2021 in randomly selected secondary school students in Taif in Saudi Arabia.

Sample size

The sample size was calculated by using the online Epi-info software for sample size calculation according to the following equation:

1. Population size (governmental secondary school students enrolled in Taif city throughout the academic year 2018-2019.) Female N= (13839) and male N = (14161)
2. .Hypothesizes% frequency of outcome factor in the population (p):68.2%
3. Confidence limits as % of 100 (absolute +/- %) (d): 5%
4. Design effect (for cluster surveys-DEFF): 1
5. Sample Size (n) for 95% Confidence Levels = 326 +10% = 358 students.

Sampling technique

A multistage stratified random sample of 358 students in governmental schools aged between (15–18) was used to select the sample.

The first stage was a random selection of 1 school from 4 districts in the urban Taif Governorate.

The second stage included random selection of 1 class from the 3 grades in the secondary schools.

The third stage was to select one class from the 3 classes by using a systematic random sample technique.

Data collection tool

The self-administered questionnaire consisted of three sections; the first section comprised the sociodemographic data that included name, age, nationality, family income, and parent's education level.

The second part comprised the use of electronic devices at bedtime; a modified tool obtained from another published study [27] was used. The researcher developed the tool after reviewing the related literature, included twenty items, ten questions about electronic devices use at night before sleep on usual school nights, presence and use of different electronic devices in students" bedroom in the past week prior to the study, and ten questions about frequency and duration of technology use.

The third part investigated the Sleep Quality and habits determined by using the Pittsburgh Sleep Quality Index (PSQI), an effective instrument used to measure the quality and patterns of sleep among the adult population but easily understood by Adolescents. It differentiated "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month. Quality of sleep was divided into two categories: good (A total score of < 5) and poor (A total score of 5 or greater). A validated translated Arabic version was obtained [28].

Data collection technique

Data were entered into a spread Microsoft Excel Sheet and stored in Hospital Computer. Confidentiality was maintained throughout the conduct of the study.

Data entry and statistical analysis

Demographic variables and background clinical characteristics of patients were presented with numbers and percentages. Descriptive analyses were performed to demonstrate continuous and categorical variables as frequencies and percentages and means and standard deviations, respectively. We used the statistical package for social science (SPSS) version 26 for data analysis. We used Mann Whitney U test and the Kruskal Wallis test for mean analyses for abnormally distributed data. Odds ratios were calculated to investigate the association of electronic devices with sleep quality and estimate the associations of sleep quality with academic performance.

Ethical considerations

Acceptance from the Regional Research and Ethics committee was obtained. Permission of the education director in Taif city was obtained. Approval of the school headmasters was obtained. Verbal consent was obtained from all students. All collected data were kept confidential. Feedback was sent to school authorities.

RESULTS:

Table (1) shows the sociodemographic characteristics of 306 included students. Nearly half of them (50.7%) were females, 38.6% aged 17 years, and 35.6% aged more than 18. Regarding the father's education, almost half of them (50.7%) had a university degree, 31.4% had secondary education, and only 2% were uneducated. More than half of the mother's education (52.6%) had a university degree, 21.9%had a secondary degree, and 10.1% were uneducated. The vast majority of the participants (90.8%) were Saudi participants. The nationality was significantly associated with the PSQI score (P=0.049), as the Saudi participants recorded a higher PSQI score (7 ± 4) than the non-Saudi (6 ± 4). Most participants (78.8%) had enough income, 20.6% had essential income, and only (0.7) reported that the income is not enough. The family income was significantly associated with the PSQI score (P=0.000); participants with a non-enough income had the highest score (11 ± 1), while those with enough income had the lowest score (6 ± 4). Most of them (73.5%) recorded from 90-100 in the first-class score, 22.2% recorded (80-89), and 3.6% recorded (70-79). The first-class score was significantly associated with the PSQI score (P=0.000), participants who recorded (60-69) in the first-class score had the highest PSQI score (11 ± 1), while those who recorded (90-100) had the lowest PSQI score (6 ± 4).

Table (2) shows the patterns of study participants' use of electronic devices prior to sleep. The vast majority of the participants (96.1%) reported using any electronic device before sleeping and had a higher PSQI score (7 ± 4) than those who did not use any device (4%) with a mean score of (4 ± 3), this association was statistically significant (P=0.002). Most participants (77.8%) do not watch TV, and 66.4% did not use laptops before bedtime. The majority of the participants (93.2%) reported using smartphones before sleeping and recorded higher PSQI scores (7 ± 4) than those who do not use smartphones (5 ± 4), and this association was statistically significant (P=0.007). Most participants do not use iPad (91.2%) or video games (74.6%) before sleeping.

Table (3) presents the pattern of the presence of electronic devices in the bedrooms. Most of the participants (86%) reported keeping any electronic device in their bedrooms and had a higher PSQI score (7 ± 4) than those who did not use any device (14.1%) with a mean score of (5 ± 4); this association was statistically significant (P=0.000). Most participants (80.8%) do not watch TV, and 52% did not use laptops in their bedrooms. The majority of the participants (85%) reported having smart mobile in bedrooms and recorded higher PSQI scores (7 ± 4) than those who do not use smartphones (4 ± 2), and this association was statistically significant (P=0.000). Most of the participants do not keep the iPad (85%) in their bedrooms. There was a significant association between playing video games in bedrooms and PSQI score (P=0.049), as the participants who reported playing video games in bedrooms (22.6%) had a higher score (8 ± 4) than those who do not play video games (77.5%) with a mean score of (7 ± 4).

Table (4) presents the duration of using electronic devices in the bedroom before sleeping. There were a significant association between using television (P=0.025), laptop (P=0.008), and smartphones (P=0.000) and the PSQI mean score. Most participants (60.5%) never watch television before sleeping, while only 6.9% watch it over 2 hours. Less than half of the participants (41.2%) never use laptops before sleeping, and only 14.1% use them over 2 hours. Most participants (62.1%) use smartphones over 2 hours before sleeping, and 3.6% never use them. 81.1% never use the iPad before bedtime, and 4.6% use it over 2 hours. More than half of the participants (54%) surf social media for more than 2 hours before sleeping, while only 3% never surf it; this association was statistically significant (P=0.000). Less than half of the participants (38.9%) surf the internet for over 2 hours while only 8.9% never surf it before sleeping; this association was statistically significant (P=0.000).

Table (5) presents the weekly duration of use of electronic devices in participants' bedrooms prior to sleeping. Nearly half of the participants (50.4%) never watch television before sleeping, 27.8% rarely watch it, and only 5.9% watch it every night. 35.7% never use the laptop before bedtime, 23.3% use it in few nights, and only 8.9% use it once a week. Most of the participants (87%) use the smartphone every night before sleeping, and only 2.3% never use it; this association was statistically significant (P=0.000). Most participants (73.6%) never use the iPad before sleeping, and only 8.2% use it every night. Almost half of the sample (51.4%) never play video games before sleeping, and 14.8% play these games every night. Most of the students (77.5%) surf social media every night before sleeping, and only 2.7% never check the social media platforms within this time; this association was statistically significant (P=0.000). Over half of the students (52%) surf the internet every night, and only 7.2% never surf it; this association was statistically significant (P=0.000).

Table (6) estimates the association of electronic devices' usage with sleep quality. The electronic use and the Saudi nationality were found to be a significant risk factor that affects the sleep quality [OR: 13.30, 95% CI; 2.57-68.66, P=0.002] and [OR: 4.57, 95% CI; 1.58-13.24, P=0.005], respectively. . The essential income and the fathers' secondary education of were also found to be a significant risk factor that affecting the sleep quality [OR: 7.13, 95% CI; 2.58-19.71, P=0.000] and [OR: 4.16, 95% CI; 1.72-10.06, P=0.001], respectively.

Table (7) investigates the estimates for the adjusted association of sleep quality with academic performance. The essential income was significantly associated with the sleep quality and academic performance and considered a protective factor [OR: 0.96, 95% CI; 0.93 - 0.99, P=0.035]. However, the uneducated mothers were significantly associated with sleep quality and academic performance and considered potential risk factors [OR: 1.05, 95% CI; 1.001 - 1.109, P=0.045].

Table 1. Sociodemographic characteristics of the study participants in association with the PSQI mean score.

Parameter		Frequency (%)	Mean ± SD	P-value
Sex	• **Female**	155 (50.7%)	7 ± 4	0.844*
	• **Male**	151 (49.3%)	7 ± 4	
Age	• **15**	3 (1%)	8 ± 6	0.202**
	• **16**	76 (24.8%)	7 ± 4	
	• **17**	118 (38.6%)	6 ± 3	
	• **18+**	109 (35.6%)	7 ± 4	
Father education	• **Uneducated**	6 (2%)	8 ± 4	0.203**
	• **Intermediate**	49 (16%)	7 ± 4	
	• **Secondary**	96 (31.4%)	7 ± 4	
	• **University**	155 (50.7%)	6 ± 4	
Mother education	• **Uneducated**	31 (10.1%)	7 ± 4	0.283**
	• **Intermediate**	47 (15.4%)	8 ± 4	
	• **Secondary**	67 (21.9%)	7 ± 4	
	• **University**	161 (52.6%)	7 ± 4	
Nationality	• **Saudi**	278 (90.8%)	7 ± 4	**0.049***
	• **Non Saudi**	28 (9.2%)	6 ± 4	
Income	• **Enough**	241 (78.8%)	6 ± 4	**0.000****
	• **Essentials**	63 (20.6%)	9 ± 4	
	• **Not enough**	2 (0.7%)	11 ± 1	
First Class Score	• **60-69**	2 (0.7%)	15 ± 0	**0.000****
	• **70-79**	11 (3.6%)	11 ± 4	
	• **80-89**	68 (22.2%)	8 ± 4	
	• **90-100**	225 (73.5%)	6 ± 3	

*Mann Whitney u test was used.

**Kruskal Wallis test was used.

Table 2. The pattern of study participants' use of electronic devices prior to sleep in association with the PSQI mean score.

Parameter	No	PSQI Score (Mean ± SD)	Yes	PSQI Score (Mean ± SD)	P-value
Any device	12 (4%)	4 ± 3	294 (96.1%)	7 ± 4	**0.002**
TV	238 (77.8%)	7 ± 4	68 (22.3%)	7 ± 4	0.729
Laptop	203 (66.4%)	7 ± 4	103 (33.7%)	7 ± 4	0.199
Smart Mobile	21 (6.9%)	5 ± 4	285 (93.2%)	7 ± 4	**0.007**
iPad	279 (91.2%)	7 ± 4	27 (8.9%)	8 ± 4	0.130
Video Games	228 (74.6%)	7 ± 4	78 (25.5%)	7 ± 4	0.159

Mann Whitney u test was used.

Table 3. The pattern of presence of electronic devices in the bedrooms of participants in association with the PSQI mean score.

Parameter	No	PSQI Score (Mean ± SD)	Yes	PSQI Score (Mean ± SD)	P-value
Any device	43 (14.1%)	5 ± 4	263 (86%)	7 ± 4	**0.000**
TV	247 (80.8%)	7 ± 4	59 (19.3%)	8 ± 4	0.054
Laptop	159 (52%)	7 ± 4	147 (48.1%)	7 ± 4	0.069
Smart Mobile	46 (15.1%)	4 ± 2	260 (85%)	7 ± 4	**0.000**
iPad	260 (85%)	7 ± 4	46 (15.1%)	7 ± 4	0.618
Video Games	237 (77.5%)	7 ± 4	69 (22.6%)	8 ± 4	**0.049**

Mann Whitney u test was used.

Table 4. Duration of use of electronic devices in the bedrooms of participants prior to sleeping.

Electronic Device	Never	under 1 hour	under 2 hours	over 2 hours	P-value
Television	185 (60.5%)	68 (22.3%)	32 (10.5%)	21 (6.9%)	**0.025**
Laptop	126 (41.2%)	84 (27.5%)	53 (17.4%)	43 (14.1%)	**0.008**
Smart Mobile	11 (3.6%)	35 (11.5%)	70 (22.9%)	190 (62.1%)	**0.000**
iPad	248 (81.1%)	28 (9.2%)	16 (5.3%)	14 (4.6%)	0.370
Video Games	181 (59.2%)	35 (11.5%)	45 (14.8%)	45 (14.8%)	0.181
Social media	9 (3%)	61 (20%)	71 (23.3%)	165 (54%)	**0.000**
Internet surfing	27 (8.9%)	91 (29.8%)	69 (22.6%)	119 (38.9%)	**0.000**

Kruskal Wallis test was used.

Table 5. Weekly duration of use of electronic devices in the bedrooms of participants prior to sleeping in association with the PSQI mean score.

Electronic Device	Never	Rarely	Once	Few nights	Every night	P-value
Television	154 (50.4%)	85 (27.8%)	8 (2.7%)	41 (13.4%)	18 (5.9%)	0.957
Laptop	109 (35.7%)	58 (19%)	27 (8.9%)	71 (23.3%)	41 (13.4%)	0.275
Smart Mobile	7 (2.3%)	9 (3%)	2 (0.7%)	22 (7.2%)	266 (87%)	**0.000**
iPad	225 (73.6%)	30 (9.9%)	7 (2.3%)	19 (6.3%)	25 (8.2%)	0.179
Video Games	157 (51.4%)	37 (12.1%)	11 (3.6%)	56 (18.4%)	45 (14.8%)	0.071
Social media	8 (2.7%)	14 (4.6%)	2 (0.7%)	45 (14.8%)	237 (77.5%)	**0.000**
Internet surfing	22 (7.2%)	38 (12.5%)	5 (1.7%)	82 (26.8%)	159 (52%)	**0.000**

Kruskal Wallis test was used.

Table 6. Estimates for the association of electronic devices' usage with sleep quality.

Factor	Odds	95% CI for Odds	P-value
Electronics use	13.30	2.57 to 68.66	**0.002**
Nationality: Saudi	4.57	1.58 to 13.24	**0.005**
Sex: Male	0.69	0.39 to 1.21	0.204
Age in years	1.10	0.84 to 1.44	0.462
Income: Essentials	7.13	2.58 to 19.71	**0.000**
Income: Not Enough	1791007	0.00 to infinity	0.988
Father education: Secondary	4.16	1.72 to 10.06	**0.001**
Father education: Uneducated	6.46	0.41 to 101.50	0.184
Father education: University	2.27	0.95 to 5.40	0.063
Mother education: Secondary	0.98	0.35 to 2.77	0.978
Mother education: Uneducated	0.66	0.20 to 2.20	0.504
Mother education: University	1.07	0.41 to 2.81	0.875

Table 7. Estimates for the adjusted association of sleep quality with academic performance

Factor	Odds	95% CI for Odds	P-value
Sleep Quality: Poor	0.97	0.95 to 1.00	0.096
Electronics use	1.02	0.95 to 1.09	0.495
Nationality: Saudi	0.99	0.94 to 1.03	0.665
Sex: Male	1.00	0.98 to 1.03	0.608
Age in years	0.99	0.98 to 1.00	0.346
Income: Essentials	0.96	0.93 to 0.99	**0.035**
Income: Not Enough	1.01	0.88 to 1.17	0.818
Father education: Secondary	0.99	0.95 to 1.03	0.773
Father education: Uneducated	1.01	0.91 to 1.12	0.790
Father education: University	1.01	0.97 to 1.05	0.399
Mother education: Secondary	1.00	0.96 to 1.05	0.665
Mother education: Uneducated	1.05	1.00 to 1.10	**0.045**
Mother education: University	1.00	0.96 to 1.04	0.692

DISCUSSION:

The current study surveyed a large number of secondary school students from both genders and a variety of socioeconomic backgrounds to estimate the prevalence of their bedtime use of electronic devices, the prevalence of poor sleep quality among them, and

the association between those two critical issues and its impact on scholastic performance.

Our findings from the current survey confirm a worryingly high prevalence of poor sleep quality among secondary school students in Saudi Arabia. Over 70% scored above the PSQI score cut-off for good sleep quality. Quality of sleep cannot be separated from the quality of life. Poor sleep quality to the degree that one in ten students were found to have reversed sleep pattern in a previous survey of Saudi schoolchildren [27]. Our 70% poor sleep quality prevalence far exceeds the recent 41.9% prevalence reported among senior high school students from China [28]. A similar survey of Malaysian secondary school students found that poor sleep quality prevalence was 24.0%, with a clear association with academic performance and parents' income [29]. However, our 70% figure approaches the 76.5% prevalence of sleep dissatisfaction among a sample of Lebanese high school students [30].

Our results were indicative of a very high prevalence of 96.1% for pre-sleep use of electronic devices. Smart mobile was used by 93.2% of our sample. A recent Lebanese survey found 82.4% of Lebanese students engaged in electronic devices' use prior to sleep [30]. This high figure of 82.4% is still lower than our whooping 96.1% prevalence among secondary school students. In our sample, 85% used smart mobile devices almost daily, and 77.5% engaged in daily use of social media every night. That is worrying by all measures, as many authors expressed concern about the high level of smartphone use. They were clear that a phenomenon of smartphone addiction was reaching critical levels among schoolchildren and was associated with a range of physical and psychological comorbidities [31]. Also, excessive use of internet-connecting devices among high schoolchildren was shown to mediate the relationship between bullying and depressive symptoms [32].

We uncovered an important association between the use of electronic devices and poor sleep quality. A significant increase in PSQI, indicative of poor sleep quality, was related to electronic devices. Many studies confirmed that excessive use of the internet could lead to poor sleep quality, particularly the use of the internet for the sake of entertainment [33]. Furthermore, we found over half of our participants used electronic devices for over 3 hours before sleep. We also found that the more an electronic device was used before bedtime, the poorer the sleep quality. A series of investigations found similar results. Sleep quality was significantly disrupted among students engaging in excessive smartphone usage and would, worse, mediate the relationship with mental health difficulties [34]. It is becoming more noticeable among teenage students that problematic smartphone use leads to poor sleep quality. This was further theorized into a direct effect for excessive use of smartphones and disruption in a range of immunological and neuroendocrine biomarkers [35]. Migraine headache was associated with overuse of smartphones, particularly at night-time. Literature showed that poor sleep quality was not necessarily related only to excessive use of electronic devices. Even habitual usage was closely related to poorer sleep quality [36]. A recent survey found that high school students' habitual smartphone use was associated with poor sleep quality. Exposure to smartphones at night-time was associated with worsening cognition and was more pronounced with increased duration and frequency of smart device use [37]. Such overuse of electronic devices before sleep has an established negative effect on sleep quality. Still, preliminary results have shown a positive impact for strict parental guidance that can be explored in further interventional evaluations [38]. In our current survey, the mere presence of any electronic device in the bedroom of students was associated with a significant reduction in sleep quality, especially TV, laptop, and smartphones. TVs were related to excessive daytime sleepiness among high schoolchildren and poorer overall sleep quality [39]. Given the cohesive family values in Saudi culture, strict parental rules regarding electronic device presence and use could help prevent escalation into full addictive behavior among school children and improve their sleep quality [40]. However, on the adjusted analysis, the relationship between income and sleep quality among our participants disappeared. That is indicative that the association is likely an artifact of other factors, such as scholastic performance, rather than a direct effect for economic prosperity on better sleep satisfaction.

One more unique finding in our current survey is the unadjusted tendency for better sleep quality among students with higher income ratings. This contradicts recent investigations that higher family income leads to poorer sleep quality, given the increased access to electronic devices.

We found that better sleep quality was associated with a better academic score. This is a consistent finding in the literature, particularly the results from local surveys [27]. Many studies confirmed the relationship between sleep quality and academic score [41]. Poor sleep quality influences scholastic performance in high schools through a range of mechanisms. One recently proposed theory is poor

sleep quality on the four sensory processing patterns, namely, sensitivity, registration, avoiding, and seeking [42], which would have a detrimental effect on learning and academic achievement among high school pupils. Another way of looking into this association is to consider the negative effects of academic pressures on sleep habits among schoolchildren. The relationship between academic performance and sleep quality could be bidirectional. A recent study reported that high achievers were more likely to have difficulties in sleep quality and fatigue [43].

Strengths and limitations

Our current survey has the strengths of the unique large sample size of various secondary schoolchildren and the impressive response rate. However, the social desirability bias was difficult to account for during the conduct of the study and constitute a genuine limitation for the generalizability of the findings we found. Also, the cross-sectional design could not correct for reverse-causality bias. Moreover, the responses were subjective, mainly related to self-rating of income and self-disclosure of academic results. Further research should consider more objective findings related to actual scores in individual subjects.

CONCLUSION:

This study demonstrated poor sleep quality among schoolchildren in Taif, Saudi Arabia. Using electronic devices before sleeping, especially smart mobiles were significantly associated with low sleep quality. We found that the presence of any electronic devices, particularly smart mobiles and video games, in the children's bedrooms significantly affected the sleep quality among children. Additionally, watching TV, using the laptop and smart mobile, and surfing social media and the internet also significantly affected sleep quality. We found that electronics usage, Saudi nationality, essential income, and the fathers' secondary education were considered significant risk factors for sleep quality. The uneducated mothers were deemed significant potential risk factors for the children's academic performance and sleep quality, whereas the essential income was a significant potential protective factor.

Recommendations

The prevalence of poor sleep quality is worryingly high among schoolchildren. Public health campaigns should be focused on education about good sleep hygiene in schools in collaboration with teachers and school principals. Parents and children should be aware of the effect of excessive use of electronic devices, particularly smartphones and video games, on sleep quality and scholastic achievement. Action in terms of increased awareness and parent and teachers meeting should be encouraged to reduce the harmful use of electronic devices.

For quality sleep at night, electronic devices should be removed from the bedrooms of students. Given the cohesive family values in Saudi culture, strict parental rules regarding electronic device presence and use could help prevent escalation into full addictive behavior among school children and improve their sleep quality. Future research should attempt to evaluate poor sleep quality with quality of life, school stage, and the number of friends. Similarly, further studies are required to evaluate the epidemiology of addiction to electronic devices and their relationship with poor sleep quality and poor academic performance. In addition, the relationship between electronic device overuse and poor sleep quality could be explained by a range of biological, social, and psychological theories. Research in Saudi Arabia should evaluate the theoretical underpinnings for this relationship, particularly its association with the four sensory processing patterns of seeking, registration, sensitivity, and avoidance.

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