Academic Performance, Sleep Disorders and Their Association in Middle School Students in Iran

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Abstract

Background: Although sleep disorders are common problems among families and they affect the learning, memory processes and academic performance of children, there is no evaluation of these disorders in Iran. The aim of this study was to assess the prevalence of sleep disorders and its association with academic performance of school age children.

Materials and Methods: A cross-sectional study was conducted on 1,100 middle school students of Isfahan city of Iran during 2012-2013. Multi-stage random cluster sampling method was performed and five girl's schools and five boy's schools were selected. The data gathered with a validated questionnaire to evaluate the academic performance and sleep disorders.

Results: The mean duration of nocturnal sleep was 8.38 ± 1.17 which was significantly higher in the group with excellent academic performance (8.86 ± 1.18 hours), than the other two groups (8.14 ± 1.17 hours for average academic performance and 7.90 ± 1.15 hours for poor academic performance). Academic performance was significantly associated with age, gender, parental occupation, nocturnal sleep time, sleep latency and sleep disorders ($P<0.05$).

Conclusion: This study revealed that sleep disorders negatively affect the academic performance and highlighted the importance of proper sleep among children and students.

Key Words: Adolescents, Education, Iran, Performance, Sleep, Sleep disorders.

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1- INTRODUCTION

Sleeping is essential for learning, memory processes and academic performance in children and adolescents. Studies have shown that poor sleep quality, sleeping late, getting up early and interrupted night sleep impress behavior, learning capacity and school performance (1-3). Sleep disorders in children and adolescents are common problems in families and can affect the social, emotional and educational performance (4). Sleep disorders include a wide range, from falling asleep difficulty and waking up frequently during the night, to the serious primary sleep disorders like obstructive sleep apnea syndrome (5). However, other factors such as age and gender of students, parental occupation, education and marital status, could be also associates with academic performance. The prevalence of sleep disorders in children and adolescents is 11 to 47% (6, 7). In a study, the prevalence of sleep disorders have been reported approximately 25% in children, and 40% in adolescents (8). Although most empirical studies have proved that children need about 9 hours of sleep on average each night, several studies have shown that 45% of children and adolescents, sleep less than 8 hours over night (3, 9, 10).

The most common result of inadequate or disrupted sleep is increased drowsiness during the day (2, 10). Increased sleepiness during the day, results in reduced alertness and dysfunction of specific brain regions including the prefrontal cortex which can cause neuro-cognitive dysfunction (5, 11). In the present study we aimed to assess the prevalence of sleep disorders and its association with school performance in Iranian middle school students in the Isfahan city, Iran.

2- PATIENTS AND METHODS

2-1. Study design and population

This cross-sectional study was conducted on 1,100 middle school students in 2012-2013 school-years in Isfahan city, the Central of Iran.

2-2. Methods

Multi-stage random cluster sampling method was performed. The data gathered with a validated questionnaire which was used in similar studies to evaluate sleep disorders (12-14), with some new questions designed by the researcher for the research purposes. The sleep disorders questionnaire included 24 questions to evaluate student sleep and for any question, five answers were considered. The answers are including; **1**: never, **2**: rarely, once a month, **3**: sometimes, one to two times per week, **4**: occasionally, three to five times a week, and **5**: always and every night. For each question, the answer 3, 4 or 5 choose, were considered as the sleep disorder (13, 14).

In addition, the last semester scores, and average of students were asked to evaluate school performance. For each lesson (Science, Math, Spelling, History, Geography, Religion and Literature), scores equal to 17 or more were considered as excellent, scores of 17-15 were considered as good, and scores equal to 15 or less, were considered as poor academic performance. After necessary coordination with the education authorities in Isfahan, we went to five girl and five boy's schools which selected randomly for sampling by computer software. After providing a brief description of the research objectives, questionnaire along with the informed consent were delivered to students, and one week later, the completed questionnaires were gathered.

2-3. Measuring tools: validity and reliability

The questionnaire was validated by three specialists comment on its content approval and the questionnaire reliability acquired by using a pilot study of 40

students with Cronbach's alpha test value of 0.87.

2-4. Ethical consideration

This study was reviewed and approved by the Ethics Committee of the Isfahan University of Medical Sciences (ID number: 390522) and written informed consent was obtained from all participants.

2-5. Inclusion and exclusion criteria

Inclusion criteria included: the 12-15 years old adolescents, who were studying in Isfahan middle schools in 2012-2013 school year, no sex restriction, and access to student final scores. The students with chronic psychiatric and neurological disease that may affect academic performance, were excluding from the study (15).

2-6. Data Analyses

The Kolmogorov-Smirnov test was used to evaluate the distribution of quantitative variables. Values were expressed as frequency (number and percentage), and mean ± standard deviation (SD). Fisher's exact test and Chi-square tests were used for comparison of categorical variables, whereas t-tests and one-way ANOVA test were used to compare numerical variables. Pearson's and Spearman correlation coefficient were calculated for assessment of correlation between quantitative and qualitative variables, respectively. Statistical analyses were performed using the SPSS software package, version 20.0 (SPSS Inc., Chicago, IL, USA). A P-value < 0.05 was considered significant.

3. RESULT

3-1. Demographic Data

From the all 1,100 students participating in this study, the girls were 565 (51.4%), and the boys were 535 (48.6%), the age range was 11-16 years and the mean age was 13.26±1.09 years old. 414 students (37.6%) were in the first grade, 287 students (26.1%) were in the second grade,

and 399 students (36.3%) were in the third grade. 42.3% of the students had excellent academic performance, 30.1% of them had average academic performance and 27.6% of them had poor academic performance. A detailed of characteristics baseline of participants is shown in **Table.1**.

3-2. Academic Performance

Academic performance was significantly associated with age and gender of students, parental occupation, education and marital status. Academic performance was significantly better in girls than boys (P<0.001). In the group with better academic performance than two others, the mean age was lower. Academic performance of students who had working mothers was significantly better than the students whose mothers were housewives (P<0.001). Academic performance of students whose parents education level were high school or higher and their parents had specialized jobs (doctors, engineers, workers, university professors), was better than others. Students whose parents were divorced or died had poorer academic performance than others (**Table.1**).

3-3. Sleep characteristics and disorders

The mean duration of nocturnal sleep was 8.38±1.17 which was significantly higher in the group with excellent academic performance (8.86±1.18 hours), than the other two groups (8.14±1.17 hours for good academic performance and 7.90±1.15 hours for poor academic performance).

The reported sleep disorder in this 1,100 middle school student was shown in **Table.2**. To investigate the relationship between sleep disorders and academic performance the 24 questions were scored as grading of sleep quality that the sum of the scores was 24 in the best and 120 in the worst case. The maximum score of selected questions in this study was 98, the minimum score was 24 and the mean score was 40.77±8.90. The mean was

41.20±9.19 in girls and 40.32±8.58 in boys, which was not statistically significant (P=0.104), however, the mean was lower in the group with excellent academic performance than others (P<0.001). Our results showed that students who had enough and good sleep at night, had better academic performance than others. Sleep latency was more than one hour only in 8.5% of students. In the students who had sleep latency more than 30 minutes, the academic performance was significantly weaker than those who had less latency period (**Table.3**). In the case of disrupted sleep, 45.9% of cases did not wake up during the night any time and only 2.1% of the cases mentioned waking up more than 5 times during the night. In addition, students who were awakened 3 times or more during the night had weaker academic performance than others. In our study there was no association between total sleeping hours and academic performance (P=0.938), but it has been shown that students who wake up before 6 AM had weaker academic performance than other students (P=0.005). Moreover, it was observed that resistance and fearing of falling asleep, difficulty falling asleep, waking at midnight and difficulty falling asleep again, respiratory disorders during sleep, snoring, night sweats, muscle cramps during sleep, morning headaches, difficulty waking up, fatigue, drowsiness and naps during the day, concentration problems, staying late in bed in the morning, late arrival to class because of oversleep and parasomnia (nocturia, nightmares, sleep walking, sleep talking and bruxism), were associated with weaker academic performance (**Table.4**). In our study, no association was seen between watching TV and playing computer after 9 PM, use of sedative medication and student academic performance (**Table.4**).

Table-1: Characteristics baseline of students

Variables	Average of school scores			P-value
	Poor (≤15)	Good (15-17)	Excellent (≥17)	
Frequency	304 (27.6)	331 (30.1)	465 (42.3)	0.002
Age (year)	13.45+1.7	13.21+1.11	13.18+1.07	
Gender				
Female	103 (18.2)	185 (32.7)	277 (49)	<0.001
Male	199 (37.6)	145 (27.4)	185 (35)	
Father's job				
Employee	173 (27.5)	215 (34.2)	240 (38.2)	<0.001
Laborer	106 (36.2)	89 (30.4)	98 (33.4)	
Specialized jobs	23 (13.3)	26 (15)	124 (71.7)	
Father's education				
Illiterate	53 (34.4)	57 (37)	44 (28.6)	<0.001
Under Diploma	192 (36.6)	182 (34.7)	151 (28.8)	
Diploma	50 (22.3)	67 (29.9)	107 (47.8)	
College Degree	3 (1.7)	19 (10.7)	156 (87.6)	
Mother's job				
Employed	26 (16.2)	33 (20.6)	101 (63.1)	<0.001
Housekeeper	276 (29.6)	297 (31.8)	361 (38.7)	
Mother's education				
Illiterate	72 (38.5)	66 (35.3)	49 (26.2)	<0.001
Under Diploma	195 (33.6)	194 (33.4)	191 (32.5)	
Diploma	29 (11.7)	61 (24.6)	158 (63.7)	
College degree	6 (7.6)	9 (11.4)	64 (81)	

Note: All data were shown as absolute count and relative frequency, except for age.

Table-2: The prevalence of sleep disorders in 1,100 middle school students

No.	Type of sleep disorders	(%)	No.	Type of sleep disorders	(%)
1	Watching TV after 9 pm	76.8	13	Morning headache	13.4
2	Hard to wake up	45.8	14	Sleep talking	12.6
3	Inadequate nocturnal sleep	37.8	15	Playing computer after 9 pm	11.5
4	Concentration problems	31.2	16	Cramps during sleep	11.4
5	Feeling tired during the day	28.8	17	Frequent late arrival to class	10.4
6	Sleep onset insomnia	24.7	18	Naps during the day	7.7
7	Fear of falling asleep	24.1	19	Nocturia	7.4
8	Nightmare	23.1	20	Snoring	4.7
9	Sleep maintenance insomnia	17.7	21	Bruxism	4
10	Sleepiness during the day	16.9	22	Sleep walking	3.4
11	Night sweats	15.6	23	Respiratory disorders during sleep	2.8
12	Resistance and fight before falling asleep	14.3	24	Sedative drugs	1.6

Table-3: Sleep pattern in school age children

Variables	Average of school scores			P-value
	Poor (≤15)	Good (15-17)	Excellent (≥17)	
Sleep time				
Before 9 PM	33 (28.4)	35 (30.2)	48 (41.4)	
9-10 PM	87 (27)	91 (28.3)	144 (44.7)	0.938
10-11 PM	102 (26.8)	121 (31.8)	158 (41.5)	
After 11 PM	80 (29.1)	83 (30.2)	112 (40.7)	
Wake up time				
Before 6 AM	84 (36.2)	74 (31.9)	74 (31.9)	
6-6:30 AM	67 (27.1)	76 (30.8)	104 (42.1)	0.005
6:30-7 AM	86 (22.7)	113 (29.8)	180 (47.5)	
After 7AM	65 (27.5)	67 (28.4)	104 (44.1)	
Sleep latency time				
5 Min	65 (26.7)	56 (23)	122 (50.2)	
5-10 Min	107 (26.2)	125 (30.6)	176 (43.1)	
10-30 Min	50 (21.4)	65 (27.8)	119 (50.9)	<0.001
30-60 Min	40 (34.8)	40 (34.8)	35 (30.4)	
> 60 Min	40 (42.6)	44 (46.8)	10 (10.6)	
Average of night sleep time	124 (24.6)	160 (31.7)	221 (43.8)	<0.001

Note: All data were shown as absolute count and relative frequency.

Table-4: Association of academic performance and sleep disorders in school age children

Variables	Average of school scores			P-value
	Poor (≤15)	Good (15-17)	Excellent (≥17)	
Mean score of sleep disorders	44.21±9.45	41.60±9.18	37.89±7.31	<0.001
T.V watching after 9 PM	240 (28.6)	247 (29.4)	352 (42)	0.936
Computer playing after 9 PM	32 (25.4)	37 (29.4)	57 (45.2)	0.746
Fear of falling asleep	101 (38.1)	85 (32.1)	79 (29.8)	<0.001
Resistance before falling asleep	68 (43.3)	50 (31.8)	39 (24.8)	<0.001
Using narcotic medications	8 (50)	4 (25)	4 (25)	0.12
Falling asleep difficulty	85 (31.2)	94 (34.6)	93 (34.2)	<0.001
Waking up at night and sleeping again difficulty	88 (45.6)	68 (35.2)	37 (19.2)	<0.001
Respiratory disorder during sleep	15 (48.4)	7 (22.6)	9 (29)	0.031
Night snoring	19 (37.3)	18 (35.3)	14 (27.5)	0.08
Nocturia	40 (48.8)	29 (35.4)	13 (15.9)	<0.001
Night sweats	69 (40.4)	54 (31.6)	48 (28.1)	<0.001

Nightmare	94 (37.5)	88 (35.1)	69 (27.5)	<0.001
sleepwalking	21 (55.3)	7 (18.4)	10 (26.3)	<0.001
Sleep talking	58 (42.6)	53 (39)	25 (18.4)	<0.001
Grinding(bruxism)	17 (38.6)	18 (40.9)	9 (20.5)	<0.012
Muscle cramps during sleep	57 (46)	40 (32.3)	27 (21.8)	<0.001
Comfortable sleep during night	129 (18.9)	172 (25.3)	380 (55.8)	<0.001
Morning Headache	66 (45.2)	53 (36.3)	27 (18.5)	<0.001
Hard morning wakeup	161 (32.3)	158 (31.7)	180 (36.1)	<0.001
Sleepiness during day	64 (35)	67 (36.6)	52 (28.4)	<0.001
Naps during day	54 (26.5)	23 (26.7)	9 (10.5)	<0.001
Poor concentration	160 (46.9)	135 (39.6)	46 (13.5)	<0.001
Tiredness during day	129 (41.2)	117 (37.4)	67 (21.4)	<0.001
Late arrival to class	52 (46.8)	42 (37.8)	17 (15.3)	<0.001

4- DISCUSSION

It is proposed that academic performance could be associates with age and gender of students, parental occupation, education and marital status. In our study the mean age in the group with poor academic performance was higher than other groups; this result was also seen in previous studies by Pagel et al. (16), and BaHammam (15). To evaluate the association between gender and academic performance a study has been conducted by BaHammam et al. in 2006 on elementary school students in Saudi Arabia. Their results showed that girls had better academic performance than boys (15). This data was in agreement with our result, as academic performance was significantly better in girls than boys in the present study. We found that academic performance was positively associated with occupation and education level of their parents. Academic performance of students who had working mothers were better than those whose mothers were housewives, it was in contrast of BaHammam's study which showed no association between mother's occupation and academic performance of primary school children (15).

Azhar et al. in 2013 indicates that students belonging to strong financial status perform better than those who face problems in finance. Similarly, parental education boosts up their children's performance (17). Also, other study showed that formal and informal parental occupation significantly influences secondary school students' academic performance in Malaysia. Moreover, the result demonstrated that students from a parent with formal occupation perform well than those from parents with informal occupation (18). We found that those students who had separated parents or one or both of their parents were died had weaker academic performance than others, this result was also present in a study by Omoruyi in 2014. This study revealed that broken homes, socio- economic status of the parents and single parenting are determinant of adolescents' academic achievement in schools (19). Studies have shown that poor quality of sleep, sleeping late, getting up early and disrupted sleep strongly influence learning capacity, academic performance and behavior (1-3).

On the other hands, approximately 20 to 50% of children and adolescents suffer from sleepiness (16, 20). In our study, the prevalence of sleepiness in adolescents was 16.9%. Present study was the first study to examine the relationship between sleep disorders and academic performance in middle school students in Iran. Our result showed that students who had sleep disorders had weaker academic performance than others. Moreover, no significant difference was found between the mean scores of sleep disorders in males

and females. These results were in agreement with findings of Park et al. in 2001 which suggest that there was no any correlation between sleep disorders and gender (21). However, in other studies Laberge et al. in 2001 and Oginska et al. in 2006 were founded different findings and proposed that sleepiness and need for sleep in girls is more than boys (22, 23). It is demonstrated that most children and teenagers need 9 hours of sleep at night (24), while it is obtained 8.38±1.17 in this study. Wolfson and Craskadon showed in those high school students who go to sleep earlier in the night and have longer sleep, a significantly better academic performance than others (25). Sadeh et al. noted in their study that increased sleep time leads to better while decreased sleep time leads to worse neuro-behavioral function (26). In our study, the average sleep time was significantly higher in the group with excellent academic performance, but in contrast to other studies there was no any association between time to go to bed and academic performance. However, Eliasson et al. in 2002 (27), show no correlation of total sleep time with academic performance.

The current study also shown that students who rise before 6 o'clock in the morning, had weaker academic performance than others. In a study Kahn et al. showed that sleep latency more than 30 minutes and fragmented sleep (wake up more than once during the night), will undermine the academic performance (28), this was demonstrated in our study too. Moreover, students who had breathing disorders during sleep such as snoring and sleep apnea had weaker academic performance than others (13), this also was seen in present study. In support of our findings, in a meta-analysis, sleep-disordered breathing was significantly correlated with poorer academic performance for core academic domains related to language arts, science and math and with unsatisfactory progress/learning problems but not general school performance (29).

5- CONCLUSION

This study revealed that sleep disorders negatively affect the academic performance and highlighted the importance of proper sleep among children and students. The findings of the present study double the necessity of reforms and appropriate measures to reduce the adverse consequences of sleep disorders which have a direct effect on academic performance, improvement and student learning. In addition, school managers should have guidance services with an experienced counselor to counsel students by sleep disorders, or students by family problems such as child raised by single parent and/or parents who do not pay adequate attention to their children and those students experiencing challenges in schools.

6- COMPLIANCE WITH ETHICAL STANDARDS

7- ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

8- INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

9- CONFLICT OF INTEREST

The authors declare that they have no conflict of interest related to the study or preparation of the manuscript.

10- ACKNOWLEDGMENTS

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