



Original Research Article

## Sleeping Hours and Overweight/Obesity among High School Children of Mandya City, Karnataka, India

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### ABSTRACT

**Introduction:** The aetiology of obesity is multifactorial. Sleep duration is one of the modifiable risk factors that seems to be important in the regulation of body weight and metabolism.

**Aim:** To study the relationship between sleeping hours and childhood overweight/obesity.

**Methodology:** This was a cross sectional population based questionnaire based study conducted on high school children of Mandya city. English and local language Kannada version questionnaire was used to elicit the information. Anthropometric measurements of height, weight were taken using standard equipments. The statistical significance was evaluated at 95% confidence level ( $p < 0.05$ ).

**Results:** 4663 study subjects were included. The prevalence of overweight/obesity was 9.63%. The highest prevalence of overweight/obesity in boys and girls was found in children who slept for 6-8 hours (boys - 4.15%, girls - 7.76%). The difference in prevalence of overweight / obesity was not statistically significant with relation to number of sleeping hours.

**Key Words:** Sleeping hours, Children, overweight/obesity, High school.

### INTRODUCTION

Obesity has become a major contributor to the global burden of chronic disease and disability, affecting virtually all ages and socioeconomic groups. [1] Childhood obesity was previously considered a problem of affluent countries. Today the problem has even appeared in developing countries. [2] Once considered a high-income country problem, overweight and obesity are now on the rise in low and

middle-income countries, particularly in urban settings. [3]

The aetiology of obesity is multifactorial and involves complex interactions between genetic, environmental, cultural and social factors. [4] The risk factors of obesity can be classified into non modifiable (e.g., age, sex, ethnicity, family tendency etc) and modifiable (e.g., dietary factors, physical inactivity, psychosocial factor, sleep, breastfeeding etc). [5] Sleep duration is one of the modifiable risk factors

that seems to be important in the regulation of body weight and metabolism through several ways like increased sympathetic activity, increased cortisol levels, impaired glucose tolerance, modulation of key hormones such as leptin and ghrelin.<sup>[6,7]</sup>

To our knowledge, only a few studies have studied the relationship between short sleeping hours and childhood obesity in South India. Thus the present study aimed to study the relationship between sleeping hours and overweight/obesity in high school children of Mandya city.

## **MATERIALS AND METHODS**

This was a cross sectional, population based study conducted on high school children of Mandya city, Karnataka between June 2012 and May 2013. Study was initiated after obtaining approval from the Institutional Scientific Committee and the Institutional Ethics Committee of Mandya Institute of Medical Sciences, Mandya. Permission from Deputy Director Public Instruction (DDPI) and school head was also obtained. The purpose of the study was explained and oral consent was obtained from the participants before enrolling them in the study. All the high school children of Mandya city who gave consent for the study were included as study subjects (n = 4663)

**Questionnaire survey:** A pretested semi-structured questionnaire (English or local language Kannada version in which ever language the child is comfortable with) was given to children who gave consent to elicit the information. Sleep duration was categorized as follows: < 6 h, 6-8 h, 8-10 h and > 10 h.

### **Anthropometric measurements**

To calculate Body Mass Index (BMI), height and weight were taken using standard equipments (stadiometer, bathroom scale weighing machine respectively) following NHANES guidelines.<sup>[8]</sup> The

instruments used for the study were calibrated daily.

The height was measured with stadiometer. Subjects were made to stand barefoot on the flat surface with weight distributed evenly on both feet and heels together, and the head positioned so that the line of vision is perpendicular to the body (Frankfurt line).<sup>[8]</sup> The arms were hung freely by the sides, the head, back, buttocks, and heels in contact with the vertical board. The individual was asked to inhale deeply and maintain a fully erect position. The movable headboard was brought onto the topmost point on the head with sufficient pressure to compress the hair. The height was recorded to the nearest 0.1 cm.

The weight was measured in kilograms using standardized bathroom weighing machine with the subject standing erect on centre of the platform, with the body weight evenly distributed between both the feet with light clothing and looking straight. The same machine was used throughout the study and was calibrated every day before using it. The weight was recorded to the nearest 0.5 kg.

Two visits were made to each school to ensure complete coverage. Children who were not available in the school during two visits were excluded from the study. Health education regarding the risk factors for overweight/obesity and other non-communicable diseases and the preventive measures was given at the end of the examination to the children.

**Statistical analysis:** Data was entered into Microsoft excel sheet and analysed using SPSS version 21 software. Statistical tests like percentages, measures of central tendency, measures of dispersion and inferential statistical tests like chi-square test were used. The statistical significance was evaluated at 95% confidence level (p < 0.05).

## RESULTS

**Table 1: Descriptive characteristics of the study subjects**

Variable	Boys	Girls	Total
Age (years)	13.76 (± 1.069)	13.49 (± 0.976)	13.65 (± 1.028)
Height (cm)	97.79 (± 73.19)	118.22 (± 61.78)	109.13 (± 67.85)
Weight (kg)	40.95 (± 9.77)	42.23 (± 9.08)	41.66 (± 9.41)
BMI (kg/m <sup>2</sup> )	17.28 (± 3.52)	18.57 (± 3.90)	17.99 (± 3.79)
Overweight (%)	3.23	5.52	4.50
Obese 1 (%)	2.80	5.41	4.25
Obese 2 (%)	0.77	0.97	0.88

Values are mean (SD)

A total of 4663 children were included in the study with 2589 (55.52%) girls and 2074

(44.48%) boys. The descriptive characteristics of the study subjects are shown in table 1.

Among the 4663 study subjects, 210 (4.50%) were overweight, 198 (4.25%) and 41 (0.88%) belonged to obese 1 and obese 2 category respectively. The prevalence of overweight and obesity in girls was 143 (5.52%) and 165 (6.38%) respectively and among boys, 67 (3.23%) and 74(3.57%) were overweight and obese respectively. Table 2 shows the frequency of study subjects according to their BMI (weight/height<sup>2</sup>).

**Table 2: Sex wise distribution of study subjects according to BMI**

Sex	Underweight (< 18.5)	Normal (18.5 – 22.9)	Overweight (23 – 24.9)	Obesity 1 (25 – 24.9)	Obesity 2 (≥ 30)	Total
Girls	1443 (55.73)	838 (32.37)	143 (5.52)	140 (5.41)	25 (0.97)	2589
Boys	1488 (71.74)	445 (21.46)	67 (3.23)	58 (2.80)	16 (0.77)	2074
Total	2931 (62.86)	1283 (27.51)	210 (4.50)	198 (4.25)	41 (0.88)	4663

Figures in parenthesis indicate percentage

**Table 3: Distribution of overweight / obesity and gender with respect to number of sleeping hours**

Sleeping hours	< 6 hrs	6-8 hrs	8-10 hrs	>10 hrs
Boys (n = 2074)				
Number (%)	280 (13.5)	1215(58.6)	476 (23.0)	103 (5.0)
Overweight/obese (%)	20 (0.96)	86 (4.15)	29 (1.4)	6 (0.29)
p-value	0.866			
Girls (n = 2589)				
Number (%)	337 (7.2)	1570(33.7)	554 (11.9)	128 (2.7)
Overweight/obese (%)	41 (1.58)	201(7.76)	57 (2.20)	9 (0.35)
p-value	0.138			
Total (n = 4663)				
Number (%)	617 (13.2)	2785(59.7)	1030 (22.1)	231 (5.0)
Overweight/obese (%)	61(9.89)	287 (10.31)	86 (8.35)	15 (6.49)
p-value	0.109			

Figures in parenthesis indicate percentage

Table 3 presents the relationship between overweight/obesity and sleeping hours. The highest prevalence of overweight/obesity in boys and girls was found in children who slept for 6-8 hours (boys - 4.15%, girls - 7.76%). The difference in prevalence of overweight / obesity was not statistically significant with relation to number of sleeping hours both in boys and girls with  $p = 0.866$  and 0.138 respectively.

## DISCUSSION

Studies suggest that sleep duration is one among the important causes which regulate the body weight and metabolism by the modulation of key hormones such as leptin and ghrelin. [9,10] But in the present study, there was no statistical significance between prevalence of overweight/obesity and sleeping hours. This was in contrast with the study done by Kuriyan R which showed that children who slept less than 8.5

hours / day had significantly higher odds (6.7) of being overweight when compared to children who slept more than 9.5 hours/day. [9] A meta-analysis by Cappuccio FP reported odds of 1.89 for short duration of sleep and obesity. [11] Cross sectional and prospective epidemiological studies have also showed an increased risk of overweight/obesity in children and adolescents who were short sleepers. [12,13]

This finding may be because of the limitations like the timings reported by children as going to bed and rising rather than timing of sleep and waking. Errors in self-reportage would have contributed to the bias in estimating the relationship between sleep and high body mass. The relationship may be confounded by other factors like physical activity, diet intake, stress, psychiatric and somatic problems like sleep apnea in children etc which may lead to disturbances in sleep. Other factors like genetic tendencies, age, sex also play a role in childhood overweight/obese. Further studies are needed to be done to see the relationship between sleeping hours and overweight/obesity.

## CONCLUSION

In the present study, statistical significance was not found between sleeping hours and childhood overweight/obese. Further studies crossing the above limitations need to be done to assess the relationship between sleeping hours and childhood overweight/obese

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