ORIGINAL RESEARCH

Sleep Problems in Children with Autism Spectrum Disorder in Bangladesh: A Case–Control Study

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Background: Sleep problems in children with Autism Spectrum Disorder (ASD) are highly prevalent, but little information is available on this issue in low- to middle-income countries (LMIC) such as Bangladesh. Therefore, the present study investigated the prevalence and socio-demographic determinants of ASD sleep disturbances in a comparison with typically developing children (TDC).

Methods: A cross-sectional interview study was carried out within a total of 446 Bangladeshi mothers, whose children's mean age was 8.1±2.9 years (151 ASD [8.5±2.7 years] and 295 TDC [7.9±2.9 years]); in addition to socio-demographics, the Child Sleep Habit Questionnaire (CSHQ) was used, and a cut-off score of 41 out of 93 points considered as reflecting sleep problems.

Results: About 89.7% of the children reported having problems in sleep, with ASD reporting higher frequency vs TDC (94.00% vs 87.50%; χ^2=4.678, p=0.031). The overall mean CSHQ score was 48.7±7.6 in total sample, whereas ASD children reported higher scores compared to TDCs (50.9±8.1 vs 47.5±7.0, p<0.001). Similarly, subscales of CSHQ such as sleep duration (4.23±1.56 vs 3.90±1.31, p=0.017), sleep anxiety (7.23±2.05 vs 6.45 ±1.92, p<0.001), night waking (3.82±1.07 vs 3.17±1.89, p<0.001), parasomnias (8.86±2.06 vs 7.85±2.27, p<0.001), and sleep disordered breathing (4.02±2.92 vs 3.43±2.07, p=0.014) were more problematic among ASD compared to TDC. Lastly, 28.5% of ASD reported taking sleep-related medications vs 0.3% for TDC (n=1).

Conclusion: Bangladeshi ASD children are highly likely to manifest sleep disturbances, which warrant urgent implementation of parental educational and support programs to mitigate the impact of sleep problems in ASD families.

Keywords: sleep problems, insomnia, ASD, autism spectrum disorder, child sleep habit questionnaire, Bangladesh

Introduction

Autism Spectrum Disorder (ASD) stands for a group of neurodevelopmental disorders that usually manifest deficits across three major behavioral components, namely (i) social interactions and communicative skills, (ii) restricted interest spectrum (eg, rigid routines or rituals, specific food and clothing preferences, and difficulty coping with the environment), and (iii) stereotyped and repetitive behaviors (eg, repetitive movement with object, recitative body movements such as rocking and hand-flapping).[1–4] The social activities of children with ASDs (ASD) are restricted, although some ASD children are arguably able to lead independent and fulfilling lives. In general, life-long care and a supportive environment are needed for the majority of ASD, due to frequently occurring educational

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achievements, difficulties in social interactions, as well as limited employment opportunities.

However, ASD are prone to suffering from a wide-ranging array of life-long difficulties, and the presence of sleep problems is one that is commonly reported as being much more prevalent than in typically developing children (TDC).[5] For instance, the prevalence of sleep problems among ASD families is reported between 66% and 86%, whereas 13% to 86% will suffer from sleep issues among children with other neurodevelopmental disorders, and 9% to 50% in TDC.[6–8] In the context of the sleep problems experienced among ASD, difficulty in falling asleep is the most frequent, whereas other prominent problems include– (i) restless sleep, (ii) do not want to stay on own bed, (iii) sleep awakenings, iv) difficulty to wake up in the morning, v) reduced REM (Rapid Eye Movement) sleep and enhanced undifferentiated sleep, immature organization of eye movements into discrete bursts, less time in bed, reduced total sleep time, altered REM sleep latency.[1,9] In contrast, common sleep problems among TDC included sleep walking, bed time resistance, nighttime awakenings and sleep terrors.[10] Insufficient sleep or problems in the context of sleep behaviors increase the severity of autism symptoms, and generate an added level of stress and disruption in the family,[1,11] further buttressing the importance of sleep in the context of ASD. ASD sleep problems are also associated with different adverse health outcomes, such as lower ability of motor coordination or verbal communication, reduced social interactions, higher anxiety, hyperactivity, aggression, and altered eating habits, to name a few.[12]

According to the World Health Organization report, one in 160 children (0.625%) will be diagnosed with ASDs.[13] In Bangladesh, the prevalence of ASD is estimated at 0.15% to 0.8%,[14] and may reach 3% in metropolitan areas, likely because of increased diagnostic access. However, arguably Bangladesh is experiencing a higher prevalence of children with ASDs, and studies assessing ASD common clinical issues such as sleep problems, are extremely scarce; among the currently available evidence, Begum et al[15] reported on the distribution of socio-demographic characteristics, whereas another qualitative study by Preity et al[16] studied ASD parental views towards autism. However, such limited information and reduced awareness as to the actual prevalence and clinical phenotypic manifestation of ASD in Bangladesh may arguably hinder the implementation of appropriate policies regarding the diagnosis and treatment of children with

ASD. Thus, the present study was conducted to assess the hypothesis that sleep problems were more frequent in ASD families and to assess whether such sleep-related difficulties were associated with socio-demographic factors among ASD and TDC families.

Methods
Study Site and Participants
The present comparative study was conducted between May and August 2019 and included the mothers with ASD children (M-ASD) and mothers of typically developing children (M-TDC) residing in Dhaka, the capital of Bangladesh. Based on the randomization school assignment, M-ASD participants were recruited from eight specialized schools of ASD children, whereas the M-TDC participants were recruited from twelve regular schools. The only inclusion criterion for participating in the interview was being a mother of a child aged between 4 and 15 years. A total of 512 mothers were approached to participate the study, and of these 446 mothers agreed and provided their informed consent. Their children's mean age was 8.1±2.9 years. In total, data from 151 M-ASD (mean age of children 8.5±2.7 years) and 295 M-TDC (mean age of children 7.9±3.0 years) were available for analyses.

Data Collection
Face-to-face structured interviews were conducted in the schools. The research team randomly approached school administrators in the city, and after being granted formal permission by the appropriate school authorities, the survey interviews were carried out. Each interview lasted approximately 35 minutes, and all interviews took place during school opening hours. A structured questionnaire was administered by the research team, and comprised questions concerning socio-demographic characteristics, and the Child Sleep Habit Questionnaire (CSHQ).

Measures
Sociodemographic Factors
Questions concerning socio-demographic variables included age, education (number of years studied at school/college), occupation, family type, monthly income, total number of children, birth order of the child among the siblings. Family income was categorized based on Mamun and friends' study as either upper class (families having an income of more than 30,000 Bangladeshi Taka

[BDT] a year), middle class (families having between 15,000 and 30,000 BDT a year), or lower class (families having less than 15,000 BDT a year).[17] Use of sleeping pills was also assessed in this study.

Child Sleep Habit Questionnaire

Sleep problems were assessed using the Child Sleep Health Questionnaire [CSHQ; 8]. The CSHQ contains 33 items related to a number of key sleep domains such as – (i) bedtime resistance, (ii) sleep onset delay, (iii) sleep duration, (iv) anxiety, (v) night walking, (vi) parasomnias, (vii) sleep disordered breathing, and (viii) daytime sleepiness. Information was obtained from the mothers of the child on the basis of recollection related to the last 2–3 weeks. Items are rated on a 3-point scale, if the sleep behaviors occur ≥5 days/week, ie, "usually", whereas 2 to 4 days and 0 to 1 day are denoted as "sometimes" and "never", respectively. The CSHQ has a possible score ranging from 31 to 93 points, and higher scores indicate more sleep problems. However, a score of 41 points is considered as the cutoff for the presence of problematic sleep.[18,19] Parent's perception regarding their child's sleep was also recorded.

Ethics

The study procedures were conducted in accordance with the Declaration of Helsinki, 1975. First of all, the study protocol was reviewed at the CHINTA Research Bangladesh. Later on, a formal ethical approval was granted by the ethics committee at the Institute of Allergy and Clinical Immunology of Bangladesh (Ref No: IRBIACIB/ECE/07201915/299). All mothers were informed about the purpose of the study and their informed consent was obtained prior to participation in the survey interview. Confidentiality of data and privacy of the participants was strictly maintained, and participants were informed that they had the right to withdraw from the study at any time.

Statistical Analysis

Data analyses were completed by using SPSS version 22.0 (Chicago, IL). Descriptive statistics (ie, percentage and frequencies) as well as inferential statistics (ie, chi-square test, independent t-test, and ANOVA test) were performed to identify potential relationships of child sleep problems with the variables under investigation among the ASD and TDC groups. In Table 1, the distribution of the participants across the child group was compared using chi-square tests. Comparisons on CSHQ overall and subscales scores across ASD and TD children were evaluated based on independent t-tests. In Table 3, independent t-tests, and ANOVA tests were used to see the relationship of the studied variables with insomnia based on (i) total children, (ii TD children, and (ii) ASD children. The statistical significance level was set at $p<0.01$ with 95% confidence intervals for the test.

Results

From a total of 446 mothers who completed the structured interview, 33.9% (n=151) were M-ASD and 66.1% were M-TDC. Among ASD, the proportion of male children was high (n=121/151), whereas equal distribution of the two sexes occurred in TDC (n=51.5%). Half of the children were 4–7 years of age, 82.7% were from nuclear family, almost always from the higher socio-economic class (71.7%), and mothers' and fathers' higher education levels were also ubiquitously present (Table 1). 21.9% of the M-ASD reported a positive family history of ASD and 41.7% had no subsequent children after the birth of their ASD child. About 9.9% of all children were reported to be taking sleeping pills, primarily among ASD children (ie, 28.5% vs 0.3%; χ2 = 88.928, $p<0.001$) (Table 1).

Figure 1 presents the distribution of problematic sleep across the two groups. About 89.7% of the children were reported to have sleep problems, but the prevalence was higher in ASD compared to TDC (94.00% vs 87.50%; χ^2=4.678, $p = 0.031$). Furthermore, the overall mean score in CSHQ was 48.67±7.56 in the total sample, whereas ASD children reported higher scores compared to TDC ones (50.90±8.11 vs 47.53±7.01, $p<0.001$). Similarly, subscales of CSHQ such as sleep duration (4.23±1.56 vs 3.90±1.31, $p=0.017$), sleep anxiety (7.23 ±2.05 vs 6.45±1.92, $p<0.001$), night awakenings (3.82 ±1.07 vs 3.17±1.89, $p<0.001$), parasomnias (8.86±2.06 vs 7.85±2.27, F=20.589, $p<0.001$), and sleep disordered breathing (4.02±2.92 vs 3.43±2.07, $p=0.014$) were more prevalent among ASD compared to TDC. There were no significant differences between the two groups for the bedtime resistance, sleep onset delay, and daytime sleeping sub-items of the CSHQ (Table 2).

Table 3 represents the relationships within CSHQ overall scores and other variables as explored in the total cohort, ASD, and TDC. Of the socio-demographic items, the use of sleeping pills was significantly associated with sleep problems. The TDC who reported using sleeping

Table 1 Distribution of the Socio-Demographic Variables of ASDs and TD Children

Variables	Total (n; %)	Child Type		Statistics		
		ASD (n; %)	TDC (n; %)	χ^2 Test Value	df	p-value
Child type						
ASD TDC	151; 33.9% 295; 66.1%					
Child gender						
Male Female	264; 59.2% 182; 40.8%	121; 80.1% 30; 19.9%	143; 48.5% 152; 51.5%	41.440	1	<0.001
Age group						
4–7 years 8–11 years 12–15 years	223; 50.0% 153; 34.3% 70; 15.7%	66; 43.7% 63; 41.7% 22; 14.6%	157; 53.2% 90; 30.5% 48; 16.3%	5.652	2	0.059
Family type						
Nuclear family Joint family	369; 82.7% 77; 17.3%	125; 82.8% 26; 17.2%	244; 82.7% 51; 17.3%	0.000	1	0.985
Monthly family income (BDT)						
Less than 15,000 15,000 to 30,000 More than 30,000	6; 1.3% 120; 26.9% 320; 71.7%	2; 1.3% 24; 15.9% 125; 82.8%	4; 1.4% 96; 32.5% 195; 66.1%	14.162	2	<0.001
Fathers' educational qualification						
Less than grade 5 Grade 5 to 10 Higher (grade 10+)	34; 7.6% 38; 8.5% 374; 83.9%	6; 4.0% 4; 2.6% 141; 93.4.0%	28; 9.5% 34; 11.5% 233; 79.0%	15.693	2	<0.001
Mothers' educational qualification						
Less than grade 5 Grade 5 to 10 Higher (grade 10+)	38; 8.5% 48; 10.8% 360; 80.7%	7; 4.6% 7; 4.6% 137; 90.7%	31; 10.5% 41; 13.9% 223; 75.6%	14.839	2	<0.001
Fathers' profession						
Service Business Others	297; 67.0% 137; 30.9% 9; 2.0%	95; 63.3% 49; 32.7% 6; 4.0%	1202; 68.9% 88; 30.0% 3; 1.0%	5.013	2	0.082
Mothers' profession						
Housewife Service Others	375; 84.5% 67; 15.1% 2; 0.5%	130; 86.1% 19; 12.6% 2; 1.3%	245; 83.6% 48; 16.4%	4.906	2	0.086
Total child						
One More than one	142; 31.8% 304; 68.2%	42; 27.8% 109; 72.2%	100; 33.9% 195; 66.1%	1.703	1	0.192

(*Continued*)

Table 1 (Continued).

Variables	Total (n; %)	Child Type		Statistics		
		ASD (n; %)	TDC (n; %)	χ^2 Test Value	df	p-value
Birth order of the child						
First	266; 59.6%	101; 66.9%	165; 55.9%	7.085	2	0.029
Second	143; 32.1%	36; 23.8%	107; 36.3%			
Third	37; 8.3%	14; 9.3%	23; 7.8%			
Had any child after ASD born						
Yes	63; 41.7%	63; 41.7%				
No	88; 58.3%	88; 58.3%				
Family history of ASD						
Yes	33; 21.9%	33; 21.9%				
No	118; 78.1%	118; 78.1%				
Use of sleeping pills						
Yes	44; 9.9%	43; 28.5%	1; 0.3%	88.928	1	<0.001
No	402; 90.1%	108; 71.5%	294; 99.7%			

pills scored higher on the CSHQ scale when compared to ASD (66.00 ± 0.00 vs 53.30 ± 9.69).

Discussion

Sufficient and adequate sleep is vital for maintaining cognitive and emotional development. Conversely, the presence of sleep disturbances is associated with serious physical and mental health consequences, further leading to deterioration of quality of life.[20–23] Such issues are particularly prominent among children suffering from developmental disorders. Although previous studies in developed countries have now conclusively shown that children with ASD are more vulnerable to sleep problems, studies in Bangladeshi children have never been pursued. Thus, the present study provides important information on this regarding the context of an LMIC where the awareness and diagnosis of ASD is still lagging.

Using the CSHQ score of 41 as the cutoff point,[18,19] we found that ASD children are more likely than TDC to present with sleep problems and their overall scores are also higher. It is possible that the perception of children's quality sleep in Bangladesh may differ from other countries, possibly because parents and children are more likely to sleep in the same room, or because parents are more likely to watch their children during their sleep as opposed to parental habits in developed economies.[24,25] Higher prevalence of sleep problems has been reported among

ASD (66% to 86%), when compared to either children with other neurodevelopmental disorders (13% to 86%) or TDC (9% to 50%).[6–8] The CHSQ scores reported here are relatively higher than those reported in India, the neighboring country of Bangladesh (ie, 48.1 [±7.6] vs 41.4 [±4.2]; p=0.001).[26] However, utilizing the same instrument, the present mean score of ASD was also higher than the CHSQ scores reported in China [47.69 ±9.28[27]], America [47.39±8.21[27], 48.83±9.68[28], 49.06 ±8.95[19]], Canada [42.09±3.53[29]], and Israel [50.74 ±1.13[30]]. However, in a study of ASD children in Oman, a similar or slightly higher CHSQ score emerged in ASD children [ie, 51.1±7.8[31]]. Interestingly, the frequency of use of pharmacological sleeping aids may serve as a better and more robust indicator of sleep problems in ASD.[32–35] In this context, 28.5% of the present ASD reported using sleeping pills, as opposed to only 0.3% of TDC.

The CHSQ collates a large variety of sleep problems and even when analyzing the various subsets separately, Bangladeshi ASD children consistently reported higher scores when compared to TDC in the majority of the sub-items.[36–39] Some of these sleep issues are potentially disruptive to family stability and can impose substantial stress that further compounds the perception of altered sleep. For example, parasomnias that co-occur in the setting of underlying bedtime resistance can add substantial
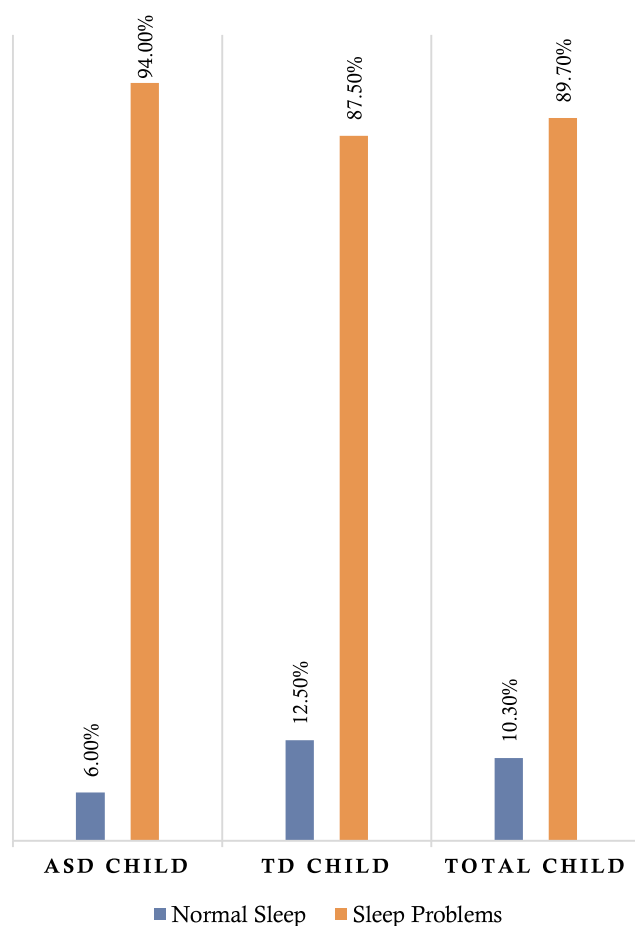
Figure 1 Distribution of problematic sleep across ASD and TDC children.

distress to families.[28,37] Similarly, the presence of sleep-disordered breathing may further exacerbate ASD children's stereotyped behaviors, social interaction problems and lead to increased assessments of overall level of ASD severity.[40] Conversely, improvements in sleep may lead to improvement in social communication, attention, and reductions in the frequency of repetitive behaviors in patients with ASD.

Some studies have reported that girls with ASD may exhibit reduced sleep duration[41,42]; however, this is not consistent with our present findings. Other demographic factors (for example, parental education levels) seemed to be unrelated to the presence of sleep problems in our cohort. It is possible, albeit still uncertain, that higher education may enable more intense levels of clinical care among ASD children and that such interventions may palliate and mitigate the frequency and severity of sleep problems in their children. As alluded above, children belonging to lower income families may be more likely to share bedrooms, have a television in the bedroom,[43] and live in a "noisy home environment",[44] all of which can foster or enhance poor sleep. Indeed, Bagley et al[45] suggested that sleeping environments are responsible for disruptive sleeping behaviors. Notwithstanding, we found no associations between socio-economic status and sleep disturbances, and previous studies in other countries did not examine this particular issue, such that comparisons are precluded.[41,46]

A few methodological limitations merit mention in relation to the present study. For example, information was based on subjective parental reports. Accordingly, use of more objective assessments of sleep as well as in-depth evaluation of ASD severity would be highly desirable.[31] Indeed, assessment of potential associations between ASD severity as well as the presence of other co-morbidities and the magnitude of CHSQ scores was not possible. Despite the aforementioned limitations, the present study provides initial observations on sleep problems in children with ASD in Bangladesh, which may help facilitate further studies, and lead to recommendations for changes in current (primary health care service to detect ASD) healthcare policies. For example, development and implementation of educational programs for

Table 2 Comparison on CSHQ Overall and Subscales Scores Across ASD and TD Children

Variables (Mean ± SD)	Total Child	Mean and SD Score Across Child Type			
		ASD Child	**TD Child**	**T value**	**p-value**
CSHQ overall	48.67 ± 7.56	50.90 ± 8.11	47.53 ± 7.01	20.669	<0.001
Bedtime resistance	11.70 ±2.76	11.79 ± 2.69	11.66 ± 2.80	0.223	0.630
Sleep onset delay	1.74± 0.89	1.76 ± 0.88	1.73 ± 0.90	0.132	0.716
Sleep duration	4.01 ± 1.41	4.23 ± 1.56	3.90 ±1.31	5.742	0.017
Sleep anxiety	6.71 ± 2.00	7.23 ± 2.05	6.45 ± 1.92	15.515	<0.001
Night waking	3.39 ± 1.69	3.82 ± 1.07	3.17 ± 1.89	15.158	<0.001
Parasomnias	8.19 ± 2.25	8.86 ± 2.06	7.85 ± 2.27	20.589	<0.001
Sleep disordered breathing	3.63 ± 2.40	4.02 ± 2.92	3.43 ± 2.07	6.111	0.014
Daytime sleepiness	13.17 ±3.86	13.24 ± 4.43	13.14 ±3.53	0.066	0.798

Table 3 Comparison of CSHQ Scores and Socio-Demographic Variables Between ASD and TD Children

Variables	Total Child		ASD Child		TD Child	
	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Child gender						
Male	48.73 ± 7.48	0.862	50.42 ± 7.99	0.147	47.29 ± 6.72	0.561
Female	48.60 ± 7.69		52.83 ± 8.42		47.76 ± 7.28	
Age group						
4–7 years	49.07 ± 6.78	0.065	50.81 ± 7.65	0.449	48.33 ± 6.25	0.056
8–11 years	48.99 ± 7.57		51.63 ± 8.32		47.14 ±6.43	
12–15 years	46.74 ± 9.49		49.09 ± 8.89		45.66 ± 9.66	
Family type						
Nuclear family	48.60 ± 7.50	0.659	50.95 ± 8.55	0.883	47.40 ± 6.61	0.476
Joint family	49.02 ± 7.88		50.69 ± 5.69		48.17 ± 872	
Monthly family income (BDT)						
Less than 15,000	48.00 ± 4.81	0.053	48.50 ± 3.53	0.300	47.75 ±5.85	0.573
15,000 to 30,000	47.26 ± 6.54		48.66 ± 7.71		46.91 ±6.21	
More than 30,000	49.22 ± 7.90		51.37 ± 8.20		47.84 ±7.40	
Fathers' educational qualification						
Less than grade 5	48.70 ± 7.29	0.932	54.50 ± 10.25	0.508	47.46 ± 6.03	0.878
Grade 5 to 10	48.23 ± 8.83		49.25 ± 8.46		48.11 ±8.98	
Higher	48.72 ± 7.47		50.80 ± 8.03		47.46 ± 6.82	
Mothers' educational qualification						
Less than grade 5	48.55 ± 7.39	0.873	51.42 ± 6.16	0.660	47.90 ±7.58	0.925
Grade 5 to 10	48.16 ± 8.88		53.57 ± 9.51		47.24 ±8.55	
Higher	48.76 ± 7.41		50.74 ±8.15		47.54 ± 6.64	
Fathers' profession						
Service	48.39 ± 7.28	0.327	50.48 ± 8.25	0.272	47.41 ±6.57	0.593
Business	49.04 ± 7.93		51.34 ±7.35		47.76 ± 7.99	
Others	51.77 ± 10.46		55.83 ± 10.75		43.66 ±0.57	
Mothers' profession						
Housewife	48.81 ± 7.53	0.727	50.96 ± 8.17	0.838	47.67 ±6.92	0.494
Service	48.04 ± 7.88		50.89 ±8.19		46.91 ±7.55	
Others	47.50 ± 4.94		47.50 ±4.94		-	
Total child						
One	48.95 ± 7.43	0.596	49.69 ± 7.83	0.254	48.65 ±7.27	0.051
More than one	48.54 ± 7.63		51.37 ±8.20		46.96 ±6.82	
Birth order of the child						
First	48.82 ± 7.70	0.608	50.75 ±8.53	0.866	47.64 ±6.92	0.904
Second	48.21 ± 7.28		50.91 ± 7.32		47.30 ±7.08	
Third	49.43 ± 7.69		52.00 ±7.34		47.86 ±7.62	

(*Continued*)

Table 3 (Continued).

Variables	Total Child		ASD Child		TD Child	
	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Had any child after ASD child						
Yes	51.50 ± 8.65	0.443	51.50 ±8.65	0.443		-
No	50.47 ± 7.72		50.47 ± 7.72			
Family history of autism						
Yes	52.75 ± 8.28	0.139	52.75 ± 8.28	0.1399		-
No	50.38 ± 8.02		50.38 ±8.02			
Use of sleeping pill						
Yes	53.59 ± 9.77	<0.001	53.30 ±9.69	0.022	66.00 ± 0.00	0.008
No	48.14 ± 7.09		49.95 ± 7.22		47.47 ±6.94	

ASD parents regarding lifestyle changes for their child (eg, bedtime routines) at the community level to alleviate sleep disturbances among ASD children and mitigate the impact of such disturbances on the whole household.

Conclusions

In summary, Bangladeshi children in general and those with ASD appear to be more likely to report sleep disturbances. Thus, early screening and diagnosis of such sleep problems and their potential underpinnings may enable interventions aimed at mitigating the adverse consequences of sleep disorders while contributing to increase the quality of life of the children and their families.

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Disclosure

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