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PREVALENCE OF SLEEP DEPRIVATION AMONG CHILDREN IN AL-MADINAH AL-MUNAWARH, KSA

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ABSTRACT

Objectives: to determine the prevalence of sleep deprivation among children, its causes, and parents' awareness of the effects of sleep deprivation on their children's health. **Methods:** A cross-sectional study was carried out among mothers in Medina, Kingdom of Saudi Arabia, from August till November 2016. Our study comprised all the mothers in Saudi Arabia raising children aged from 6 to 13 years old who agreed to participate. 2010 responses which were conveniently collected through self-administered semi structured questionnaire prepared by the researchers. **Results:** There is 44% of the sample following a regular schedule for sleeping and waking, while 49.6% of them is not. We noted that 74.9% of the sample of children sleep more than 5 hours in school nights compared to 70.4% of them who sleep the same duration in the night before the vacation or the weekend, but for the time to wake-up in the morning, we noted that 49.6% of them wake up at (4-6) am in regular nights compared to 11.5% of them who wake up at this time during the nights of the vacations. We found that 89.1% of them use computer, TV and video games, while only 10.9% of them don't. **Conclusion:** About a quarter of Saudi children suffer from sleep deprivation. About half of Saudi children aren't following regular schedule for sleeping and waking. There is a poor knowledge of parents regarding the effects of sleep deprivation on their children's health. We recommend educating the parents about it, and teaching them how to overcome this problem.

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Introduction

Sleeping is important to every living creature. Having good sleep quality at the right times helps us protect our mental and physical health. Sleeping is the primary activity of the brain during early development. Circadian rhythms, or the sleep-wake cycle, are managed by light and dark, and these rhythms require time to develop, resulting in the irregular sleep schedules of newborns. The rhythms start to develop at about six weeks, and by three to six months most infants have a regular sleep-wake cycle. As it's known, there are two alternating types of sleep: 1. Non-Rapid Eye Movement (NREM) or "quiet" sleep: During the deep states of NREM sleep, blood supply to the muscles is increased, energy is restored, tissue growth and repair occur,

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and important hormones are released for growth and development. 2. Rapid Eye Movement (REM) or "active" sleep: During REM sleep, our brains are active, and dreaming occurs. Our bodies become immobile, breathing and heart rates are irregular. Each age group needs different duration of sleep. Preschoolers (3-5) typically sleep 11-13 hours each night, and most do not nap after five years of age. Children aged six to 13 need 9-11 hours of sleep [1]. Sleep deprivation is classified to total and partial. 'Total sleep deprivation refers to the avoidance of sleep for a period of at least 1 night. Partial sleep deprivation, or sleep restriction, refers to the reduction in the total sleep time relative to one's usual baseline during a 24-hour period. This is probably the most common form of sleep deprivation encountered in everyday life.' Sleep deprivation has been linked to serious changes in mood states and their regulations [2]. Insomnia is a common problem of sleeping deprivation due to many things such as over-thinking, mood disturbance, problems with motivation or performance at school, daytime sleeping, and side effects of some medications, but it often returns to normal by many things like relaxation strategy, and good sleeping hygiene like avoiding using mobile phones, "social media", caffeine and nicotine, and reducing noise and light, and providing a warm room [3]. And there is a relationship between bad sleeping hygiene and bad behavior exactly in the waking up early manner such as anger, rudeness, violence, un-mannered responses and madness. Staying up late is very bad especially for children, and they will be tired all day, and it will affect their life, their grades at school and their daily life and relationships with family and friends, so the parents have to be very strict for their children's own good [4].

There were some studies about sleep habits conducted in the United States of America that said in the 2004, Sleep in America™ poll finds that children are getting less sleep than experts recommend, and more than two-thirds of children experience frequent sleep problems. Children's poor sleep habits also take a toll on parents/caregivers, some of whom lose an estimated 200 hours of sleep a year due to their children's nighttime awakenings [5]. And also, in the 2006, Sleep in America™ poll finds that American adolescents (6th - 12th grade) are not getting the sleep they need, and this lack of sleep gets worse as they progress through their teen years. Most parents are unaware that their kids aren't sleeping enough, but they can play a key role in helping them get a good night's sleep [6]. Also we found some studies regarding sleep disturbance conducted in Saudi Arabia. A cross sectional study about sleep habits in adolescents of Saudi Arabia; distinct patterns and extreme sleep schedules were conducted by Roah A. Merdad and her friends, in Jeddah, November 2014, and they found that the prevalence of sleep disturbance was 65%, and the excessive daytime sleepiness was found in 37% of the students [7]. Another study about sleep duration and its correlates in a sample of Saudi elementary school children was conducted by Ba Hammam A and their friends in 2006, it showed that nighttime sleep duration is shorter in Saudi school children compared to the published data. Several factors appeared to affect sleep duration, including mothers' educational level, daytime naps and watching TV at night [8]. Although the above published data about the sleep disturbance prevalence and its consequences on children exist, there is no study in Medina, Saudi Arabia. So, the aim of this study was to determine the prevalence of sleep deprivation among Saudi children, its causes, and the parents' awareness about the effects of sleep deprivation on their children' health.

Materials and Methods

Study Design: A cross-sectional study was carried out among mothers in Al-Madinah Al-Monawarah region, Kingdom of Saudi Arabia during the academic year 2016-2017. **Questionnaire Design:** self-administered semi structured questionnaire was prepared by the researchers. The items in the questionnaire were obtained from numbers of validated questionnaires, and the validity was completed by reviewing it by experts. Before the start of the study, the semi-structured questionnaire was pre-tested on 35 of the subjects to explore if there is any ambiguity or items leading to the misunderstanding of the questionnaire, in order to reach to its current final form. These 35 subjects were not included in the main survey. The questionnaire was re-administered after a week to the same sample of the pilot study to check test-retest reliability. It contained 7 parts as following: Socio-demographic data of the child, socio-demographic data of the mother, medical condition of the child and drug use, risk factors of sleep deprivation, sleep timing questionnaire, symptoms and sign of sleep deprivation, awareness of parents regarding the effects of sleep deprivation on their children (Appendix1).

Sample Size: There are approximately 2010 mothers who agreed to participate in the study and filled in the questionnaire completely.

Data collection: At the beginning, our study was a part of a health campaign which was carried out in Al Rashed Mall in Al Madinah from 14 till 19th of August 2016, where we had about 65 responses which were conveniently collected, all mothers who attended the events were asked to participate in answering the questionnaire after informing them about the aim and objectives of the study.

Then during October & November 2016, to maximize the responses, by the help of about 27 data collectors, who were asked to distribute the questionnaire electronically via social media till we had about 2010 responses. Our study comprised all mothers both Saudi & non-Saudi in KSA raising children aged from 6 to 13 years old. Those who were non-cooperative were excluded from the study.

Ethical Consideration: Official permissions were obtained from the scientific ethical committee of college of Medicine, Taibah university, Medina, KSA. Informed consent was obtained from all the participants after describing the aim of the study. Privacy and confidentiality were assured. This study was conducted according to the principles of the Helsinki Declaration (Ethical Principles for Medical Research Involving Human Subjects).

Data Analysis: The statistical analysis program, Statistical Package for Social Science (SPSS v.22) was used in the study in data entry and analysis, with the use of the necessary statistical methods to achieve the objectives of the study. The following statistical methods were used:

- A. Descriptive analysis, which included frequency, percentage, means and standard deviation.
- B. Significant chi –square was used to test for a significant difference between different variables. $P < 0.05$ was considered to indicate a statistically significant result. Analyzed data will be presented in the form of tables and figures.

Results and Discussion

This study aimed to determine the prevalence of sleep deprivation among Saudi children, its causes, and the parents' awareness about the effects of sleep deprivation on their children's health.

Socio-demographic data

Table 1. Socio-demographic data of the child (n = 2010)

Variable	#	%	
Gender	Boy	1081	53.8
	Girl	929	46.2
The child's age	6-7 Y	2010	100.0
	7-8Y	372	18.5
	8-9Y	280	13.9
	9-10Y	356	17.7
	10-11Y	107	5.3
	11-12Y	111	5.5
The child's nationality	12-13Y	117	5.8
	Saudi	1875	93.3
school level of the child	Non Saudi	135	6.7
	First 3 years of elementary school	1238	61.6
Residence place	Last 3 years of elementary school	772	38.4
	City	1945	96.8
How does the child spend his free time?	Village	65	3.2
	At home	1426	70.9
	With friends	215	10.7
Who does the child live with?	With relatives	369	18.4
	With both parents	1815	90.3
The nature of the relationship between the child and his / her parents?	With one of them only	195	9.7
	Good	1918	95.4
	Bad	92	4.6

Regarding demographic data, the study included children and adolescents from 6 to 13 years old, but most of them aged between 6 and 7 years old. While more than half of the children were boys.

Table 2. Socio-demographic data of the mother (n = 2010)

Variable	#	%	
Mothers' age	younger than 25 years old	234	11.6
	older than 25 years old	1776	88.4
Mothers' nationality	Saudi	1868	92.9
	Non Saudi	142	7.1
mothers' residence place	Al Madinah	1812	90.1
	Another city	198	9.9
Mothers' educational level	Uneducated	89	4.4
	Elementary	108	5.4
	Intermediate	165	8.2
	Secondary	416	20.7
	University	1063	52.9
Mothers' employment status ?	Master, doctorate	169	8.4
	Employed	937	46.6
Monthly income of the family	Unemployed	1073	53.4
	2000 – 5000 SAR	357	17.8
	5000-7000 SAR	400	19.9
	7000- 10000 SAR	542	27.0
Sleep time for the family	More than 10000 SAR	711	35.4
	Early from 8 pm to 12 am	787	39.2
	Late after 12 am	503	25.0
	Child sleeps early while both parents sleep late	720	35.8

Sleep time for the family is late (after 12 am) for a quarter of children, this is a significant amount. With a child's early school day, he does not have sufficient sleep hours when he sleeps late. At this study, the majority of participants are living at city, and the nature of the city's life may have a role in contributing to the delay of families in sleeping and their tendency to sleep.

Medical condition of the child and drug use

We noticed that 94% of the Saudi children and teenagers don't take any medicines, while only 6% of them take medicines.

Risk factors of sleep deprivation:

Regarding children and teenagers' distribution according to practicing sports and the period they spend practicing, we found that 34.6% of them practice sports; 20.3% of them practice sports for less than half an hour a day, 14.3% of them practice sports for more than an hour a day. According to using a commuter or watching TV, or playing video games, we found that 89.1% of children and teenagers' use computer, TV and video games, while 10.9% of them don't. We found that 74.5% of the Saudi children and teenagers have their breakfast daily, while 25.5% of them don't. The most eaten foods on breakfast were milk 17%, cheese & fruit 15%, sweet & juice 14%, fast food 13%, vegetables 12%. According to the participants' distribution depending on whether they are smokers or exposed to smoking, we found that 97.2% of them aren't smokers, while 2.8% of them are, 22.3% of them are exposed to smoking as secondhand smoke, and 77.6% of them don't.

Sleep timing questionnaire

Healthy sleep requires adequate duration, good quality, regularity, appropriate timing, and the absence of disturbances and disorders [9]. According to the children and teenagers' distribution depending on following a regular schedule for sleeping and waking, we noted that 49.6% of them do not follow a regular schedule for sleeping and waking, while 44% of them follow a regular schedule for sleeping and waking, 6.4% do not know. Two primary processes which govern how much sleep is obtained, are the homeostatic sleep drive and the circadian rhythm. The circadian system (internal clock) helps to regulate sleep/wake cycles and hormonal secretions, while the homeostatic sleep drive increases the need for sleep as the period of wakefulness lengthens [10]. About half of our participants aren't following regular schedule for sleeping and waking, Of course this will affect their circadian and thus affect their sleep regulation, and contribute to their sleep deprivation. About a quarter of the participants of this study usually wake up during night commonly once at night, for special reasons like eating or drinking, and the most need one hour or less to fall asleep again. The children and teenagers' distribution according to: bedtime , the total amount of time that the children are still awake during the night before he / she first falls asleep on regular nights, and vacation nights .We noted that 43.9% of the sample of the children sleep at (8-10) pm on the night of the study versus 20.9% of them sleep in this time at the night before the weekends or vacations, while 26.3% of the sample of the children sleep at (10-12) pm on the night of the study versus 34.6% of them sleep at this time at the night before the weekend, and a significant chi-square test showed the lack of differences in children's sleep time both at study nights and the nights before the weekends or vacations. As for the total amount of time that the child stays awake during the night before he / she first falls asleep , we noted that the majority of the children are sleeping in a period not exceeding one hour on sitting on the bed at the normal nights, while that percentage was slightly less than the percentage at nights before vacations, and the significant chi-square test showed the lack of differences in the total amount of time that your child stays awake during the night before he / she first falls asleep both at study nights and the nights before the weekends or vacations.

The children and teenagers' distribution according to waking up during the night on regular nights and weekends or vacations nights, where we noted that 26.1% of them wake up during the study nights while only 21.5% of them do during vacation nights.

Table 3. shows the children and teenagers' (who wake up during the night) distribution according to: the reason he / she wakes up, the numbers of times he / she wakes up during a night, the time it usually takes to fall asleep again, on regular nights, and vacation nights.

		Study nights		The night before the vacation weekend	
		#	%	#	%
the reason he / she wake up	For special reasons (to go to the bathroom , to eat or drink)	342	65.3	247	57.2%
	other reasons	70	13.4	76	17.6%
	I don't know	112	21.4	109	25.2%
the numbers of times he / she wake up during a night	once	423	80.7	345	79.9%
	more	101	19.3	107	24.8%
the time it usually takes to fall asleep again	one hour or less	478	91.2%	349	80.8%
	more	46	8.8%	83	19.2%

Table 4. Shows the children and teenagers' distribution according to: The duration the child sleeps during the night, the wake up time of the child in the morning, the time it usually takes to fall asleep again.

		Study nights		The night before the vacation weekend	
		#	%	#	%
your child's sleep duration at night	5 h or less	378	18.8	349	17.4
	more than 5 h	1506	74.9	1415	70.4
your child's rise time	4-6 am or before	997	49.6	231	11.5
	6-8 am	791	39.4	357	17.8
	8-10 am	70	3.5	668	33.2
	others	81	4.0	419	20.8
the time your child generally spends between the awakenings in the morning & getting out of bed	My child get up out of bed if he woke up immediately	1134	56.4	1112	55.3
	takes time	793	39.5	739	36.8

American Academy of Sleep Medicine recommended that Children 6 to 12 years of age should sleep 9 to 12 hours per 24 hours on a regular basis to promote optimal health [9].

This means that a quarter of children at this study suffered sleep deprivation. Our results correspond to the results of another study at KSA for Hammam et al., who reported that 26.2% of children at their study had sleeping problems [11]. Also, a study in the USA found that 27% of the elementary school children had sleeping problems [12]. Higher ratio of sleep deprivation (32.2%) was found by [13].

Considering the children and teenagers' distribution according to taking a nap during the day or not, we noted that 39% of them take a nap during the day, and the rest of them do not take a nap.

Regarding the children and teenagers' (who are taking a nap) distribution on study days versus weekends, we noted that 65.9% of them take a nap in the days of the study while only 7.4% take a nap in the days of vacations or weekends.

Table 5. shows the children and teenagers' (who follow the nap system) distribution according to: the number of days per week, duration of the nap, and timing of the nap during the day

		Study nights		The night before the vacation weekend	
		#	%	#	%
How many days a week	Once	707	90.52%	484	83.88%
	Twice	32	4.10%	71	12.31%
	Three or more times	42	5.38%	22	3.81%
How long is the nap?	one hour or less	274	35.17%	259	46.42%
	1-2 h	336	43.13%	203	36.38%
	2-3 h	143	18.36%	71	12.72%
	more than 3 h	26	3.34%	25	4.48%
What time of day is the nap?	From one o'clock to four o'clock in the evening	626	80.88%	318	56.18%
	After four o'clock to eight o'clock in the evening	97	12.53%	123	21.73%
	Other	51	6.59%	125	22.08%

Considering the children and teenagers' distribution depending on their status after taking a nap, we noted that 64.6% wake up after taking a nap actively, while 23% of them are not.

Symptoms and signs of sleep deprivation:

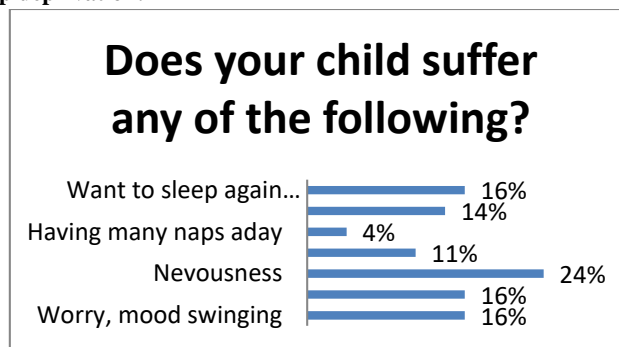


Diagram 1. shows the main symptoms of sleep deprivation suffered by children and adolescents

Where we noted that the most important of these symptoms are: nervousness, anger, worry, mood swinging.
Awareness of parents regarding the effect of sleep deprivation on their children's health:

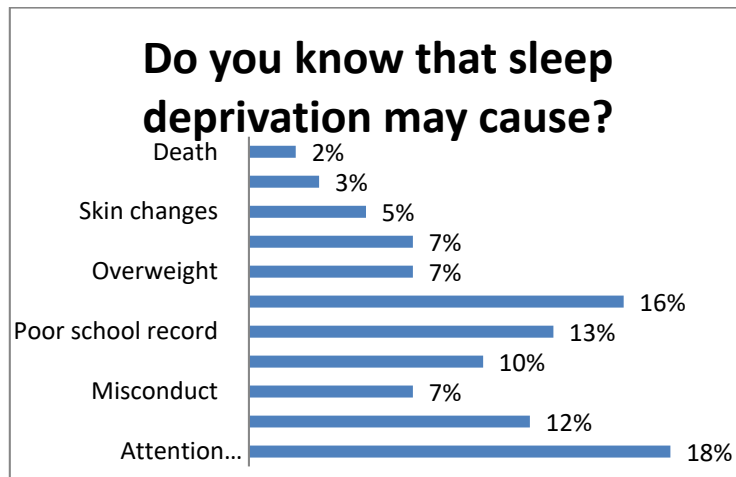


Diagram 2. shows the most important consequences of the sleep deprivation on children and adolescents, according to the knowledge of their mothers

Where we found that the most known effects are: Attention deficiency, fatigue, tiredness, poor school record, mood swinging, nervousness, poor memory. While lack of sleep is known to cause poor attention, worse grades, school absences, poor social interactions, irritability and crankiness, depression and increased risk-taking behaviors [14].

Table 6. The relationship between Sleep deprivation and Socio-demographic

Socio-demographic		child sleep duration at night		P-value	Result	regularity of sleep of the child			P-value	Result
		5 h or less	more than 5 h			yes	no	I don't know		
Employment status of mother	Employed	253	724	0.000	There is a relationship	424	540	60	0.017	There is a relationship
	Unemployed	180	934			560	555	71		
Educational level of mother	Uneducated	50	47	0.000	There is a relationship	52	45	7	0.015	There is a relationship
	Elementary	36	82			42	72	8		
	Intermediate	30	141			76	92	17		
	Secondary	89	354			187	246	33		
	University	195	913			543	566	62		
Master, doctorate	44	136	98	85	6					
Time of sleeping for the family	Early from 8 pm to 12 am	162	656	0.000	There is a relationship	521	315	39	0.000	There is a relationship
	Late after 12 am	193	339			122	403	37		
	Child sleeps early while both parents sleep late	87	672			350	385	57		

According to our results, there was a relationship between the child's sleep duration at night and the employment status of the mother, the educational level of the mother and the time of sleeping in the family. It is expected that because the employee mother is forced to wake up early, she and her children sleep early. Also educated mother recognizes the importance of adequate sleep for the child, and tries to give him or her enough sleep. Also, when the family sleeps, it creates the appropriate situation for the child's sleep, so the child automatically goes to sleep. Regarding the relationship between the regularity of the sleep of the child and the employment status of the mother, educational level of the mother and the time of sleeping in the family has conformable results.

Table 7. The relationship between Sleep deprivation and medical condition of the child

medical condition of the child		child sleep duration at night		P-value	Result	regularity of sleep of the child			P-value	Result
		5 h or less	more than 5 h			yes	no	I don't know		
Does the child take any medication	Yes	59	81	0.000	There is a relationship	66	68	9	0.879	There is no relationship
	No	385	1589			927	1040	124		

Taking medication may affect children' sleep depending on the type of medication and its side effects and the nature of the disease. In this study, only 6% of children take medicines. Also, there was a relationship between taking medication and the sleep duration. But, there was no relationship between taking medication and the regularity of sleep.

Table 8. The relationship between Sleep deprivation and Risk factors of sleep deprivation

Risk factors of sleep deprivation		child sleep duration at night		P-value	Result	regularity of sleep of the child			P-value	Result
		5 h or less	more than 5 h			yes	no	I don't know		
Exercise	Yes	158	577	0.672	There is no relationship	915	935	103	0.000	There is a relationship
	No	286	1095			71	165	29		
using computer & watching TV	Yes	331	1522	0.000	There is a relationship	915	935	103	0.000	There is a relationship
	No	108	135			71	165	29		
breakfast	Yes	269	1327	0.000	There is a relationship	851	733	82	0.000	There is a relationship
	No	176	343			144	374	51		
Smoking	Yes	41	24	0.000	There is a relationship	44	16	5	0.000	There is a relationship
	No	400	1647			951	1089	128		

Experimental evidence has suggested that exercise may be associated with better sleep quality [15]. However, in our study more than half of the participants don't usually exercise, this may increase the likelihood of sleep deprivation. There was no relationship between children's sleep duration at night and exercise, and also between the regularity of the sleep of the children and exercise. Our results do not match the results by [16] who reported that the chronic vigorous exercising is positively related to adolescents' sleep and psychological functioning. Also, males with low exercise levels are at risk for increased sleep complaints and poorer psychological functioning.

Most of the children and teenagers at this study use computers, watch TV and play videos by 89.1%. About 36.6 % of them do these acts before sleeping. At this study, there was a relationship between the children's sleep duration at night and using computer and watching TV, also between the regularity of the sleep of the children and using computer and watching TV. These results correspond to the results by [11] who found that watching TV or playing computer games at bedtime affects the sleep onset. Also, [17] reported that the television-viewing habits like; increased daily television viewing amounts, and increased television viewing at bedtime, especially in the context of having a television set in the children' bedroom, associated most significantly with sleep disturbance.

In the present study, about 2.8% of the participants are smokers, while 22.3% face the effects of smoking by passive smoking. Our results showed that there is a relationship between child sleep duration at night and smoking, also between the regularity of the sleep of the children and smoking. This could be due to the reason that smoking associates with difficulty initiating sleep, and with a constellation of symptoms suggestive of the sleep fragmentation. Sleep disturbance may be more prevalent among smokers due to the stimulant effects of nicotine, nightly withdrawal, an increased prevalence of sleep disordered breathing relative to nonsmokers, and/or an association with psychological disturbance [18].

Table 9. The relationship between nap and time of sleeping during night

		time of sleeping during night					P-value	Result
		8 pm or before	8-10 pm	10 pm - 12 am	after 12 am	Do not sleep		
does your child take naps during the day	Yes	75	99	290	211	33	0.000	There is a relationship
	No	88	376	468	272	58		

Sleep deprivation has been found to be associated with daytime napping [19]. The current study showed a relationship between nap and time of sleeping during night. According to our results there was high rate of napping during daytime by 61%. 65.9% of them napping in the days of the study which is expected after the long school day, and the majority of them wake up actively after napping. Our results are higher than results of another study in KSA which found that 40% are napping during the daytime [19]. These ratios in KSA society are higher in the western societies [20]. This difference may be due to the difference in lifestyle between KSA and the western societies. The increase in the percentage of those who nap may be indirectly the body need or the wish for more sleep due to sleep deprivation [21].

Conclusion

About a quarter of Saudi children suffer from the sleep deprivation. Medications did not significantly affect the sleep of children. There was high prevalence of using computer, watching TV and playing videos among those children, these habits affected the regularity of sleep and sleep duration. Smoking was rare among these children, but exposure to passive smoking was not insignificant. Thus, there was a relationship between the child sleep duration at night and smoking, also between the regularity of sleep of the child and smoking. About half of Saudi children aren't following regular schedule for sleeping and

waking. There was high prevalence of napping during daytime among Saudi children, and also there is a relationship between taking a nap and the time of sleeping during night.

Recommendation

1. Educating parents about the causes and effects of sleep deprivation among children and how to overcome it.
2. Work on the early sleep of the child even if the whole family needs to sleep to prepare the conditions for the sleep of the child.
3. Attention to breakfast for children.
4. Keep children from direct and passive smoking.
5. Using computer, watching TV and playing videos should be reduced among children, specially before sleeping.
6. Organizing children's sleep time and duration.
7. If the child has nightmares or any factors that cause him to wake up at night, parents must work to get rid of them.

Conflict of interest

The authors declare no conflict of interest in the conduct of this research.

Authors' contributions

We confirm that all authors whose names feature in this article have contributed equally and substantially to the conception of this study, provided research material, read and revised this review manuscript critically, gave approval to the final draft, and they all are responsible for the contents and the submission of the manuscript for publication.

Reem: designed the questionnaire, collected and analyzed the data, conducted the research results, wrote the protocol, participated in writing research methodology, acknowledgement and abstract, drafting the article, revising it critically for important intellectual content, approved the final version submitted. **Rayyan:** designed the questionnaire, collected and analyzed the data, participated in writing the introduction. **Shahad:** designed the questionnaire, collected and analyzed the data, conducted the research results, participated in writing the discussion. **Shumukh:** presented the idea of the research, designed the questionnaire, collected and analyzed the data, participated in writing the introduction, recommendations & conclusion. **Yousef:** designed the questionnaire, collected and analyzed the data, conducted the research results, participated in writing the discussion, recommendations & conclusion. **Dr. Abdalhadi:** did the supervision & guidance throughout all parts of the research.

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