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A Cross Sectional Study On Sedentary Behavioral Time In Children Aged 12-15 Years And Its Association With Sleep Duration

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Abstract

Introduction*: Sedentary behavior in children has been found to be a potential risk factor for metabolic health. Screen time sedentary behavior and non-screen sedentary behavior are two broad categories of sedentary activity. Excessive screen usage, especially during adolescence, has been associated with behavioral problems, depression, low self-esteem, increased aggression, poorer academic performance, more sleep problems, and obesity. This study investigates the relationship between sleep duration and sedentary time.*

Objectives*: To find out the sedentary behavioral time in children aged 12-15 years and to analyze the association between sedentary behavior and sleep duration.*

Methods*: A questionnaire based cross sectional study was conducted. A total of 300 children from urban and rural schools located in Thanjavur were selected. The questionnaire comprised of the sedentary time spent in various activities during weekdays and weekends and the average sleep time per day. The total sedentary time was compared with the average sleep duration in both the groups of our study. Pearson's correlation was used to correlate sedentary time and sleep duration.*

Results*: Children were spending an average time of 11.7 hours per day in sedentary behaviour with an average sleep duration of 7.9 hours per day. Negative correlation was found between sedentary time and sleep duration.*

Conclusion*: Higher sedentary behavioural time was associated with shorter sleep duration in children.*

Key words: *Sedentary behavior, Screen time, child, Sleep.*

INTRODUCTION:

According to Sedentary Behavior Research Network (SBRN), Sedentary behavior is defined as any waking behavior characterized by an energy expenditure less than or equal to 1.5 metabolic equivalents while in a sitting, reclining or lying posture [1]. Sedentary behavior has emerged as a potential risk factor for metabolic health in children [2]. Research shows that children and youth were spending an average time of 8.6 hours per day during waking hours being sedentary [3]. Sedentary behavior appears to have a negative impact on the average sleep duration in children leading to various sleep disorders. Sleep deprivation is associated with various physical and mental health problems in children [4].

Sedentary behavior can be broadly categorized as screen time sedentary (TV viewing, internet use, mobile/video gaming) and non-screen (travel, school work, leisure time) sedentary behavior. This categorization is essential since the impact on various aspects of health problems are quite variable in both the categories. In the last decade, with technological advancement, there is a dramatic increase in the usage of electronic gadgets among children. Excessive exposure to screens especially during adolescence has been associated with lower academic performance, increased sleep problems, obesity, behavioral problems, increased aggression, lower self- esteem and depression [5].American academy of paediatrics AAP recommends that children under the age of 18 months should not use screen media other than video conferencing, and that preschoolers should not watch more than an hour of high-quality programs each day. According to the AAP policy statement, older kids and teens should have regular restrictions on the number of hours and kinds of media they can use each day without sacrificing the recommended daily allowance of physical exercise (1 hour) and enough sleep (8 to 12 hours, depending on age)[6].

The purpose of this study was to examine the association of sedentary time with sleep duration.

METHODS

This cross sectional study was conducted at one urban and two rural schools randomly selected in Thanjavur district, Tamilnadu, India between January 2019 to June 2019. One hundred and fifty students from urban school and 150 students from rural schools were recruited after obtaining approval from the Institutional Ethical Committee. The children were not provided any incentives to participate in the study. Prior permission was obtained from the Head of each school. All participants provided assent and parents / guardian provided informed consent.

Data on socio-demographic characteristics, academic performances, socio-economic status, sedentary time and sleep duration was collected by questionnaires for both weekdays and weekends. Children who submitted questionnaires with incomplete data and those on long term medications which impair sleep or pre-existing sleep disorders were excluded. The domains of sedentary behaviour namely time spent in sitting for each of these meals – breakfast, lunch and dinner; travelling to and fro from school; travelling to other places; sitting at school; screen time activities; sitting while reading; sitting and talking; sitting while playing indoor games; sitting for hobbies and sitting while listening to music was enquired for both weekdays and weekends. The total sedentary behavioral time was calculated by summing up the duration of each domain during weekdays and weekends.

B G Prasad scale updated in 2019 was used to measure the socio-economic status in both urban and rural school children [7]. The academic performance of the children were graded with respect to the marks obtained during the examinations. The students obtaining marks ranging from 81 to 100 were graded as Grade A; those obtaining marks ranging from 61 to 80 were graded as Grade B and those obtaining marks ranging from 41 to 60 were graded as Grade C. The total sleep duration per day during weekdays and weekends was also measured. With reference to National Sleep Foundation guidelines [8], children were divided into three categories as: 1. 'short sleepers' (<8 hours), 2. 'normal sleepers' (8-10 hours) and 3. 'long sleepers' (>10 hours). All parameters and expressed data were compared between the groups.

STATISTICAL ANALYSIS

The data were entered in MS office excel 2010 and coded . The data were analyzed using Graph pad prism Version 5. The categorical data like sex, type of duration, grades were represented as frequency with proportions, n(%). The continuous data like height, age, and weight were represented as mean with SD. For number of siblings and number of family members, median with interquartile range were used for summary. The mean of height, weight and age between the groups (rural Vs urban) were compared using unpaired ‘t’ test. The frequencies of parameter in the groups were compared using Chi square test and Fisher’s exact test. Kruskal-Wallis test was used to compare the median of number of siblings and family members between the four groups. $p<0.05$ was considered statistically significant. Correlation between sedentary time and sleep duration was done using Pearson's correlation test. The strength of association between the variables was measured using R value. We found the R value to be -0. 337. Negative correlation was found between the study variables. Hence it was inferred that with increasing sedentary time, the duration of sleep decreases.

RESULTS

The flow of recruitment and selection of groups was shown in Figure 1. The baseline characteristics of the study population are discussed in the Table 1. The average total sedentary time in our study population was 11.7 hours per day (Figure 2). Comparison of frequency distribution of waking-up time and falling asleep time between the groups in the study population on weekdays was depicted in table 2. In our study, sitting at school was the highest sedentary behaviour during weekdays comprising an average of 5.6 hours per day. 30% of the study children exceeded the recommended screen time per day during weekends and 9% of the students exceeded the recommended screen time during weekdays (Table 3). Screen time was the highest sedentary behaviour during weekends comprising an average of 2.5 hours per day in our study population. The average sleep duration was 7.9 hours per day in our sample of Indian children which was below the recommended sleep duration of 8 to 10 hours per day (Figure 3). The average sedentary behavioral time was correlated with average sleep duration (Table 4).

DISCUSSION

Over the past few decades, children's everyday lives have undergone significant change, which has affected their wellbeing and increased the prevalence of a number of health issues. Children today spend more time engaging in sedentary behavior, including using electronic media, when left to their own devices.[9] Children of all ages particularly adolescents with greater media usage appear to be getting less sleep than needed to function optimally during the day [10]. There are multiple efforts in comparing sedentary behavioral time and sleep duration [11-20] and our results were in line with the results of previous studies. Olds et al., in their study have observed that adolescents spend an average of 5.75 hours per day in non screen sedentary time and 3.8 hours per day in screen sedentary time [11]. The average screen time sedentary time was 1.5 hours per day, while the average non-screen sedentary time was 10.2 hours. According to Coombs N et al., children and adolescents from lower socioeconomic backgrounds watch more TV, but they also spend less time sitting down and not watching TV during the holidays.[12] In the present study, children of lower socioeconomic class had an average sedentary time of 10.7 hours per day in comparison to children of higher socioeconomic class whose average sedentary time was 12.7 hours per day. Arundel et al. have stated that adolescents spend 57% of their after school time in sedentary behavior [13]. In our study, we observed that children spent 21% of their time per day in sitting at school and also 30% of their after school period in sedentary behavior. Sisson et al. found that 47% of the U.S. children were exceeding the recommended total screen time per day .i.e. > 2 hours per day [14]. In our study, 30% of the students exceeded the recommended screen time per day during weekends and 9% of the students exceeded the recommended screen time during weekdays. We also observed that more number of urban children (45%) exceeded the recommended screen time when compared to rural children. Chaput et al. found that going late to bed was associated with higher sedentary time in children [15] while Lakerveld et al. made a similar observation in adults [16]. Stefan et al. found that both short and long sleep duration in children were associated with increased screen time and total sedentary time [17]. In our study, average total sedentary time in children was higher and it was correlated negatively with their sleep duration and this was in accordance with that observed by Lakerveld et al. Moreover, Owens J et al. had suggested that increase in the total screen time in children affects not only the quantity of sleep but also its quality [18]. Chahal H et al. in their study among Canadian children found that the availability and night time use of electronic entertainment and communication devices was associated with shortend sleep duration and obesity. They recommended that limiting the availability of electronic devices in children's bedrooms and discouraging their night time use may be considered as a strategy to promote sleep and reduce childhood obesity[19]. Bulck J. et al. found that media usage was associated with sleep patterns in a negative way. They also suggested that structured activities like doing sports were less likely to displace sleep time, while unstructured activities like media usage were more likely to displace sleep time [20].

There were a few limitations in our study. All data in our study were self reported by the respondents and objective assessment of sedentary behavioral time and sleep duration were
done. Though the effect of sedentary behavior on the duration of sleep was studied, its effect on quality of sleep was not studied.

In future, larger prospective studies with objective assessment of sedentary behavior and sleep are needed to explain the causal pathways and to bring forth the adverse effects of sedentary behavior on overall health. There is a dire need to change the traditional school environment into new innovative flexible learning spaces so as to curtail the sedentary time at school.

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Conflicts of Interest: None stated.

Table 1: baseline characteristics of the study population.

S. No	Parameter	Overall (n=300)	Rural (n=150)	Urban (n=150)
1	Age in years	13.1 ± 0.8	12.75 ± 0.8	13.5 ± 0.6
2	Gender ratio (M:F)	181:119	93:57	87:63
3	Height in cm	142.4 ± 12.1	135.7 ± 9.1	149.1 ± 11

4	Weight in Kg	34.2 ± 9.2	28.4 ± 5.46	40.1 ± 8.4

Data are expressed as mean with SD except gender (proportions).

Table 2: comparison of frequency distribution of waking-up time and falling asleep time between the groups in the study population on weekdays:

S. No	Time	Overall (n=300)		Rural Boys (n=93)		Rural girls (n=57)		Urban Boys (n=87)		Urban girls (n=63)	
		n	%	n	%	N	%	n	%	N	%
	Waking up time										
1	4-4.30 am	0	0	0	0	0	0	0	0	0	0
2	5-5.30 am	21	7	4	4	2	3.5	13	15	2	3.2
3	6-6.30 am	197	65.7	52	56	36	63.2	61	70	48	76.2
4	7-7.30 am	82	27.3	37	40	19	33.3	13	15	13	20.6
5	8-8.30 am	0	0	0	0	0	0	0	0	0	0
	Falling asleep time										
6	7-7.30 pm	0	0	0	0	0	0	0	0	0	0
7	8-8.30 pm	1	0.3	0	0	1	1.8	0	0	0	0
8	9-9.30 pm	25	8.3	11	11.9	5	8.8	4	4.6	5	8
9	10-10.30 pm	166	55.4	46	49.4	31	54.4	55	63.2	34	54
10	>11 pm	108	36	36	38.7	20	35	28	32.2	24	38

Data are expressed as n (%).

Table 3: comparison of frequency distribution of screen time between the groups on weekends.

S. No	Duration of screen time in holiday	Overall (n=300)		Rural Boys (n=93)		Rural girls (n=57)		Urban Boys (n=87)		Urban girls (n=63)		p value (Statistical test)
		N	%	n	%	n	%	N	%	n	%	
1	Nil	69	23	45	48.4	23	40.4	1	1.1	0	0	<0.0001* Fisher's exact test
2	<1 hr	46	15.3	9	9.7	8	14	14	16.1	15	23.8	
3	1-2 hr	95	31.7	22	23.7	21	36.8	28	32.2	24	38.1	
4	2- 4 hr	33	11	3	3.2	1	1.8	14	16.1	15	23.8	
5	>4 hr	57	19	14	15.1	4	7	30	34.5	9	14.3	

Data are expressed as n (%). Fisher's exact test was used to compare the proportions between the groups.
* indicates $p<0.05$ and considered significant.

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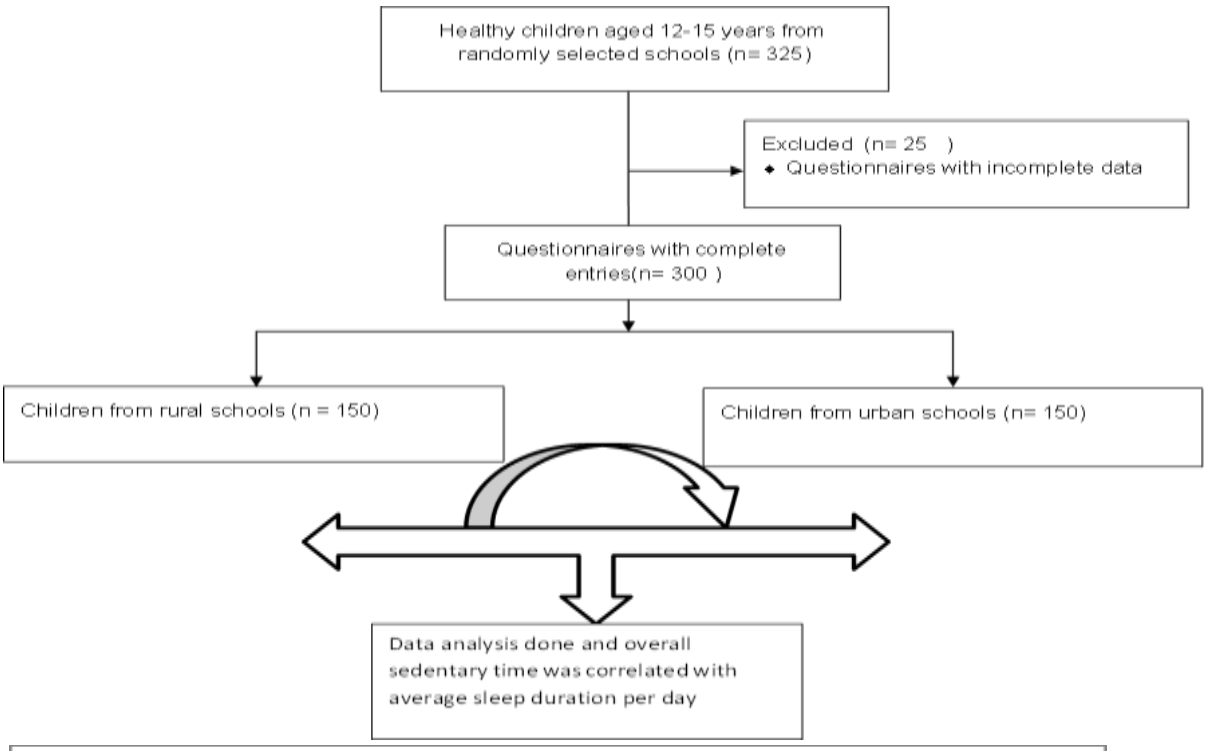
Figure 1: Study Flowchart



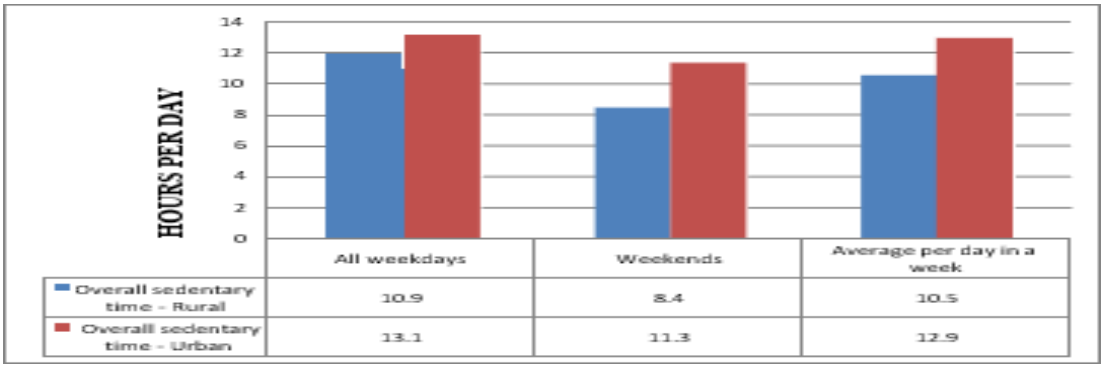


Figure 2: sedentary time of the children on different days in the study groups.

The vertical bar diagram shows the overall sedentary time in the study population during school days, holidays and average sedentary time per day in a week. Data are expressed as actual numbers (n) for different groups. The height of the bar diagram represents the total sedentary hours per day.

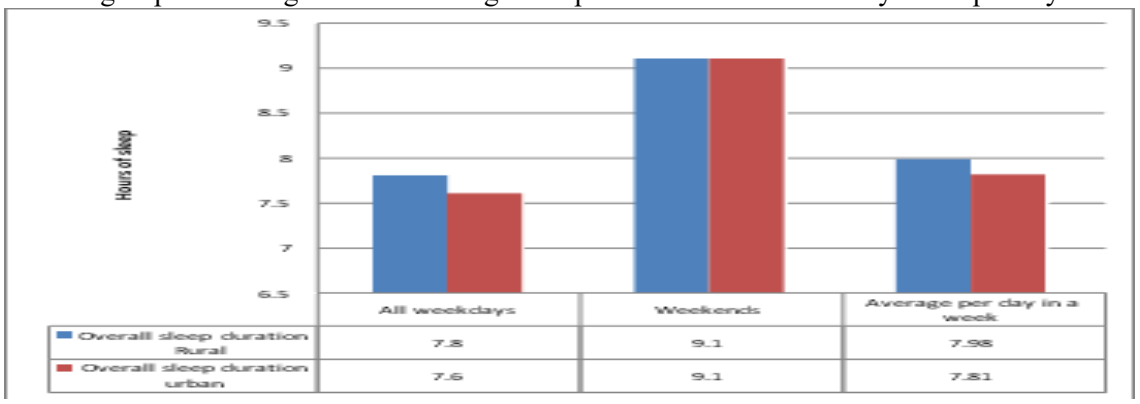


Figure 3: Sleep Duration Of The Children On Different Days In The Study Groups

The vertical bar diagram shows the overall sleep time in the study population during school days, holidays and average sleep time per day in a week. Data are expressed as actual numbers (n) for different groups. The height of the bar diagram represents the total duration of sleep per day.

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