Sleep Problems/Habits and School Performance in Elementary School Children

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No previous studies have assessed the relationship between sleep problems/habits and school performance in Saudi school children. Therefore, we surveyed parents of a sample of elementary school children in Riyadh to assess the relation between sleep problems/habits and school performance in this age group. The study was conducted in Riyadh city among elementary school children (boys and girls) during springtime of the year 1999. Questionnaires were distributed by trained medical students according to the sampling process and parents were asked to score each item that describes the child behavior within the past 6 months. School performance was assessed using the latest monthly evaluation report provided by the school. Students' performance was stratified as "excellent students" (≥85%) or "average students" (<85%). Completed questionnaires were returned from the households of 1012 students. Boys were 511 (50.5%) and girls 501 (49.5%). The mean age was 9.5±1.9 years ranging from 5 to 13 years. Six hundred and forty nine students (64.1%) of students had "excellent" performance and 363 students (35.9%) had "average" performance. School performance was significantly associated with children's age, gender, father's educational level, and mother's educational level. It was evident that the presence of sleep problems, poor sleep habits, or shortened total sleep time was affecting the students' school performance. Sleep problems and habits may negatively affect school performance. Schools, parents, and pediatricians need to take an active role to consider sleep and sleep disorders in the context of school performance and daytime functioning. **(Sleep and Hypnosis 2006;8(1):12-18)**

Key words: sleep, school, children, elementary, primary

INTRODUCTION

Sleep medicine practitioners have long had a strong feeling that irregular sleep pattern or reduced sleep duration may affect school performance in children. Limited numbers of studies have attempted to assess the relationship between sleep habits and academic performance (1). Most of those studies have focused on adolescents and college students. Studies that assessed school performance and sleep in elementary school children targeted children in the age group 8-10 years (1-3). To our knowledge, no studies addressed the relation between sleep habits and school performance in younger age groups. In general, survey studies in children and adolescents consistently demonstrated

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that children with irregular bedtimes, later bedtimes during weekdays and increased complaints of increased daytime sleepiness have lower school performance compared to their peers who do not have such sleep problems (4-6). Most of the previous studies relied on self-reported or parents reported sleep-wake habits and problems rather than objective assessment of sleep (actigraphy or polysomnography). One of the problems that faced investigators is the measurement of academic performance. Different modalities have been used including, grade point average (based on self-report or actual record), self-reported average grades, teacher ratings, and parent's report (1).

No previous studies have assessed the relation between sleep problems/habits and school performance in Saudi elementary school children. Moreover, to our knowledge, no study has assessed the impact of sleep habits and patterns on school performance in younger elementary school children. Therefore, we surveyed parents of a sample of elementary school children in Riyadh to assess the relationship between sleep problems/habits and school performance in this age group.

METHODS

This study was conducted in Riyadh city. Every public school was assigned a number, and then 10 public boys' schools and 10 public girls' schools were selected randomly. The same sampling process was done for the classes and students in each selected school. The study was conducted on March, 1999 (Dhu Alqaada 1419 H) where all schools started at 07:00 and ended between 12:00 and 13:00 depending on the grade (usually, students are required to report to school before 06:45). Elementary schools in Saudi Arabia include students from grade 1 to grade 6. Students were almost evenly distributed between the six grades of school ranging from 15.4% to 19.2%.

Within a large project to assess sleep in elementary school children, a questionnaire was designed to assess sleep habits, sleep problems, home environment, demographic data and parent's educational level based on our experience and the literature (7,8). A pilot sample was drawn from the studied population to test the data-gathering mechanisms and to assess the legibility, validity and reliability of the questionnaire. Sixty questionnaires were distributed and the needed modifications were done. Observations used in the pilot sample were not counted as part of the final sample. Letters addressed to the parents explaining the survey, its procedures and its aim were sent home with each child. Questionnaires were distributed by trained medical students according to the randomization process. Parents were asked to score each item that describes the child behavior within the past 6 months. Students who were reported by their families to have any of the following problems: chronic neurological diseases, psychiatric diseases (diagnosed by a psychiatrist) or chronic respiratory diseases were not included in the study.

The questionnaire included two formats of questions: closed questions with multiple choices, for example "Does your child have regular sleep-wake schedule? (yes, no, I do not know)," and open questions to be completed with proper answers. The following sleep problems were assessed: bedtime resistance (how often is it difficult getting your child to go to bed?), sleep-onset delay (does your child have difficulty falling asleep at night?), fear (does your child express any fears or worries before going to bed?), sleep interruption (does your child have difficulty sleeping through the night?), nightmares and sleep terrors based on the DSM-VI criteria (9), enuresis, sleep walking, sleep talking, difficulty rising on morning during weekdays (does your child have difficulty getting out of bed in the morning during weekdays?, daytime fatigue (does your child complain of

being tired in the daytime), enough sleep (do you think your child is getting enough sleep?), and snoring. Bedtime resistance, sleep-onset delay, difficulty rising on morning during weekdays and snoring were considered present if the problem occurred at least 3 times per week. For the other problems the occurrence of at least once per week was enough to be coded as a problem.

For school performance, we asked the parents to use the latest monthly evaluation report provided by the school. As the studied group comprised elementary school children who usually have continuous assessment, the monthly evaluation was >65% in 95% of the students. Therefore, in the analysis, students' performance was stratified as "excellent students" (≥85%) or "average students" (<85%). This way of dichotomous division of academic performance has been used before in the assessment of the relationship between sleep habits and school performance (10). The relationship between children's school performance and children's characteristics, parent's characteristics, sleep problems, children's sleep habits was analyzed.

Statistical analysis

Data has been entered in MS Excel and analyzed using SPSS version 10.0. Whereas, categorical variables were expressed in proportions, continuous variables were expressed in means ± standard deviation (SD). Chi-square test was used for comparing categorical data. Further analysis of residuals was performed to identify the categories responsible for the significant chi-square values as suggested by Haberman (1973) (11). To explore for association between sleep problems and habits and school performance, a univariate logistic regression model was initially used, subsequently, all significant variables in the univariate analysis were entered into a multiple logistic regression model to assess if any variable could predict school performance.

RESULTS

One thousand and five-hundred questionnaires were distributed and 1200 questionnaires were returned giving a response rate of 80%. Of the 1200 returned questionnaires, 188 questionnaires were eliminated because the data was not complete or children had one of the chronic illnesses specified in the study protocol that precludes inclusion. Boys were 511 (50.5%) and girls 501 (49.5%). The mean age was a 9.5±1.9 year ranging from 5 to 13 years. Thirty eight point five percent of the questionnaires were completed by fathers, 47.2% by mothers and 14.3 by others.

When school performance was stratified into "excellent" and "average", 649 students (64.1%) of students had "excellent" performance and 363 students (35.9%) had "average" performance. School performance was significantly associated with children's age, gender, father's educational level, and mother's educational level (Table 1). That is, age group 6 and 9 years students were performing excellently, when compared with the age group of 13 years and girls performed better than boys. Parents' educational level had a significant relationship with student's school performance. That is, students of parents whose educational level was University or higher performed better compared to children whose parents were illiterate or had primary education. There was no difference in school performance between children whose mothers were working compared to children whose mothers were housewives.

When the relation between sleep problems and school performance was analyzed, it was observed that the presence of bedtime resistance, sleep interruption, nightmares and terror, enuresis, snoring, difficulty in awakening on weekdays or daytime fatigue was significantly associated with lower school performance (Table 2). It was evident that the presence of any of the

Table 1. The association between school performance and children's characteristics, parent's educational level and job status (percentages)

Associated variables	School performance		X² – value	P-value
	Excellent	Average		
Age				
6	60 (75.6)*	19 (24.4)		
7	89 (66.35)	47 (34.65)		
8	102 (62.8)	61 (37.2)		
9	108 (69.1)*	48 (30.9)	17.9	0.02
10	103 (62.2)	63 (37.8)		
11	95 (65.4)	50 (34.6)		
12	78 (61.0)	50 (39.0)		
13	14 (36.0)	25 (64.0)*		
Sex				
Male	247 (38.0)	264 (72.7)	109.7	< 0.0001
Female	402 (62.0)	99 (27.3)		
Father's education level				
Illiterate	25 (45.9)	29 (54.1)*		
Primary	81 (53.9)	69 (46.1)*		
Intermediate	97 (53.1)	86 (46.9)*	48.03	< 0.00001
Secondary	151 (62.9)	89 (37.1)		
University	268 (76.4)*	83 (23.6)		
High education	27 (79.1)*	7 (20.9)		
Mother's education level				
Illiterate	58 (47.3)	64 (52.7)*		
Primary	110 (54.8)	90 (45.2)*		
Intermediate	129 (62.1)	78 (37.9)	39.24	< 0.0001
Secondary	175 (71.4)*	70 (28.6)		
University	137 (74.5)*	59 (25.5)		
High education	4 (100)*	0		
Mother's Job				
Employed	177 (27.2)	104 (28.8)	0.196	0.7
House wife	472 (72.8)	259 (71.2)		

* The difference between the excellent and average performers is statistically significant.

Table 2. The association between school performance and children's sleep problems (percentages)

Associated variables	School performance		X² – value	P-value
	Excellent	Average		
Bedtime resistance				
No	416 (64.1)	182 (50.0)	11.2	0.001
Yes	233 (35.9)	181 (50.0)		
Sleep interruption				
No	622 (95.8)	330 (91.0)	6.8	0.009
Yes	27 (4.2)	32 (9.0)		
Night mares				
No	620 (95.6)	330 (90.9)	5.6	0.018
Yes	29 (4.4)	33 (9.1)		
Sleep terror				
No	636 (98.0)	338 (93.1)	12.3	0.0004
Yes	13 (2.0)	25 (6.9)		
Enuresis				
No	630 (97.1)	332 (91.5)	13.0	0.0003
Yes	19 (2.9)	31 (8.5)		
Snoring				
No	622 (95.9)	335 (92.3)	4.1	0.04
Yes	27 (4.1)	28 (7.7)		
Difficulty in Awakening WD				
No	419 (75.7)	203 (55.8)	28.8	< 0.0001
Yes	158 (24.3)	160 (44.2)		
Daytime fatigue				
No	597 (92.0)	308 (84.8)	7.5	0.006
Yes	52 (8.0)	55 (15.2)		

Table 3. The association between school performance and children's sleep habits/ practices (percentages)

Associated variables	School performance		X² – value	P-value
	Excellent	Average		
Sleep regularly				
No	64 (9.8)	66 (18.1)	8.29	0.004
Yes	585 (90.2)	297 (81.9)		
Sleep with parents				
No	572 (88.1)	299 (82.4)	4.83	0.03
Yes	77 (11.9)	64 (17.6)		
Watch TV after 8 PM				
No	312 (48.1)	132 (36.3)	8.34	0.004
Yes	337 (51.9)	231 (63.7)		
Play computer games after 8 PM				
No	503 (77.5)	233 (64.1)	11.48	0.0007
Yes	146 (22.5)	130 (35.9)		
Watch TV at bedtime				
No	373 (57.4)	162 (44.6)	10.35	0.001
Yes	276 (42.6)	201 (55.4)		
Does your child get enough sleep?				
No	99 (15.2)	81 (22.3)	5.75	0.016
Yes	550 (84.8)	282 (77.7)		
Sleep in class				
No	642 (98.9)	347 (95.6)	_	0.006
Yes	7 (1.1)	16 (4.4)		

above sleep problems was affecting the students' school performance.

School performance was also related to sleep habits and practices. Students who were reported by parents to have any of the following sleep habits; irregular bedtime, sleep with parents, watching television (TV) after 8 PM, playing computer games after 8 PM, watching TV at bed time, reported by parents as "not getting enough sleep", refuse to go to school and sleep in class performed significantly less than their peers who do not have those problems (Table 3).

Bedtime during weekdays was significantly earlier in the excellent group 21:12±4.2 minutes compared to the average group 21:30±6 minutes (p<0.001). Additionally, nighttime sleep duration during weekdays was significantly longer in the excellent group (510±2.7 minutes versus 495±3.6 minutes, p=0.02). On the other hand, no differences between the two groups could be elicited with regard to bedtime, rise time and nighttime sleep duration during weekends. In the excellent group, 38% used to have daily nap compared to 33% in the average group (p=0.09).

Multiple logistic regression models showed none of the studied variables could predict school performance.

DISCUSSION

This is the first study to address the relationship between school performances and sleep characteristics in elementary school children in Saudi Arabia. To our knowledge, no previous studies in the literature have assessed this interaction in the age group 6-8 years. Based on our findings, many factors appeared to affect school performance. Table 2 demonstrated that students with different sleep problems had lower school performance compared to normal sleepers. Limited studies have assessed the relation between sleep problems and school performance in middle childhood. Al-Sharbati (3) in a sample of Libyan elementary school children demonstrated that school failure was higher among poor sleepers compared to good sleepers. Children with sleep disordered breathing (SDB) were reported consistently to have lower performance at school (12,13) Moreover, a study of seventh and eighth grade students showed that earlier childhood

snoring predicted current school performance (14). Treating children with SDB has been shown to have significant improvement in grades the following years compared to those who were not treated reflecting the importance if early detection and treatment of sleep problems (13).

Certain sleep habits were associated with lower school performance. Therefore, health care professionals should be aware of the potential harmful effects of certain sleep habits like TV watching at bedtime and its impact on sleep in children. Moreover, parents should recognize the potential contribution of having a TV set in the child's bedroom (15). Most of the previous studies assessing sleep habits and academic performance focused on middle school, high school, or first year college students (1). In a survey of 972 Belgium students (8-10 years), Kahn et al (2) reported that school achievement difficulties were significantly more among poor sleepers than among youngsters without sleep difficulties. Bedtime during weekdays of children who did not have excellent performance was significantly delayed (18 minutes later) compared to those with excellent performance. Nighttime sleep duration during weekdays was significantly longer (15 minutes more) among excellent performers. These results concur with previous reports in adolescents. In a sample of 3000 high school students, Wolfson and Craskadon (16) reported significantly longer total sleep time and earlier bedtimes in students with higher grades. Students reporting Bs or better got on average school nights, 17-33 minutes more total sleep and going to bed 10-50 minutes earlier than C, D and F students. Although the differences in sleep duration may appear relatively small, it may be physiologically important. Sadeh et al (17) have shown recently that modest changes in sleep duration in school-aged children improve (in the case of extension) and worsen (in the case of restriction) neurobehavioral function.

With regard to sleep pattern during weekends, we found no difference between excellent performers and others. Studies in adolescents have shown that later weekend rise time and bedtime was associated with lower school performance (18,19). As schools in Saudi Arabia start at the same time, it was not possible to assess the relationship between school start time and performance. However, Epstein and colleagues (20) in a sample of Israeli school children demonstrated that children who start school at 07:15 or earlier expressed more frequent complaints of daytime fatigue and sleepiness throughout the school day, a greater tendency to doze off in class, and attention/concentration difficulties in school compared to those who started school at 08:00 regardless of total sleep time. We found no difference between the two groups with regard to daytime nap. However, Kahn et al (2), reported that preadolescents who were described by their parents to need daily nap were more likely to experience grade retention compared to their peers.

The present study reports important findings, nevertheless, certain caveats pertain that need to be addressed. First, parent-reported data have clear limits, however, the validity of self-report and parent-report surveys estimates of sleep pattern of students has been demonstrated (21,22). Moreover, self-reported and school-reported grades were reported to have good correlation (r=0.79) (23). Second, school performance is difficult to assess, as there are many hidden confounders that may influence its measurement such as motivational changes, self-concept, ethics and social class. On the other hand, one of the major problems of this data is the colinearity between the studied variables, which were obvious in our preliminary analysis. Therefore, multiple logistic regression analysis failed to reveal any predictors of school performance. Nevertheless, at this stage, crude analysis is needed for the researchers to build a solid

base for their future studies, especially that this area of research has not been well explored in our geographical area. Third, since the study was cross-sectional, no conclusions about long-term ramifications of inadequate sleep can be drawn. Future investigations should gather longitudinal data across time and try to control for different confounders.

In summary the present study showed that sleep problems, poor sleep habits, shortened total sleep time and late bedtimes in elementary school children are negatively associated with school performance. Schools, parents, and pediatricians needs to take an active role to consider sleep and sleep disorders in the context of school performance and daytime functioning.

REFERENCES

1. Wolfson AR, Carskadon MA. *Understanding adolescents' sleep patterns and school performance: a critical appraisal. Sleep Med Rev 2003;7:491-506.*

2. Kahn A, Van De Merckt C, Rebuffat E. Mozin MJ, Sottiaux M, Blum D, Hennart P. *Sleep problems in healthy preadolescents. Pediatrics 1989;84:542-546.*

3. Al-Sharbati MM. *Sleep problems among pupils in Benghazi, Libya. Saudi Med J 2002;23:1105-1109.*

4. Wolfson AR, Carskadon MA. *Sleep schedules and daytime functioning in adolescents. Child Dev 1998; 69: 875-887.*

5. Cortesi F, Gianotti F, Mezzalira E, Bruni O, Ottaviano S. *Circadian type, sleep patterns, and daytime functioning in adolescents. Sleep Res 1997;26:707.*

6. Giannotti F, Cortesi F, Ottaviano S. *Sleep, behaviour and school functioning in school-aged children. Sleep Res 1997;26:197.*

7. Epstein R, Chillag N, Lavie P. *Starting times of school: Effects on daytime functioning of fifth-grade children in Israel. Sleep 1998;21:250-56.*

8. Andres TF, Carskadon MA, Dement WC, Harvey K. *Sleep Habits of children and the identification of pathologically sleepy children. Child Psychiatry Hum Dev 1978;9:56-63.*

9. APA (American Psychiatric Association). *Diagnostic and statistical manual of mental disorders, 4th edition. (DSM-VI). Washington: The American Psychiatric Association; 1994.*

10. Link SC, Ancoli-Israel S. *Sleep and the teenager. Sleep Res 1995;24a:184.*

11. Haberman SJ. *The analysis of residuals in cross-classfied tables. Biostatistics 1973;29:205-220.*

12. Chervin RD, Clarke DF, Huffman JL, Szymanski E, Ruzicka DL, Miller V, Nettles AL, Sowers MR, Giordani BJ. *School performance, race, and other correlates of sleep-disordered breathing in children. Sleep Med 2003;4:21-27.*

13. Gozal D. *Sleep-disordered breathing and school performance in children. Pediatrics 1998;102:616-620.*

14. Gozal D, Pope Jr DW. *Snoring during early childhood and academic performance at ages thirteen to fourteen years. Pediatrics 2001;107:1394-1399.*

15. Owens J, Maxim R, McGuinn M, Nobile C, Msall M, Alario A. *Television-viewing habits and sleep disturbance in school children. Pediatrics 1999;104:27.*

16. Wolfson AR, Craskadon MA. *Sleep schedules and daytime functioning in adolescents. Child Dev 1998;69:875-887.*

17. Sadeh A, Gruber R, Raviv A. *The effects of sleep restriction and extension on school-age children: what a difference an hour makes. Child Dev 2003;74:444-455.*

18. Trockel MT, Barnes MS, Egget DL. *Health-related variables and academic performance among first-year college students: implications for sleep and other behavior. J Am Coll Health 2000;49:125-131.*

19. Allen R. *Social factors associated with the amount of school week sleep lag for seniors in an early starting suburban high school. Sleep Res 1992;21:114.*

20. Epstein R, Chillag N, Lavie P. *Starting times of school: effects of daytime functioning of fifth-grade children in Israel. Sleep 1998;21:250-256.*

21. Sadeh A. *Assessment of intervention for infant night waking: parental reports and activity-based home monitoring. J Consult Clin Psychol 1994;62:63-68.*

22. Wolfson AR, Carskadon MA, Acebo C, Seifer R, Fallone G, Labyak SE, Martin JL. *Evidence for the validity of a sleep habits survey for adolescents. Sleep 2002;26:213-216.*

23. Dorbusch SM, Carlsmith JM, Bushwall SJ, Ritter PL, Leiderman PH, Hastorf A, Gross RT. *Single parents, extended households, and the control of adolescents. Child Dev 1985;56:326-341.*