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Relation of Sleep and Body Mass Index in school children of Pondicherry

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ABSTRACT

Recent studies in various populations indicate that lack of sleep is one of the potential risk factors predisposing the youth to obesity. A sound sleep is required for a sound wakefulness and learning. Sleep deprivation is associated with overweight and obesity. To see the relationship of sleep duration and Body Mass Index (BMI) in adolescents. A cross sectional study was undertaken in six randomly selected private higher secondary schools of urban Pondicherry. Total 1545 students participated in study. Self administered questionnaire contained the information regarding age, sex, height, weight, sleeping time, wake up time etc. Mean age of the participants was 15.9 years (SD ± 0.74) and mean sleep duration was 7.0 hours (SD ± 1.1). Nearly one fifth participants were found to be overweight and obese. BMI differed significantly between boys and girls ($p < 0.001$). Mean BMI was significantly different among three groups of sleep duration (Short Sleep, Medium Sleep, Long Sleep). There was a definite relationship between short sleep duration and obesity in the present study.

Key words: sleep, BMI, adolescent, obesity, overweight.

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INTRODUCTION

Despite the mounting evidence that adequate sleep is important for overall health, sleep curtailment is pervasive in modern society, and the average night sleep duration in adults has declined from 8.5 hours to <7 hours in last few decades [1]. A sound sleep is required for a sound wakefulness and learning. Mental and physical balance is required during this period specifically due to stress of competitive atmosphere of school education. Sleep in adolescence is of specific importance. Short sleep duration in adolescents has been attributed to delayed bedtimes coupled with fixed early rise times due to morning school schedules [2].

Delayed sleep is associated with psychosocial factors such as a growing sense of autonomy, opportunities for evening social interactions, homework given by school and after-school employment etc [3]. Various studies in different parts of the world indicate that short sleep duration attributes to overweight and obesity [4-9]. Only few studies were carried out in India to know the relation of BMI and sleep, present study was an attempt to see any relationship of sleep and Body Mass Index (BMI).

MATERIALS AND METHODS

A cross sectional study was undertaken during August-September 2008 among selected higher secondary school students of urban Pondicherry. After enlisting all the private higher secondary schools in Pondicherry city, six schools were selected randomly. Permissions prior to the study were obtained from the school authorities. From each selected school five sections were selected randomly for the study and all the students in these sections were included in sample.

Trained medical interns collected data under supervision. Self administered questionnaire was prepared and pretested. After making necessary corrections questionnaire was used for the study. Verbal consent was obtained prior to the administration of questionnaire. Information regarding age, sex, sleeping time, wake up time etc. were included. All the questions were explained properly to the students before study and queries by the students were resolved. Subjects were asked to give the information regarding sleep for most of the nights in last one month. Height and weight were measured by the trained interns. Height was measured barefooted on a height measuring scale nearest to 1 cm and weight was recorded from standard weighing machine nearest to 0.1 kg. BMI (in kg/m^2) was calculated by the standard formula [$\text{BMI} = \text{Weight in kg} / (\text{Height in meters})^2$]. Collected data were analyzed using SPSS 16.0 version software. Chi square test and Anova Test were used for statistical analysis wherever applicable. $p < 0.05$ was considered statistically significant.

RESULTS

Sleep duration in present study has been divided in three groups, Short Sleep Duration (SSD)-less than 8 hours, Medium Sleep Duration (MSD) - 8 to 9 hours and Long Sleep Duration (LSD)-9 hours or more. Total 1545 students participated but 1503 completed questionnaires

were analyzed. Mean age of the participants was 15.9 years (SD \pm 0.74) and mean sleep duration was 7.0 hours (SD \pm 1.1). Table 1 shows age and gender wise distribution of students. 46.8% boys and 52.1% girls were of age 16 years.

Overall 20.4% of the participants were overweight and obese. Among boys, 16.8% were overweight and obese while among girls, it was 23.7%. Overall difference in the BMI between boys and girls was highly significant ($p < 0.001$, Chi square value 37.78) (Table 2)

There was no significant difference in sleep duration between boys and girls in present study. (Table 3)

Mean Sleep duration reduced as the age increased both in boys as well as girls. Mean sleep duration among boys was 6.95 hours and among girls 6.97 hours. (Table 4)

Table 1: Age and gender wise distribution of students

Age (yr)	Boys (n-718) No. (%)	Girls (n-785) No. (%)	Total (n-1503) No. (%)
15	192 (26.7)	248 (31.6)	440 (29.3)
16	336 (46.8)	409 (52.1)	745 (49.6)
17	171 (23.8)	122 (15.5)	293 (19.5)
18	19 (2.6)	6 (0.8)	25 (1.7)

Figures in parenthesis are percentages

Table 2: Relationship between BMI and gender

BMI (kg/m ²)	Gender		Total (n-1503) No. (%)
	Boys(n-718) No. (%)	Girls(n-785) No. (%)	
<18.5	260 (36.3)	187 (23.8)	447 (29.8)
18.5-24.99	337 (46.9)	412 (52.5)	749 (49.8)
25.00-29.99	100 (13.9)	127 (16.2)	227 (15.1)
≥ 30	21 (2.9)	59 (7.5)	80 (5.3)

Significant difference, p value - 0.00

Table 3: Relationship between sleep duration and gender

Sleep duration (hr)	Gender		Total (n-1503) No. (%)
	Boys (n-718) No. (%)	Girls (n-785) No. (%)	
<8	526(73.3)	580(73.9)	1106(73.6)
8-8.9	160(22.3)	174(22.2)	334(22.2)
≥ 9	32(4.4)	31(3.9)	63(4.2)

No significant difference, p value- 0.89

Table 4: Relationship of age, gender and mean sleep duration

Age (yr)	Mean Sleep duration in Boys (hr)	Mean Sleep duration in Girls (hr)
15	7.3	7.3
16	7.1	6.9
17	6.9	6.6
18	6.5	7.1
Overall	6.95	6.97

Overall mean BMI was significantly different among three groups of sleep duration. Students in MSD group (8 - <9 hr) had the lowest mean BMI (20.9 kg/m²), while in SSD group (<8 hr) mean BMI was 21.7 kg/m² and in LSD group (≥9 hr) mean BMI was 21.3 kg/m². For 15 years of age, mean BMI was significantly different among three groups (f value 3.46, p value 0.03), while for the 16, 17 and 18 years of age it was not significantly different.

There was no significant difference of BMI among three groups of sleep duration in boys (f value 0.91, p value 0.40) while in girls, it was significant different. (f value 3.69, p value 0.03). Among girls mean BMI was 22.5 kg/m² in SSD and 22.0 kg/m² in LSD and lowest (21.3 kg/m²) in MSD.

DISCUSSION

The findings of the study are consistent with some previous studies [4-9] on sleep and obesity among children as well as adults. There was a relationship between short sleep duration and obesity in our study.

In present study, overall one fifth of adolescents were overweight and obese and further it was more in girls as compared to boys. According to NFHS-3 [10] Obesity is more in females as compared to males in India as well as in Tamilnadu. A study conducted by Mahajan P et al [11] revealed that female children from private schools and urban areas were at greater risk of being overweight and obese.

There was no difference in mean sleep duration between boys and girls, similar finding was observed in a study conducted by Kathorita RG et al [12]. In our study we found that MSD group was having lowest mean BMI while SSD and LSD groups were having higher mean BMIs. Similar results were observed in a chinese study by Yu [7]

A study by Shi et al [13] showed that the association between sleep and obesity was more in younger age group (below 12 years), although there was no significant association between age and sleep. In our study, for 15 years of age mean BMI significantly differed in three sleep duration groups while for 16,17 and 18 years of age there were no significant difference.

A South Indian study by Kuriyan [14] in the age group 6-16 years showed that children

who were having sleep less than 8.5 hours per day had significantly higher odds of overweight when compared to children who slept more than 8.5 hours.

In contrast to our study, gender difference was not observed in the study by Gupta et al [5], while in another study by Knutson [15] a significant association between short sleep duration and BMI was seen in male adolescents only.

Limitations of the Study

There are few limitations of this study. We are unable to adjust for puberty status, which is shown to be related to the risk of obesity [16]. Further, information on physical activity and diet is lacking.

CONCLUSION

Current study confirms that sleep duration is associated with overweight and obesity specially among girls and in younger age (15 year). In our study it was found that in addition to short sleep, long sleep duration (≥ 9 hr) is also related with overweight and obesity. Regardless of the cause and effect relationship, given the existing evidence, encouraging adequate sleep (sleep duration 8-9 hours) in childhood is important in the prevention of obesity.

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