Original Research Article

Assessment of sleep quality in school children of 6-12 years in COVID-19 pandemic

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ABSTRACT

Background: Sleep disorders in children are one of the common disorders and their frequency has increased during the COVID-19 pandemic. The study aims to assess the quality of sleep and study the parameters of sleep in school children aged 6-12 years in pandemic with the help of children's sleep habit questionnaire (CSHQ).
Methods: A survey-based study was conducted from December 2020 to March 2021 using the data obtained from CSHQ. The study involved 498 school children, among which 244 were male participants and 254 were female participants. It involved students from schools of Rahata and Mumbai, Maharashtra.
Results: The results of the study were withdrawn. Bedtime Resistance had mean value of 11.79±4.56, sleep onset delay had mean of 1.56±0.71. Average of sleep duration was 4.56±2.09. Sleep anxiety had mean of 7.48±3.1, night wakings had mean of 4.27±1.91. Mean of parasomnias was 10.1±4.46. Average of sleep disordered breathing was 4.09±1.86, for daytime sleepiness mean was 13.04±5.44 with significance of p<0.0001.
Conclusions: The study concluded that sleep time became lesser and bedtime became later in present scenario of COVID-19. The subscale items of CSHQ scale have increased values indicating towards altered sleep pattern. The total scoring of CSHQ for age group 6-9 years on average is higher than age group 10-12 years except "sleep onset delay" and "sleep duration". Also, the total scores of female participants are higher as compared to male participants.

Keywords: Sleep pattern, Sleep problems, Bedtime, School children, CSHQ, Sleep in COVID-19

INTRODUCTION

Good quality sleep is considered essential for good health and well-being. However, lifestyle and environmental factors are now-a-days causing increasing difficulties in sleep.[1] Sleep is natural periodic state of rest for mind and body with closed eyes characterized by partial or complete loss of consciousness. Unconscious state leads to reduced response of brain to the stimuli which in turn, decrease body movements.[2] Getting enough sleep has many benefits like reducing stress levels, mood improvements, better functioning at work place, schools and colleges, weight maintenance and improved health. It is understood that sleep plays an active role in re-normalization of changes that occurred during previous walking. Sleep is a complex phenomenon which is characterized by multiple processes. There are number of theories that suggest that sleep plays an active role in processes including synaptic plasticity, memory functions, metabolic functions, energy balance and metabolic waste.[3] Sleep duration and quality also affects overall behavior of the children and their parents in turn. Good sleep makes child less irritable and cranky, reduced mood swings and decreased attention demands from parents. Sleep occurs in repeating modes, in which the body alternates between two different modes: non-rapid eye movement (NREM) and rapid eye movement (REM). NREM is the phase which occurs first without eyeball movement and after a translational period is called

as slow wave sleep or deep sleep where the body temperature and heart rate falls and brain uses less energy. It occupies 70-80% of total sleeping duration. Dreams are absent in this phase. REM is known as paradoxical sleep, which is associated with fast brain waves and conjugate eye movements and is main occasion for dreams and nightmares. It occupies 20-30% of sleeping period. REM contributes for memory function.[2] The sleep cycle of alternate NREM and REM takes an average of 90 minutes occurring 4-6 times in a night sleep.[4] Circadian rhythm is body's internal sleep-wake cycle which repeats body processes every 24 hours.

Human sleep requirements vary by age and amongst individuals. Sleep is considered to be adequate when there is no daytime sleepiness nor dysfunction. For children, by the time an infant reaches age of 2 years, their brain size has reached 90% of an adult-sized brain. The hours that a child spend asleep influences his/her ability to perform on the cognitive tasks. It also influences language development and vocabulary. Hours of sleep required for neonates (0-3 months) is 14-17 hours, for infants (4-11 months) is 12-15 hours, toddlers (1-2 years) require 11-14 hours, pre-schoolers (3-4 years) require 10-13 hours, school-aged children (5-12 years) require 9-11 hours, for teenagers (13-17 years) is 8-10 hours.[5] Good sleep affects adults as well as children. Other than reducing behavioural problem in children due to loss of sleep, it results in increasing level of physical activity, increases creativity of child, improved concentration, better problem-solving skills, increase energy levels and helps increasing memory to remember things.[6] Traditionally, afternoon nap was considered very important because it re-energized the child and improved functioning for evening, but, now-a-days, the pattern of sleep cycle has changed due to online school and classes as travel duration is reduced, reducing tiredness. Also, long duration sleep is necessary for overall growth of child's physical, mental and cognitive development.

Childhood routine refer to the predictable and repetitive behaviour that occurs daily or weekly in home-environment. Hence bedtime routine is of utmost importance. Bedtime routine is defined as predictable activities that occur in the hour or so before child goes to sleep.[7] In India, the average duration of daily sleep including nocturnal and daytime nap was 10.32±1.18 hours and the percentage of children who took regular daytime nap was 28.2%. Co-sleeping, a traditional cultural practice in our country was in 93% of children.[8] Bedtime routine contributes to a series of positive developmental growth outcomes including improved sleep, inclusive of language development, literacy, child emotional and behavioural regulation, parent-child attachment and overall family functioning.[7]

In the current scenario of global pandemic, people are confined at their home. Schools and colleges are partially or fully resumed on virtual platform with the help of electronic gadgets and internet usage. The routine activity and sleep cycle have changed a lot during lockdown. Usage of electronic device has become a part of the schedule and the schools as well as classes are being conducted online. It also affects the sleep cycle.

Sleep is a behaviour that includes various aspects such as sleep duration, sleep latency, daytime sleep, etc. Psychological impact as well as physiological impact of compromised sleep is well known. It includes mental health issues, metabolic disorders and behavioural changes Sleep is also affected by sedentary activity involving screen time exposure.[9] An example of physiological impact of compromised sleep is respiratory dysfunction seen in many neuro-developmental disorders. Psychological disturbances include difficult and antisocial behaviour, conduct disorder and overactivity, emotional problem such as anxiety, depression. Effects of sleep deprivation on cognitive functions is seen as daytime sleepiness and impaired performance at school. Attention deficit hyperactivity disorder (ADHD) and other various behavioural problems are also associated with loss of sleep. The reason for this includes confrontation with parents, fear or embarrassment about their sleep disorder. Impairment of growth and failure to thrive are also seen due to reduced sleep.[10] Hence proper duration and good quality sleep is essential.

The objective of the present study is to assess the quality of sleep and to evaluate the sleep parameters in school children aged 6-12 years in COVID-19 pandemic.

METHODS

The study was conducted on online basis through google forms from the period of December 2020 to March 2021. It was descriptive, observational study. Form included the demographic detail on first page, consent form on 2nd page and the CSHQ scale on the 3rd page. Participants were children and their parents from schools around Rahata and Mumbai, Maharashtra. The consent form was provided in 3 languages (English, Hindi, and Marathi). After approval from ethical committee, 498 children were screened for assessing quality of sleep.

The CSHQ scale has reliability from 0.62 to 0.79, content validity. Sensitivity of scale is 0.80 and specificity is 0.72. Inclusion criteria for study was healthy and normal children, children willing to participate, school children aged from 6-12 years and both male and female children. Exclusion criteria included any previous diagnosed sleep disorders, any kind of diagnosed medical or psychological illness seen in children, autistic children and participants without smart phone.

The statistical analysis of the study was done by using Microsoft excel. Various statistical measures such as mean, standard deviation (SD) were used for analysing the data. The results are concluded to be highly significant with the p value <0.0001 for each subscale item of CSHQ scale.

RESULTS

The objective of the study was to assess the quality of sleep in school children aged 6-12 years in COVID-19 pandemic with the help of CSHQ. The duration of study was from December 2020 to March 2021.

A total of 498 participants were selected for the study considering the inclusion and exclusion criteria, who are agreeing to participate in the study. The gender ratio of male: female participants is 2.8:3.

The participation number for age of 6 year old is 72, for 7 year is 56, that of 8 year is 75, for 9 year 71, for 10 year 66, and for 11 and 12 year is 75 and 83 respectively.

Mean values of CSHQ subscales

Figure 2 shows mean and standard deviation values for individual subscale items of CSHQ (bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night waking, parasomnias, sleep disordered breathing, and daytime sleepiness). It also shows comparison between mean and standard deviation values for each subscale item. Inference of p value for each item is significant. Figure 3 shows mean values for two different age group including both the genders. Group one is of children within age of 6-9 years and other is age group of 10-12 year old school children. Individual value of each subscale item is given for both age groups. Figure 4 shows mean for each subscale item in males and females from 6-12 years respectively.
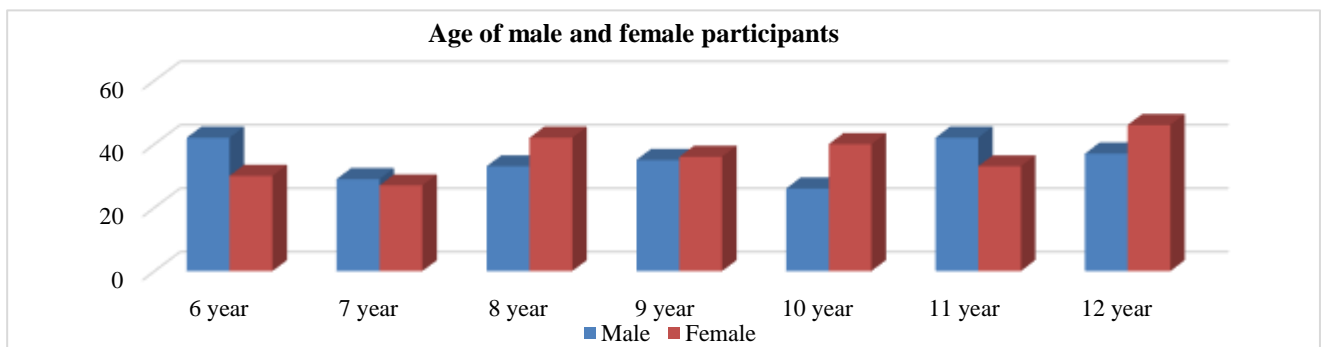

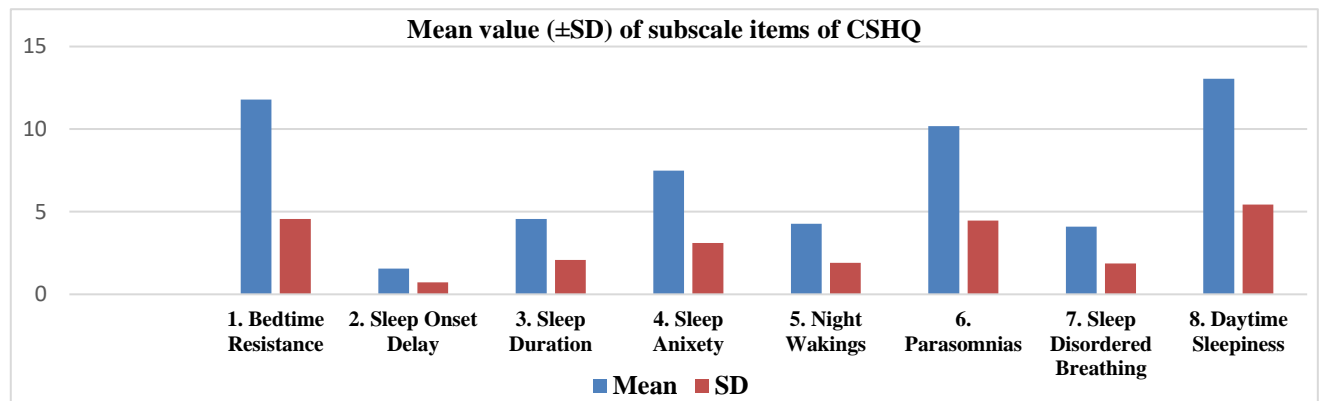**Figure 1: Participation of male and female in different age group.**

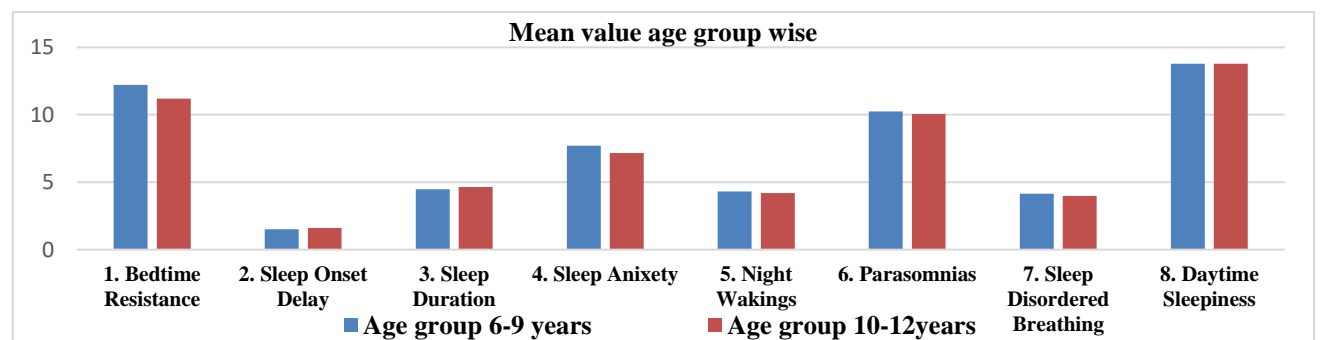**Figure 2: Mean value (±SD) of subscale items of CSH.**

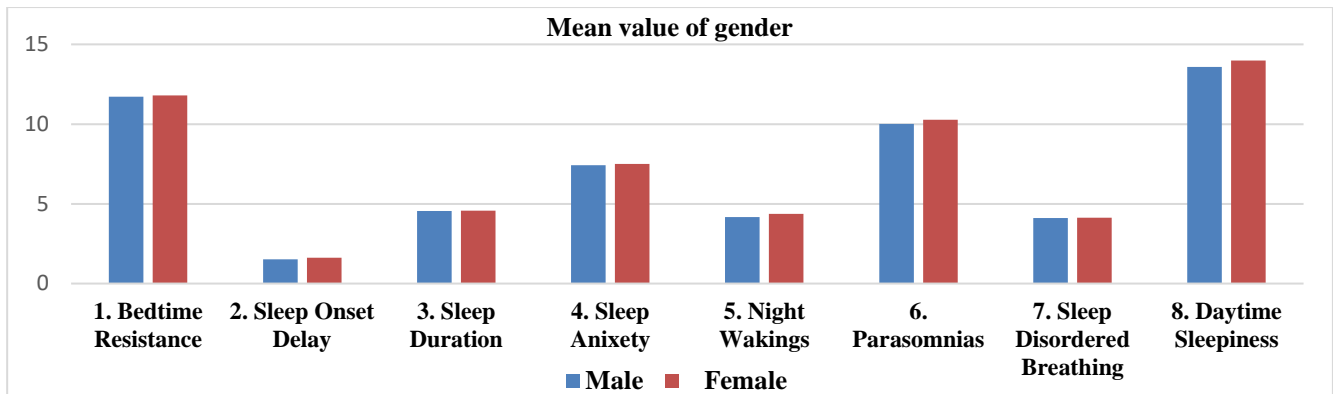**Figure 3: Mean value of age group 6-9 and 10-12 years.**

Figure 4: Mean value of male and female participants.

DISCUSSION

Sleep problems present in different manner in varying age group leading to significant dysfunction in multiple aspects of everyday functioning. Onset of sleep disorders could further complicate any underlying medical condition. Current evidence links disrupted sleep to problem in behavior, attention, memory, learning, etc. It has shown impact on child's overall growth, development and abilities to learn new things, thinking power, creativity.[11]

The present scenario of COVID-19 has taken a toll on the children's mental as well as physical health. Social distancing via school closure is one of the important measures taken globally to stop the spread of disease among kids. Eating and sleeping habits have also drastically changed in most of the households as an impact on children by this pandemic.[12] The sleeping pattern has also been altered as the school and classes are being terminated and conducted online for a limited period of time, which eventually has changed the whole routine cycle, with limited access to the outdoor activities and interaction with other children. All of these factors along with increased exposure to screen contribute towards unconstrained and disorganized sleep schedule.

Present studies on sleep quality in school children during pandemic show marked delay in sleep timing, poor quality of sleep and altered sleep pattern. The unhealthy sleeping pattern in school aged children is associated with increasing levels of stress and onset of anxiety, irritability which further accelerate increase in risk of onset of depression and fearfulness.[13] In pediatric age group it led to increasing fear levels, uncertainty, social isolation that is missing schools. The pandemic has created imbalance on normal school and daily routine.[14]

The present study aims to assess the quality of sleep and to study parameters of sleep in school children aged 6-12 years in COVID-19 pandemic. The CSHQ is used to assess sleep quality in this study. The CSHQ is a self-report questionnaire for parents about the sleep habits and sleep disorders of their children aged from 4 to 12 years. The present study includes school children aged from 6-12 years. The CSHQ is retrospective, 45-item questionnaire filled by parents of the children willing to participate. The scale has been grouped into following 8 sleep domains: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night wakings, parasomnias, sleep disordered breathing, and daytime sleepiness.[15]

The results of the study were withdrawn and it has shown that the sleep pattern of school children aged 6-12 years is altered. Data analysis of all the 8 subscale items was done. Total 512 participants were screened out of which 498 participants were included in the study. Ratio of male: female participants is 2.8:3. Mean age of male participants is 9.02±2.08 years and mean age of female participants is 9.22±1.98 years. The scale had few short-answer questions such as bedtime of child, wake time of child, if any night waking. According to the present study, mean bedtimes of children were approximately 23:00 hours. The mean value of child's usual amount of sleep in each day were found to be 8.75 hours (SD±1.11 hours). Comparing this value with previous studies, the value of total sleep has decreased.[16] Amongst the male participants, the mean value of amount of sleep in each day is 8.74 hours (SD±1.14 hours), in females, it is 8.77 hours (SD±1.09 hours). Hence, comparatively the amount of sleep in each day for females is more than male value. Number of minutes a night waking for child that usually lasts has mean value of approximately 4.89 minutes (SD±8.41 minutes). The mean of number of minutes of night waking for males is 4.16 (SD±7.85 minutes), mean for females of night waking is 5.59 (SD±8.87 minutes), indicating increased night waking for females. The average waking time in morning is 9:00 hours.

Bedtime resistance in children is observed in child by him/her calling out or leaving his/her room after bedtime.[17] Usage of smartphone application have increased in pandemic. These applications emit blue light which suppress brain's melatonin levels, which prepares the body for sleep, thus later bedtimes.[18] The average of bedtime resistance is 11.79±4.56. Comparing this value with previous study done by Narendhran et al, the value of bedtime resistance has increased in present scenario of

COVID-19.[19] Also, the normative value of bedtime resistance in other studies has lower values than current study.[20] Comparing the values among two different age group, it is decreased in older children. Age group 10-12 years have 11.1±4.56, age group 6-9 have 12.2±4.44. Gender difference in mean value (±SD) is of 0.07, with increased bedtime resistance in females.

The mean value of sleep onset delay is 1.56±0.71. Comparing current value with normative values before pandemic, it shows decline.[15] Studies have shown significant association between the frequency of use of touchscreen and sleep quantity that is reduced duration and longer sleep onset (time taken to fall asleep).[21] Physical activities like regular exercises induce early fatigue leading to earlier sleep timing and reduced sleep onset delay.[22] The mean vale for males is 1.52±0.69 and for females is 1.61±0.73, indicating increased delay for females. Age group mean for 6-9 years is 1.52±0.70 and 10-12 years is 1.61±0.73, showing that the children of 10-12 years go to bed more lately than 6-9 year old.

Adequate sleep duration is a topic that is rising gradually as it is discussed amongst pediatricians and concerned parents. Insufficient sleep duration affects mental well-being of the child. Influence of cultural, social and environmental factors is important to understand sleep pattern. Influence of media may create negative impact on sleep duration.[23] Average sleep duration in present study is 4.56±2.09. The mean of sleep duration in 6-9 year is 4.49±2.06, in 10-12 years is 4.64±2.09. Difference in mean value (±SD) among gender group is 0.01 more in females. Previous studies state that the normative values are decreased than current value.[19]

Sleep anxiety has mean of 7.48±3.1 in present study showing that these values have shown increase in comparison to normative values.[19] Mean in 6-9 years is 7.71±3.04, in 10-12 years is 7.16±3.1. In male participants, mean is 7.42±3.08 and in females, 7.51±3.11. Researches state that anxious children have more sleep problems, increased sleeping time and altered pattern of sleep. Also, sleep anxiety leads to incomplete sleep, fearful behavior, leading to night waking as well.[24]

Frequent night-waking is defined in the literature as the night-waking that occurs every other night or more. There is increasing evidence that the short sleep duration is associated with more behavioral difficulties in school-aged children, and several studies have also shown the similar results in pre-schoolers as well. It is one of the causes of shorter sleep and is indicative of less restorative sleep for the child. Night-waking reduces both the quantity as well as quality of sleep.[25] The average of night waking is 4.27±1.91. Comparing the gender value, the mean in females is 4.36±1.96, in males it is 4.16±1.84. The mean for age group 10-12 is 4.19±1.85, for age group 6-9 year is 4.32±1.94. This value shows incline in comparison to previous studies.[19]

Parasomnias are defined as abnormal and undesirable behaviors during sleep and are thought to be due to the sleep state instability. Some of them are benign, while some of them point to a possible underlying neurodegenerative process.[26] Parasomnias have average of 10.2±4.5. The mean for male participant is 10.0±4.35 and for females, it is 10.2±4.48. The average difference among the age groups is 0.2, more in 6-9 years old. The study done by Aathira et al have lower values for average of parasomnias as compared to current study.[27]

Sleep-disordered breathing (SDB) is defined as disruption of normal respiratory patterns and ventilation during sleep. It is implicated in several behavioral and physical health issues.[28] The mean value for SDB is 4.09±1.86. The average for age group 6-9 is 4.15±1.87, for 10-12 years age group it is 3.98±1.81. The gender difference in mean of SDB is 0.01 more in female participants. It shows incline in current values as compared to normative values.[19]

Excessive daytime sleepiness (EDS), is a common presenting symptom among children and adolescents, caused by a wide range of sleep disorders and other conditions, and it may impair health, development, and daily function.[29] Daytime sleepiness has average of 13.04±5.44 approximately. The mean for male participants is 13.5±5.76 and for female participants, it is 13.9±5.76. Age group 6-9 years have 13.79±5.79 and on other hand, 10-12 years have mean of 13.78±5.73. Comparative studies show increase in current value compared to values from previous researches.[19]

Limitation of study is that the CSHQ is a questionnaire-based scale which has to be filled out by parents to determine their child's sleep habits, behavior, and possible difficulties.

Hence, unless the parents are aware of these and/or any problems in their child's sleep, the results of the CSHQ may not be reliable. As a future challenge, it will be necessary to objectively evaluate sleep habits, behavior, subscale items and to co-relate with the surrounding environment because, in the present study, lockdown also plays major role, altering the sleep cycle. Many ill-literate parents and those without smartphone have not been included. Also, the study limits involvement of children with underlying medical condition.

CONCLUSION

The summary of the study concluded that sleep time became lesser and bedtime became later in present scenario of COVID-19. The subscale items of CSHQ scale have increased values indicating towards altered sleep pattern. The total scoring of CSHQ for age group 6-9 years on average is higher than age group of 10-12 years except for "sleep onset delay" and "sleep duration". Also, the total scores of female participants are higher as compared to male participants. These scores of CSHQ co-relate to development of sleep pattern and routine of sleep cycle.

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