ASSOCIATION BETWEEN SLEEP DURATION AND BODY MASS INDEX

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ABSTRACT

Background: *Sleep is one of the important and familiar parts of everyone's life. It is one of the three pillars along with nutrition and exercise.* **Objective:** *The purpose of the present study is to find the association if exists, between self-reported sleep duration with Body mass index.* **Methodology:** *This is an exploratory study done in New Delhi, India among 100 adults aged 20-40 years using opportunity sampling method. Data on socio-demographic profile, self-reported sleep duration, body mass index were gathered from 100 subjects.* **Results:** *A significant negative correlation (p=.002) was observed between body mass index and self reported sleep duration.* **Conclusion:** *The current study establishes an association between the less duration of sleep and body mass index, which predisposes an individual for risk of developing Non-communicable diseases.*

Key Words: *Sleep, Body mass index, Non-communicable diseases, Nutrition, Exercise*

INTRODUCTION

Sleep is a large, important and familiar part of everyone's life. Along with nutrition and exercise, it is one of the three pillars on which a healthy and happy life is based, and we spend about a third of our lives sleeping (Aminoff et al, 2011). The Oxford English Dictionary defines sleep as "a condition of body and mind which typically recurs for several hours every night, in which the nervous system is inactive, the eyes closed, the postural muscles relaxed, and consciousness practically suspended". According to Merriam-Webster sleep is "the natural periodic suspension of consciousness during which the powers of the body are restored".

According to Brinkman et al, 2018, sleep is an extremely complicated process which consists of more than simply closing one's eyelids and counting sheep. It is an active state of unconsciousness produced by the body where the brain is in a relative state of rest and is reactive primarily to internal stimulus. Insufficient sleep duration is recognized as an important unmet public health problem (Colten et al, 2006) and has been included as a national health priority in Healthy People 2020 (Office of Disease Prevention and Health Promotion, 2018). Many previous studies have associated habitual short sleep duration to important adverse cardio-metabolic outcomes, including weight gain, obesity, diabetes, cardiovascular disease, and stress.

According to National Health Portal of India (2018), inadequate or unsatisfactory sleep is becoming a serious health issue of the modern living. The rush to meet the targets in the work, nuclear family, urban life style, frequent travel to different time zone, shift work, long distance of journey between home and work place are all contributing havoc to the health and becoming a slow killer. Sleep is one of the basic necessities for a healthy living. Good and adequate sleep improves the quality of life. Sleep helps the brain to work properly, improve memory and provide longevity. According to National Heart, Lung and Blood Institute the ability to function and feel well while one is awake depends on whether he is getting an adequate amount of sleep. It also depends on whether one is sleeping at a time when the body demands to sleep. While sleeping, the brain is preparing for the next day by forming new pathways to help learning and remembering information. According to National Health Portal of India (2018), premature ageing, diabetes, anxiety disorders are also some other problems associated with less sleep. Studies shows that people who get less than six hours a night sleep develop higher blood levels of inflammatory proteins than those who get more sleep.

The prevalence of obesity is increasing rapidly worldwide, which is cause for concern because obesity increases the risk of cardiovascular disease and diabetes, reduces life expectancy, and impairs quality of life. A better understanding of the risk factors for obesity is, therefore, a critical global health concern (Chokroverty, 2010).

Shorter sleep duration is associated with increased BMI. Several studies have linked insufficient

sleep and weight gain. For example, studies have shown that people who habitually sleep less than six hours per night are much more likely to have a higher than average body mass index (BMI) and that people who sleep eight hours have the lowest BMI (Kristen et al, 2012). Sleep is now being seen as a potential risk factor for obesity along with the two most commonly identified risk factors: lack of exercise and overeating (Alvarez, 2004).

During sleep, our bodies secrete hormones that help to control appetite, energy metabolism, and glucose processing. Obtaining too little sleep upsets the balance of these and other hormones.

As shown in figure1, insufficient sleep is also associated with lower levels of leptin, a hormone that alerts the brain that it has enough food, as well as higher levels of ghrelin, a biochemical that stimulates appetite (Patel et al, 2012). As a result, poor sleep may result in food cravings even after we have eaten an adequate number of calories. We may also be more likely to eat foods such as sweets that satisfy the cravings for a quick energy boost. In addition, insufficient sleep may leave us too tired to burn off these extra calories with exercise (Taheri et al, 2007).

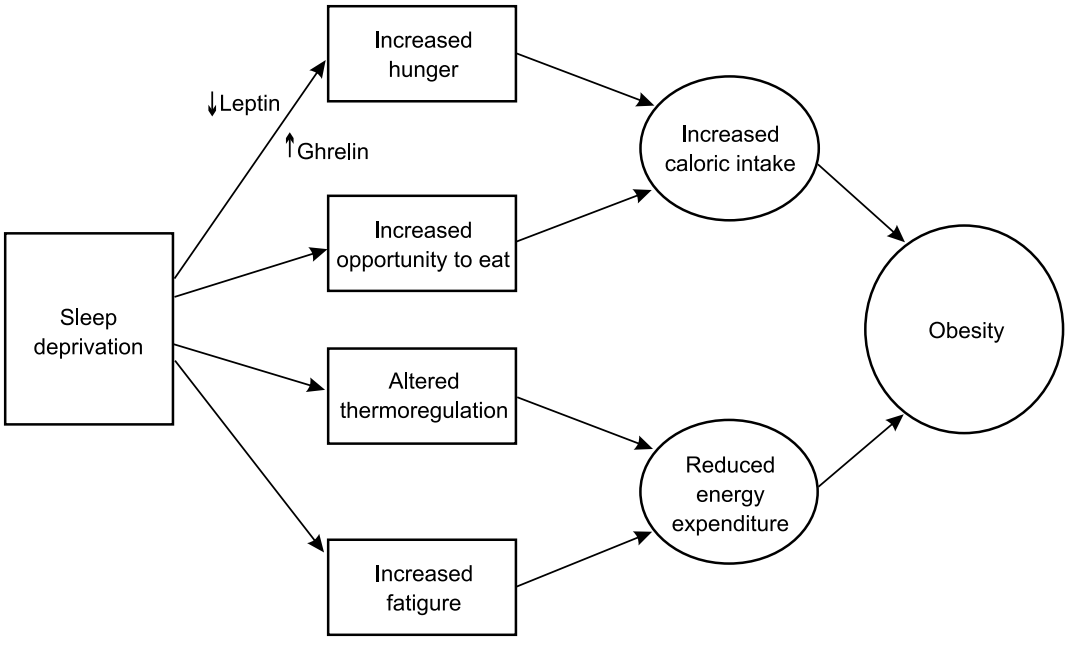

Figure 1: Potential mechanisms by which sleep deprivation may predispose to obesity

Anthropometry encompasses the physical non-invasive measurement of an individual's body relative size and contours as well as the interpretation of these measurements including inferences of composition. In clinical practices, individual reference values is used to monitor nutritional status changes over the time, assess effectiveness of the treatment in the course of disease and evaluate overall health status. Anthropometric measurements have several advantages which make them useful for nutritional assessment (Jelliffe, 1966).

Anthropometric variables particularly weight and height, are the most commonly employed measures for nutritional status and epidemiological studies due to their simplicity and ease of collection. Anthropometry is dependent on the skills of the operator and there is often considerable inter observable in variability. A major disadvantage is that these measurements are relatively insensitive and cannot detect disturbances in the nutritional status over short periods or identify specific nutrient deficiencies (Willett et al, 2013).

Weight is the most widely used parameter for assessment of nutritional status of persons. It is the simplest and the most common fundamental measurements for assessing growth and nutritional status. It indicates body mass and is composite of body constituents like protein fat water and minerals (Grandner et al, 2013).

METHODOLOGY

This cross-sectional study was carried out in urban areas of New Delhi region. Ethical approval was obtained from the Institutional Ethics Committee of Institute of Home Economics, University of Delhi, India. Details of the study procedures were given on the volunteer's information sheet. The benefits, confidentiality, and voluntary participation features of the study were explained and written informed consent was obtained from all the subjects. Adults who were willing to participate, aged between 20-40 years were considered as inclusion criteria, whereas Pregnant and lactating Mothers, adults with confirmed NCDs, and physical challenges were considered as exclusion criteria.

The subjects were in the age group of 20-40 years, both males and females. Sample Size of minimum of 100 adults (50 males and 50 females) aged 20-40 years were selected. Opportunity sampling method was used in the study. The sociodemographic information was collected with the help of a questionnaire.

The height of an individual is principally a measure of skeleton body tissue. Wall mounted stadiometer was used for taking the height. The stadiometer had a sensitivity of 0.1cm. The subjects were made to stand on flat surface, without shoes. The head was position so that the Frankfurt plane is horizontal, feet together, knees straight, heels, buttocks and shoulder blades in contact with the vertical surface of wall and arms hanging at the site owner relaxed manner. The movable horizontal bar was lowered gently till it touched the crown of the head. Accuracy of the tape in the stadiometer was tested against a standard steel tape. Accuracy of the unwinding of the tape was checked by checking whether the zero and 200cm marks lie against red line on the windows when the tape is fully wound and fully unwound. Tanita was used to measure weight of the participants. Standardization of the instrument were done every week to minimise intra

investigation error. Minimal clothing was asked before standing on the machine. Accessories like watch, purse, violet, mobile phone etc were asked to remove. BMI was calculated using the metric formula (weight in Kgs/height in meters2). The information obtained from the participants was consolidated and analysed using suitable statistical formula and tests. Data was entered and analysed using SPSS version 22. Correlation test was applied. P value <0.05 is considered as the degree significant association.

RESULTS AND DISCUSSION

An attempt was made to analyze the association between sleep duration and body mass index and was found short sleep was associated with elevated BMI.

The selected sample (N=100) was in the age group of 20-40 years. Of the total number of subjects, 49% were between 20-25 years of age, 22% were between 25-30 years of age,16% were between 31-35 years of age and 26% were between 35-40 years of age. In the study 56% and 72% of males and females were single whereas 44% and 28% of males and females were married respectively. As expected now a day almost 71% belonged to nuclear family and 29% belonged to joint families. In the study majority of subjects belonged to student category (29%) followed by private job (27%), government job (26%), homemaker (10%), self-employed (7%) and only 2% were found to be involved in business.

Table 1: Self-reported sleeping pattern of one week of the samples

Self-reported sleeping duration	Males (n=50)	Female (n=50)	Total (n=100)
<7 hours	39 (78)	42 (84)	81 (81%)
7-9 hours	10 (20)	8 (16)	18 (18%)
>9 hours	1 (2)	0	1 (1%)

It was observed in the present study that 80% of the subjects (78% males and 82% females) were sleeping less than 7 hours, and only 19% of the total sample were sleeping 7-9 hours as recommended by The National Sleep Foundation (NSF),2018.

During this phase information of sleep pattern and sleep quality of the subjects was collected for one week continuously. This phase included analysis of sleeping pattern and sleep quality. A short likelihood scale was designed to assess self-reported quality of sleep.

According to sleep statistics collected by Fitbit between January to December 2016, India falls in the bracket of countries with the worst sleeping habits in the world; clocking in an average of 6.55 hours a night. In the present study that 80% of the subjects (78% males and 82% females) were sleeping less than 7 hours, and only 19% of the total sample were sleeping 7-9 hours as recommended by NSF, 2018.

Table 2: Self-reported sleep quality of one week of the samples

Self-reported sleep quality	Males (n=50)	Female (n=50)	Total (n=100)
Sound	28 (56)	28 (56)	56
Disturb	22 (44)	22 (44)	44

Height

It was observed in the data that the mean height of the male subjects (169+8.5) was more as compared to that of females (155.5+6.3). In the present study most of the females belonged to the 150 to <160cm height group; whereas males belonged to 170 to <180 cm height as shown in Graph 3.

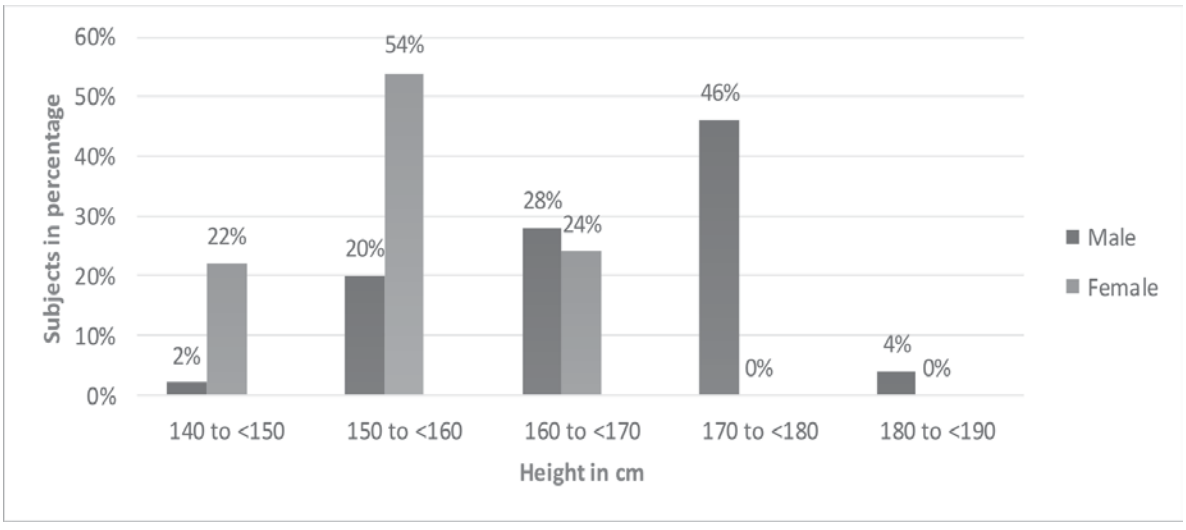

Figure 2: Percentage distribution of subjects according to height

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Weight

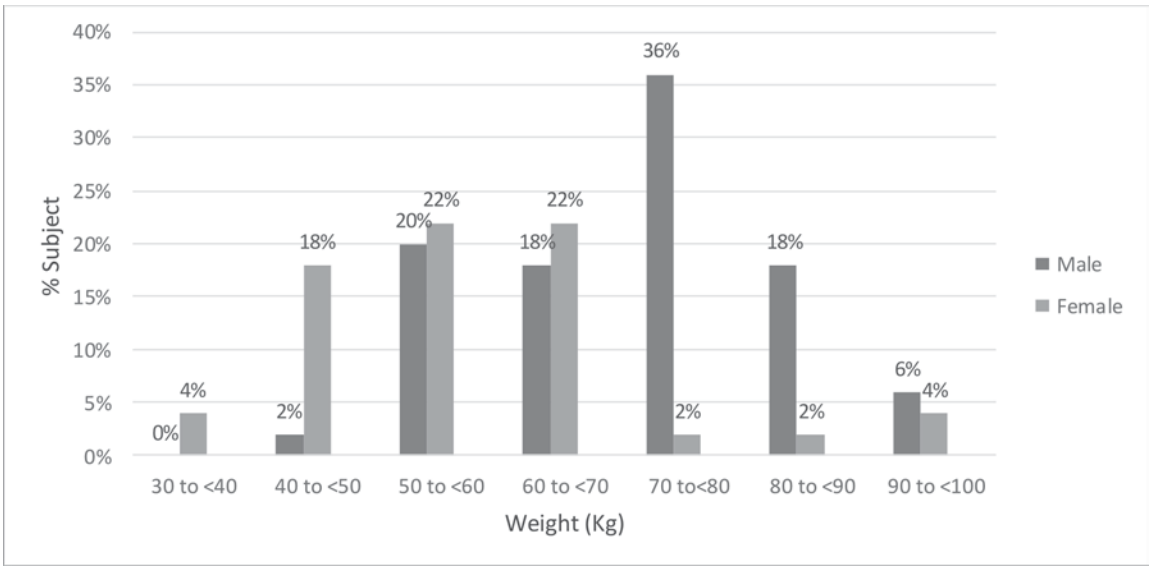

Figure 3: Percentage distribution of subjects according to weight

Taking weight into consideration mean weight of male subjects (72.6 +11.34) was found to be more than females (61.72+13.93) ranging from 49.2-97 kg and 34-95 kg respectively.

The subjects were categorised into obese, overfat, normal and underfat according to the classification given WHO, 2017.

BMI and Sleep

Body Mass Index (BMI) is a standard height to weight ratio useful for classifying risks associated with weight gain. The BMI ranges are based on the effect excessive body fat has on disease and death and are reasonably well related to adiposity. BMI was developed as a risk indicator of disease; as BMI increases, so does the risk for some diseases. According to WHO, 2017 some common conditions related to overweight and obesity include: premature death, cardiovascular diseases, high blood pressure, osteoarthritis, some cancers and diabetes.

Subjects were classified as underweight, normal, overweight, and obese as per the category according to Asian classification (Misra, 2009) for BMI. The mean BMI of the entire sample was 25.42 $\pm$ 4.37 ranging from 14.6-35.5. Taking gender into consideration for mean BMI of males (25.45+3.57) and females (25.3+5.1) no such difference was observed. Overall, 28% of the 100 subjects had a normal nutritional status, 3% were underweight, 19% overweight, and 50% obese. The prevalence of underweight was low (3%) and that of overweight and obesity was more common

in males (24% and 54% respectively) than in females (14% and 46% respectively). Hence, it can be concluded from table 3, that problems of both overweight and obesity exist among the sample.

Table 3: BMI categorisation of subjects as per their sleep duration

	Underweight <18kg/m²	**Normal 18-22.9kg/m²**	**Overweight 23.0-24.9kg/m²**	**Obese ≥25kg/ m²**	**Total**
<7hours	2	18	15	46	81
7-9 hours	1	10	3	4	18
>9 hours	0	0	1	0	1

A significant negative correlation ($p < 0.05$) was observed between BMI and self reported sleep duration. Which means with decrease in sleep duration, risk of high BMI increases. Another study has also shown sleep duration was positively associated with BMI, overweight, and obesity as well (Taheri et al, 2007).

CONCLUSION

Studies are required to examine the effect of regular short sleeping hours on appetite, food intake, and obesity. These studies could help to answer the question of whether the increase in BMI leading to overweight/obesity in our societies could be partly due to the fact that people are having less or disturbed less. And it seems well worth testing whether having sufficient and undisturbed sleep could help to maintain BMI.

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