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The Association between Sleep Disorder Patterns in School-Aged Children with Maternal Anxiety, Stress, and Depression: A Cross-Sectional Study

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Abstract

Background and Objective: Sleep problems are common in school-aged children and may have negative impacts on their health. This study aimed to determine the sleep disorder patterns in school-aged children and evaluate their association with maternal anxiety, stress, and depression.

Materials and Methods: This cross-sectional study was conducted between October 2018 and September 2019 and included children aged 7-12 years using convenience sampling. The Persian version of the BEARS questionnaire, which incorporates five basic sleep domains (Bedtime problems, Excessive sleepiness, Awakenings during the night, Regularity of sleep, Snoring), was used to assess sleep disorders. Maternal anxiety, stress, and depression were measured using the short form of the Depression, Anxiety, and Stress Scale (DASS), a caregiver self-report tool. Multivariable logistic regression was applied to assess the association between child sleep problems and maternal mental health.

Results: In the 99 children included, the most common sleep problem was nocturnal awakening, with 48.5% experiencing it. Excessive daytime sleepiness was the second most common problem, affecting 38.4% of children. In the multivariable-adjusted model, awaking during the night [odds ratio (OR): 3.16, 95% confidence interval (CI): 1.27-7.82] and bedtime problems (OR: 4.20, 95% CI: 1.16-15.20) showed a positive association with moderate to severe levels of maternal anxiety, stress, and depression.

Conclusion: The prevalence of sleep problems among school-aged children underscores the need for family awareness and education about sleep problems.

Keywords: Anxiety; Depression; Sleep disorders

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Introduction

Sleep problems in school-aged children can have negative impacts on their mental and physical health, including academic failure (1, 2). The reasons for the persistence of sleep problems from infancy to later childhood are still unclear (3). Despite its high prevalence, parents often ignore sleep problems (4). A study conducted in Tehran City, Iran, found that among school-aged children, 12.4% had bedtime problems, 62.9% had excessive daytime sleepiness, 44.2% woke up during the night, 17.1% had regularity and duration of sleep problems, and 11.9% had sleep-disordered breathing (SDB) (5).

While it is established that there is a direct association between geda-preschool children's sleep problems and maternal anxiety, stress, and depression (6, 7), little is known about school-aged children's sleep problems and concurrent maternal health disorders, especially in the Middle East and North Africa region. Previous studies in Iran reported sleep patterns and problems among school-aged children, but inadequate attention

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was paid to their association with maternal health disorders (5, 8).

This study aimed to address this research gap by investigating the relationship between sleep problems in school-aged children and the concurrent maternal anxiety, stress, and depression.

Materials and Methods

Study design: This study aimed to explore the association between sleep problems in school-aged children and concurrent maternal anxiety, stress, and depression in Tehran City. We hypothesized that child sleep problems were associated with maternal depression, anxiety, or stress. To the best of our knowledge, this is the first study on the topic in the Middle East and North African region. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences (Ethics code: IR.TUMS.MEDICINE.REC.1397.722).

Study participants: Ninety-nine mothers [mean age: 33.8 years, standard deviation (SD): 5.7] and their children aged 7-12 years were recruited using convenience sampling between October 2018 and September 2019 from an outpatient pediatric clinic of Baharloo Hospital in Tehran City. Families were excluded if the child did not live with parents, had apparent physical or mental disabilities, had recognized developmental delays due to cerebral palsy (CP), was on sleep medications, or had genetic or metabolic conditions (9).

Measures

Trained interviewers used a standard questionnaire to record demographic data, educational level, medications, and disease history of the child and mother in the past 6 months (excluding mental and physical disabilities). Anthropometric measurements, including height and weight, were taken with shoes removed and while wearing light clothing. Weight was measured to the nearest 100 grams. For children aged 7-12 years, height was measured to the nearest 0.1 cm in a standing position using a tape measure, while shoulders were in normal alignment. The body mass index (BMI)-for-age was calculated, and four categories were defined: underweight, normal, overweight, and obese based on World Health Organization/National Center for Health Statistics (WHO/NCHS) values of $< 5^{th}$, $\geq 5^{th}$, $< 85^{th}$, $\geq 85^{th}$, $< 95^{th}$, and $\geq 95^{th}$ percentiles, respectively (10). Education was grouped into three categories: less than 6 years, 6-12 years, and more than 12 years.

The BEARS questionnaire was used to identify sleep problems in school-aged children (11). This questionnaire is a helpful tool to address the most common sleep problems in children. It includes five basic sleep domains: Bedtime problems, Excessive daytime sleepiness, Awakenings during the night, Regularity of sleep/wake cycles, and Snoring. The Persian version of the BEARS, which had previously been evaluated for reliability and validity, was used in the current study (8). Trained interviewers administered all questions, with responses provided by both mothers and children.

To measure self-reported maternal anxiety, stress, and depression, the short form of Depression, Anxiety, and Stress Scale (DASS) was used (12). The short form comprises 21 questions across three subscales of depression, anxiety, and stress (7 items each). Mothers were asked to rate how much each statement applied to them during the week preceding assessment. Each question was rated using a 4-point rating scale of 0 = Did not apply to me at all, 1 = Applied to me to some degree or some of the time, 2 = Applied to me to a considerable degree or a good part of the time, and 3 = Applied to me very much or most of the time, indicating symptom severity or frequency. The Persian version of the DASS-21 was used in the current study, and its reliability and validity have been previously evaluated. Scores were categorized as follows: depression (< 5: normal, 5-6: mild, 7-10: moderate, and ≥ 11: severe), anxiety (< 4: normal, 4-5: mild, 6-7: moderate, and ≥ 8: severe), and stress (< 8: normal, 8-9: mild, 10-12: moderate, and ≥ 13: severe) (13).

Statistical analysis: The baseline characteristics were reported as mean (SD) values for continuous variables and frequencies (%) for categorical variables. For covariates with skewed distributions, the median [interquartile range (IQR)] was reported.

To compare two continuous variables, we employed the Mann-Whitney U test. For examining associations between two categorical variables, the chi-square test was used. Logistic regression models were used to evaluate the association between the child's sleep problems and moderate to severe maternal anxiety, stress, or depression in two models: model 1 (unadjusted) and model 2 (adjusted for the child's age and gender, the mother's age and education levels). Odds ratios (ORs) with 95% confidence intervals (CIs) were reported, with CIs estimated using bootstrapping.

Table 1. Characteristics of the study participants

	Total participants (n = 99)	Boys (n = 58)	Girls (n = 41)	P-value
Child's characteristics				
Age (year)	9.1 ± 1.7	9.2 ± 1.7	8.9 ± 1.8	0.42
BMI (kg/m^2)	18.9 ± 5.1	18.9 ± 5.8	18.9 ± 3.9	0.98
BMI-for-age-sex-percentile*				
Underweight	5 (5.1)	5 (8.6)	-	-
Healthy weight	79 (79.8)	44 (75.9)	35 (85.4)	
Overweight	10 (10.1)	5 (8.6)	5 (12.2)	
Obese	5 (5.1)	4 (6.9)	1 (2.4)	
Childbirth				0.36
Normal	44 (44.4)	28 (48.3)	16 (39.0)	
Cesarean	55 (55.6)	30 (51.7)	25 (61.0)	
Child illness during the last 6 months (yes)	13 (13.1)	8 (13.8)	5 (12.2)	0.82
Using any medications during the last 6 months (yes)	25 (25.3)	14 (24.1)	11 (26.8)	0.76
Mother's characteristics				
Age** (year)	33.8 ± 5.7	33.6 ± 5.9	33.9 ± 5.4	0.79
Education (year)				0.59
< 6	18 (18.2)	10 (17.2)	8 (19.5)	
6-12	70 (70.7)	40 (69.0)	30 (73.2)	
≥ 12	11 (11.1)	8 (13.8)	3 (7.3)	
Current smoking (yes)	3 (3.0)	2 (3.4)	1 (2.4)	0.77
Self-reported illness (yes)	29 (29.3)	15 (25.9)	14 (34.1)	0.37

Values are shown as mean ± standard deviation (SD) or number (%), for continuous and categorical variables, respectively.
*BMI-for-age-sex-percentile was calculated according to the World Health Organization (WHO) BMI Percentile for Child and Teen; **Mother's age at the time of the interview
BMI: Body mass index

Although all basic information was reported separately for boys and girls, the analysis was conducted across the total population to increase the study power, since there was no sex interaction between the child's sleep problems and the related outcome. STATA statistical software (version 14 SE, Stata Corporation, College Station, TX, USA) was used for all analyses, and a two-tailed P-value < 0.05 was considered significant.

Results

The study included 99 children aged 7-12 years, of whom 58.6% were boys. The mean age and BMI were 9.1 years (SD = 1.7) and 18.9 kg/m^2 (SD = 5.1), respectively. The mean age of participating mothers was 33.8 years (SD = 5.7), and most of them (70.7%) had 6 to 12 years of education. Table 1 presents the baseline characteristics of children and mothers, stratified by sex.

The most common sleep problems in both boys and girls were awakening during the night (56.9% and 36.6%, respectively) and excessive daytime sleepiness (39.7% and 36.6%, respectively) (Table 2). The children's sleep characteristics for boys and girls are presented in table 3. Among school-aged children, the median bedtime (going to bed at night) during school days was 22:40 for boys and 23:10 for girls, and wake-up time in the morning was 7:34 for boys and 7:40 for girls (Table 3).

Table 4 demonstrates the results of univariable and multivariable logistic regression analyses evaluating associations between child sleep problem domains and moderate to severe maternal anxiety, stress, or depression. In the univariable analysis, bedtime problems (OR: 3.48, 95% CI: 1.07-11.33, P-value = 0.039) and awakenings during the night (OR: 2.65, 95% CI: 1.14-6.15, P-value = 0.02) were significantly associated with moderate to severe maternal anxiety, stress, or depression. These associations remained significant after adjusting for child's age and gender as well as maternal age and education level (Table 4).

Table 2. Children's sleep characteristics for boys and girls

	Total (n = 99)	Boys (n = 58)	Girls (n = 41)	P-value
Bedtime problems	14 (14.1)	9 (15.5)	5 (12.2)	0.64
Excessive daytime sleepiness	38 (38.4)	23 (39.7)	15 (36.6)	0.76
Awakening during the night	48 (48.5)	33 (56.9)	15 (36.6)	0.05
Sleep-disordered breathing	9 (9.1)	7 (12.1)	2 (4.9)	0.22

Values are shown as number (%).

Table 3. Detail's of children's sleep characteristics

	Boys (n = 58)	Girls (n = 41)	P-value
Bedtime problems			
Does your child have any problems at bedtime?	6 (10.3)	5 (12.2)	0.77
Do you have any problem going to bed?	8 (13.8)	3 (7.3)	0.35
Excessive daytime sleepiness			
Does your child have difficulty waking in the morning?	12 (20.7)	7 (17.1)	0.65
Does your child seem sleepy during the day or take naps?	8 (13.8)	4 (9.8)	0.54
Do you feel tired a lot?[a]	18 (31.6)	6 (14.6)	0.05
Awakening during the night			
Does your child seem to wake up a lot at night?	14 (24.1)	5 (12.2)	0.14
Any sleepwalking or nightmares?	19 (32.8)	11 (26.8)	0.53
Do you wake up a lot at night?[a]	19 (32.8)	6 (14.6)	0.04
Have trouble getting back to sleep?[a]	12 (20.7)	3 (7.3)	0.09
Sleep-disordered breathing			
Does your child have loud or nightly snoring or any breathing difficulties at night?	7 (12.1)	2 (4.9)	0.31
Regularity and duration of sleep			
School days sleep duration (hour)[b]	8.9 ± 1.4	8.6 ± 1.3	0.24
Weekends sleep duration (hour)[c]	10.1 ± 1.4	9.9 ± 3.1	0.77
Bedtime hour on school days[d]	22:40	23:10	0.09
Wake time hour on school days[e]	7:34	7:40	0.85
Bedtime hour at weekends[f]	23:50	00:10	0.34
Wake time hour at weekends[g]	9:50	10:00	0.80

For continuous variables, mean ± standard deviation (SD) and for categorical variables, number (%) were reported.

[a]Child replies to the questions; [b]Median [interquartile range (IQR)]: boys [9 hours (8-9.6)], girls [8 hours (8-9.3)]; [c]Median (IQR): boys [10 hours (9.4-11)], girls [9.5 hours (9-11)]; [d]Median (IQR): boys [22:25 (21:50-23:00)], girls [23:00 (22:00-23:00)]; [e]Median (IQR): boys [7:00 (6:50-7:50)], girls [7:00 (6:50-7:25)]; [f]Median (IQR): boys [24:00 (23:00-24:50)], girls [24:00 (23:00-01:00)]; [g]Median (IQR): boys [10:00 (9:00-11:00)], girls [10:00 (9:00-11:00)]

Figure 1 illustrates the distribution of maternal anxiety, stress, or depression by child gender. No significant differences were observed in moderate to severe anxiety, stress, or depression between mothers of boys (25.8%, 31%, and 31.8%, respectively) and mothers of girls (14.6%, 24.4%, and 18.7%, respectively).

Discussion

This study aimed to determine the prevalence of sleep problems in school-aged children in Tehran City, using the BEARS questionnaire and to investigate their association with maternal depression, anxiety, and stress. The study found that sleep problems were common in school-aged children, particularly awaking during the night and excessive daytime sleepiness, with no significant gender differences. We also found that bedtime problems and awaking during the night were associated with moderate to severe levels of maternal anxiety, stress, or depression.

Although the prevalence of sleep problems observed in this study was high, it was lower than that reported in previous studies (5, 14). Mohammadi et al. reported prevalence rates of 21% for bedtime resistance, 32.5% for nighttime awakenings, 43% for excessive daytime sleepiness, and 10.5% for SDB among children aged 7-12 years (14).

Table 4. Associations between children's sleep problems and moderate to severe maternal anxiety, stress, or depression

Children's sleep problems	Mother's problems			
	Model 1		Model 2	
	OR (95% CI)*	P-value	OR (95% CI)*	P-value
Bedtime problems	3.48 (1.07-11.33)	0.03	4.20 (1.16-15.20)	0.03
Awakening during the night	2.65 (1.14-6.15)	0.02	3.16 (1.27-7.82)	0.01
Sleep-disordered breathing	1.85 (0.81-4.20)	0.14	2.01 (0.84-4.84)	0.12
Excessive daytime sleepiness	2.16 (0.54-8.61)	0.27	2.79 (0.64-12.14)	0.17

*Confidence intervals (CIs) are based on 1000 bootstrap samples.

OR: Odds ratio; CI: Confidence interval

Model 1: Univariable unadjusted model

Model 2: Adjusted for child gender, child age, maternal age, and maternal education

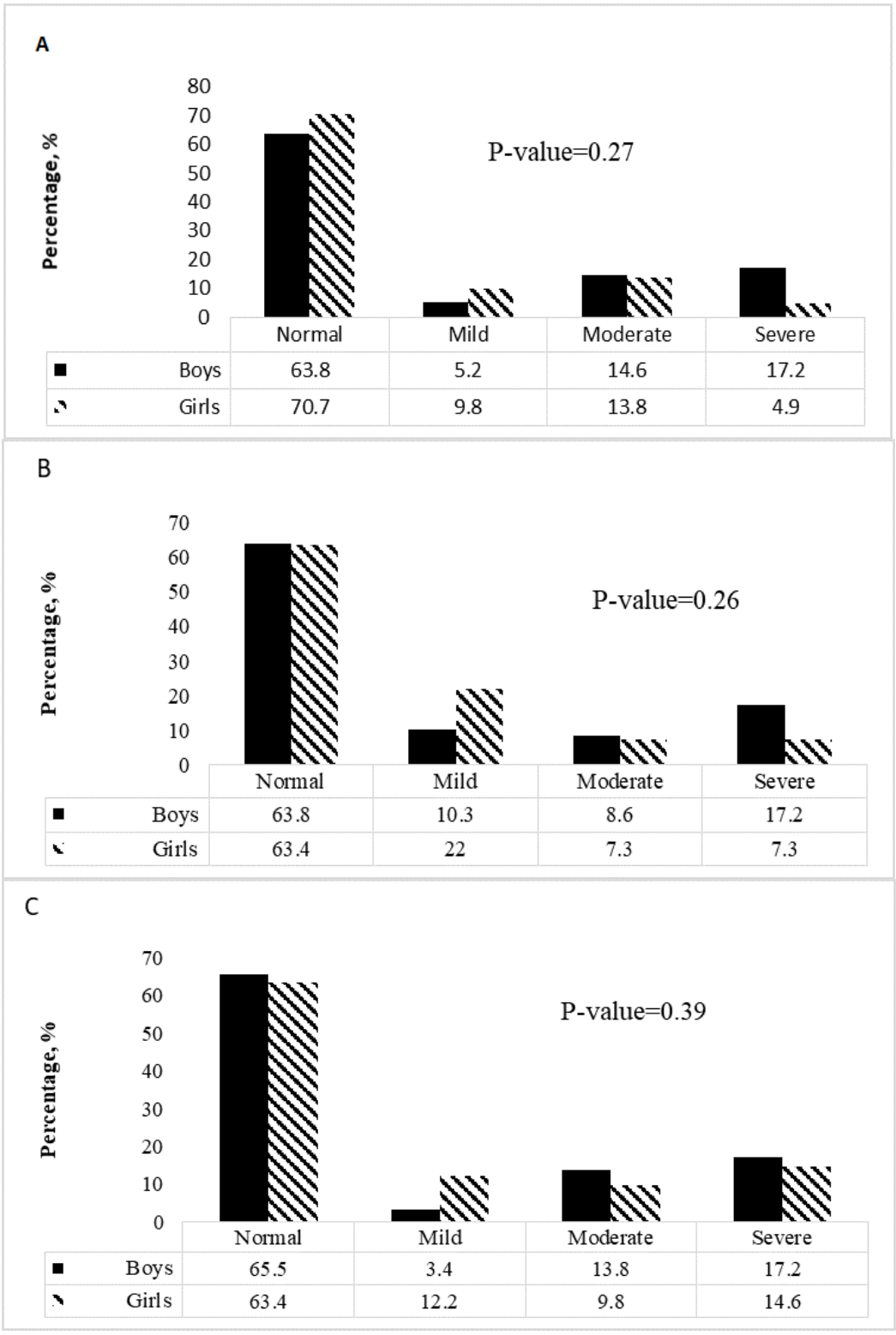


Figure 1. Distribution of maternal anxiety, stress, and depression by child gender
A: Maternal depression in mothers of boys and girls; B: Maternal anxiety in mothers of boys and girls; C: Maternal stress in mothers of boys and girls

Similarly, Ebarhim et al. found that excessive daytime sleepiness (63%) and awaking during the night (44%) were the most common sleep problems in 7-12-year-old children, followed by sleep irregularity and duration (17%), bedtime problems (12%), and SDB (12%) (5).

The current study demonstrated a significant association between maternal anxiety, stress, and depression and bedtime problems and awakening during the night. The findings suggest a relationship between school-aged child's sleep problems and maternal mental disorders. The bidirectional relationship between child sleep and maternal mental health may explain this association. Irregular sleep patterns in children disturb mothers' sleep and rest time and may affect maternal anxiety, stress, and depression (15). On the other hand, mothers with anxiety, stress, and depression may have some difficulties in adopting consistent bedtime routines, which may exacerbate sleep problems in children (9, 16).

Families use different strategies to schedule school programs and manage children's sleep behaviors. Therefore, raising parental awareness about children's sleep problems may help improve children's daytime performance (17).

To our knowledge, this is the first study in the Middle East and North Africa to evaluate the association between sleep problems in school-aged children and maternal mental disorders. The study assessed both the severity of maternal mental disorders and child sleep domains while adjusting for potential confounding factors.

Several limitations should be acknowledged. Given the cross-sectional design of the study, causal relationships between child sleep problems and maternal anxiety, stress, and depression cannot be inferred. Our study only included a sample of the urban population, which may not be representative of the entire population. Lifestyle habits, socioeconomic status, and psychological problems of children and mothers were not assessed and may have influenced the results. In addition, data were collected only from mothers, which may not reflect the experiences of other caregivers.

Conclusion

Sleep problems were highly prevalent among school-aged children, particularly excessive daytime sleepiness and awakening during the night. The study also revealed a positive association between these domains and moderate to severe levels of depression, anxiety, and stress in mothers. However, further well-designed and large-sampled studies are needed to explore the potential causal associations between school-aged children's sleep problems and parents' mental health.

Conflict of Interests

Authors have no conflict of interests.

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All procedures involving human participants were conducted in accordance with the ethical standards of the Research Committee of Tehran University of Medical Sciences, and with the 1964 Declaration of Helsinki and its later amendments (Ethics Code: IR.TUMS.MEDICINE.REC.1397.722).

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