

Original Research Article

A study of sleep duration, body mass index and blood pressure in an adult Kashmiri population

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ABSTRACT

Background: Sleep is influenced by the circadian rhythms (regular body changes in mental and physical characteristics that occur in the course of about 24 hours). Lack of a good night's sleep results in a variety of negative health and cognitive issues, which makes it critical to study the prevalence of sleep deficiency and its effects on an individual's physical and mental health. Aim of study was to access the association of sleep duration with body mass index and blood pressure in an adult Kashmiri population.

Methods: The present study was done in the Postgraduate Department of Physiology, Government Medical College and Associated Hospitals, Srinagar. This study was done on 500 subjects and it was an observational, cross sectional study.

Results: The prevalence of overweight/obese among short sleepers was quite high at 34.4% as compared to 11.7% and 15.2% among normal sleepers and long sleepers respectively. Among short sleepers 0% participants were hypotensive 47.5% were normotensive, 52.4% were prehypertensive/hypertensive.

Conclusions: In conclusion, this study showed a statistically significant increase in the prevalence of elevated blood pressure and overweight/obese subjects among short sleepers. There was an inverse relationship of prevalence of overweight/obesity and elevated blood pressure with short sleep duration. Our study also showed a statistically significant increase in the percentage of prehypertension/hypertension among overweight/obese people with a p value of <0.001 and CHI square of 43.964.

Keywords: Blood Pressure, Body mass index, Hypertension, Obesity, Sleep duration

INTRODUCTION

Sleep is defined as “a reversible state of perceptual disengagement and unresponsiveness to the environment, usually accompanied by quiescence and recumbency” (Bloch 1997).¹ Sleep is influenced by the circadian rhythms (regular body changes in mental and physical characteristics that occur in the course of about 24 hours). These are controlled by brain neurons that respond to light, temperature, hormones and other signals that

comprise the body's biological clock. This clock helps regulate the “normal” awake and sleep cycles.

There are many factors, both internal and external, that can influence the quantity and quality of the sleep we obtain.²⁻⁴ The major factors influencing sleep are: light, jet lag, shift work, pain, anxiety, and other medical conditions, medications and other substances, sleep, environment, genetic factors. During sleep, most of the body's systems are in an anabolic state, helping to restore the immune, nervous, skeletal, and muscular

systems. These are vital processes that maintain mood, memory, and cognitive performance, and play a large role in the function of the endocrine and immune systems.⁵

A number of causal pathways linking reduced sleep with obesity have been posited based on experimental studies of sleep deprivation. Chronic partial sleep deprivation causes feelings of fatigue which may lead to reduced physical activity.^{6,7} Sleep deprivation may also have neuro-hormonal effects that increase caloric intake.¹ Epidemiological and experimental evidence shows that sleep debt both increases appetite and enhances actual food intake. The association between insufficient sleep and higher body mass index is also driven by changes in satiety and hunger hormones.⁸

There is growing evidence that short sleep duration is a significant etiological factor for hypertension. Acute sleep restriction has been shown to increase blood pressure and sympathetic nervous system activity. Over time, the increased hemodynamic load from short sleep duration can lead to hypertrophic remodeling and the elevation of the cardiovascular pressure equilibrium.⁹ High blood pressure is a risk factor for ischemic heart disease syndromes and cerebrovascular disease, the main causes of more than 7 million deaths in the world each year.¹⁰ Improvement of eating habits has been considered for prevention and control of high blood pressure, and lately, many studies on the connection between sleeping hours and high blood pressure have been conducted. Several foreign studies reported that short sleeping hours can be a risk factor for high blood pressure.¹¹

In the present study, we examined the relationship of self-reported usual sleep duration with measured BMI and blood pressure values in an adult Kashmiri population. Aim of present study was to assess the association of sleep duration with BMI and blood pressure in an adult Kashmiri population.

METHODS

Study design

This was an observational, cross-sectional study. The present study was done in the Postgraduate Department of Physiology, Government Medical College, Srinagar. The study was approved by the Institutional Ethical Committee, Government Medical College and Associated hospitals Srinagar.

Study period

The study was conducted over a period of seven months from June 2021 to December 2021.

Study area

The study was conducted in the OPD of Medicine department in Government medical college Srinagar.

Study participants

The study population comprised of all the patients in the age group of 18-30 years, attended medical OPD, directly or those referred from other specialties within the hospital.

Sampling technique

Sampling was done using the convenience method of sampling. 500 subjects were recruited during the study period of 7 months from June 2021 to December 2021 with an average of 18 subjects per week, with a target of three subjects a day, after fulfilling the inclusion and exclusion criteria.

Inclusion criteria

All apparently healthy adults attending OPD, who consented for study were included.

Exclusion criteria

Known sleep disorders, medicines that might affect sleep, mild or severe insomnia, mood disorders, unstable cardiopulmonary disease, airway cancers. Pregnancy, chronic conditions or diseases (hypertension/ diabetes/ coronary heart disease/cancer/kidney disease/stroke/MI), hyperthyroidism and hypothyroidism alcohol intake. Subjects who did not give consent to the study were excluded.

Data collection/procedure

Detailed informed consent was taken from subjects and relevant information regarding name, age, gender, marital status, education, sleeping habits and medical history were collected on a structured proforma.

Tools used

Structured questionnaire, sphygmomanometer, stadiometer, calibrated weighing scale (SALTER) were used.

Sleep

The participants answered structured questionnaire (taken from various studies) with detailed information on sleep habits. In the present study, sleep duration was defined as time in bed (calculated from onset of Sleep and rise time). Sleep durations during the weekdays and during weekends were analyzed separately and the mean was taken as habitual sleep duration. Habitual sleep duration was coded as short sleep (<6 hrs/Night), long sleep (>8 hrs/night), with reference to 6-8 hours sleep as healthy sleep.

Blood pressure

Blood pressure was measured with the subject seated comfortably (after 5 minutes of rest). Three blood pressure measurements were made at least 5 minutes apart. The mean of the three

Blood pressure measurements were taken as the subjects BP. Use of antihypertensive medications was obtained. A measuring sphygmomanometer recording systolic (SBP) and diastolic (DBP) Blood pressure to the nearest 2 mmHg was used. The blood pressure classification was based on JNC 7 guidelines.

Hypertensive's were defined as those with systolic BP greater or equal to 140 mm/Hg and/or diastolic BP greater or equal to 90 mm/Hg and/or on antihypertensive measurements.

BMI

BMI, a well-established measure of obesity was calculated as weight in kilograms divided by the square of height in meters. BMI was categorized according to the WHO criteria (13) into underweight (BMI<18.5), normal weight (18.5≤BMI<25), overweight (25≤BMI<30) and obese (BMI≥30) to assess clinically applicable cut points. Height was measured (to two decimal places) using standard height meters with the participant standing upright with no shoes and headgear and the weight was measured using a calibrated weighing scale (SALTER) with the participant lightly clothed and without shoes.

Statistical analysis

Descriptive statistics and Chi-square were used and statistical analysis was done on SPSS software.

RESULTS

The study was done on young adults with age ranging from 18 yrs to 25 yrs. Majority participants were in the age range of 20-21 years-38.4% and 22-23 yrs - 28.1%. The mean age was 21.3 yrs. Among the participants there was variation in the duration of sleep.160 (32%) participants were short sleepers with a sleep duration <6 hours. 274 (54.8%) participants were normal sleepers with sleep duration of 6-8 hours, 66 (13.2%) participants were long sleepers with sleep duration > 8 hours.

The weight of participants was determined by body mass index (BMI). Out of total 500 participants, 43 (8.6%) were underweight with a BMI of < 18.5, 360 (72%) were normal weight with BMI of 18.5-24.9, 87 (17.4%) were overweight with a BMI of 25-29.9 and 10 (2%) of participants were obese with a BMI of >30. Most of the participants- 279 (55.8%) were normotensive (BP 90/60 - 120/80), however 191 (38.2%) participants were having prehypertension (BP >120/80 <139/89) and 26 (5.2%) participants were having hypertension (BP >140/90). 26

(5.2%) participants were hypertensive (BP<90/60). Correlation between sleep duration and BMI demonstrated that-4.4% of short sleepers were underweight, 61.3% were normal weight and 34.4% were overweight/obese. Among normal sleepers 10.6% were underweight, 77.6% were normal weight and 11.7% were overweight/obese. Among long sleepers 10.6% were underweight, 74.2% were normal weight, and 15.2% were overweight/obese. Thus the prevalence of overweight/obese among short sleepers was quite high at 34.4% as compared to 11.7% and 15.2% among normal sleepers and long sleepers respectively. This increase in the presence of overweight/obese among short sleepers was significant relationship with Chi square of 36.28 with a p value <0.001 (statistically significant).

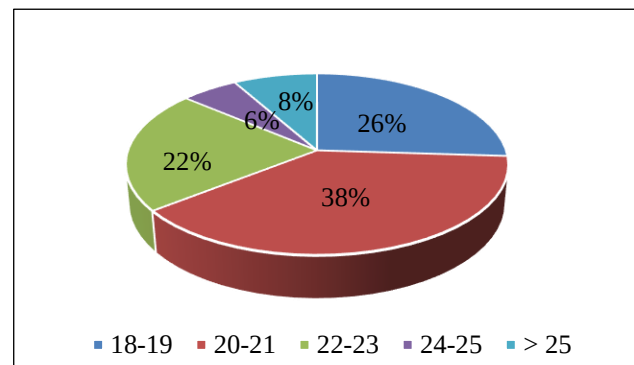


Figure 1: Age distribution of study population.

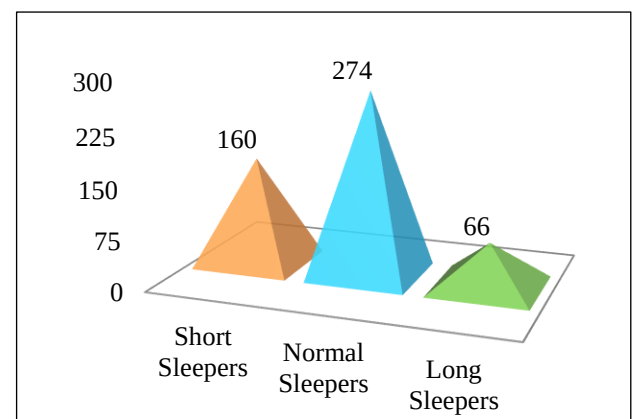


Figure 2: Distribution of study population as per sleep duration.

Among short sleepers 0% participants were hypertensive 47.5% were normotensive, 52.4% were prehypertensive/hypertensive. Among normal sleepers 1.5% were hypotensive 59.1% were normotensive, 39.4% were prehypertensive/hypertensive. There was a statistically significant increase in the percentage -of prehypertension/hypertension in short sleepers with a p value of 0.029 and Chi square of 10. 808.0% of underweight participants were hypotensive, 20.9% were normotensive and 79.1% were prehypertensive/hypertensive.

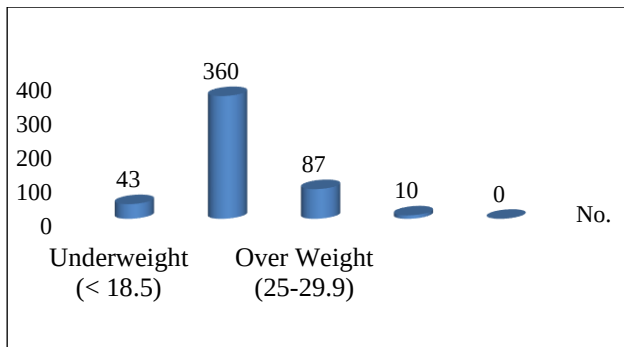


Figure 3: Distribution of study population as per BMI.

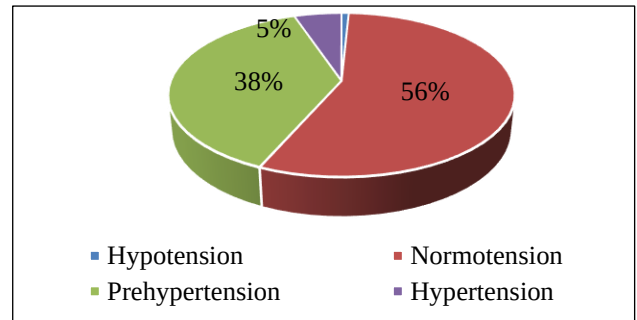


Figure 4: Status of blood pressure among study population.

Table 1: Association of sleep duration with BMI in study population.

BMI	Short sleepers		Normal sleepers		Long sleepers	
	No.	% Age	No.	% Age	No.	% Age
Underweight	7	4.4	29	10.6	7	10.6
Normal weight	98	61.3	213	77.7	49	74.2
Overweight/obese	55	34.4	32	11.7	10	15.2
Total	160	100	274	100	66	100

Chi-square=36.28; P-value<0.001(Statistically Significant)

Table 2: Association of sleep duration with blood pressure in study population.

Blood pressure	Short sleepers		Normal sleepers		Long sleepers	
	No.	% Age	No.	% Age	No.	% Age
Hypotension	0	0.0	4	1.5	0	0.0
Normotensive	76	47.5	162	59.1	41	62.1
Prehypertension/ hypertension	84	52.5	108	39.4	25	37.9
Total	160	100	274	100	66	100

Chi-square=10.808; P-value=0.029 (Statistically Significant)

Table 3: Association of BMI with blood pressure in study population.

Blood pressure	Underweight		Normal weight		Overweight+obese	
	No.	% Age	No.	% Age	No.	% Age
Hypotension	0	0.0	4	1.1	0	0.0
Normotensive	9	20.9	215	59.7	31	32.0
Prehypertension/ hypertension	34	79.1	141	39.2	66	68.0
Total	43	100	360	100	97	100

Chi-square=43.964; P-value<0.001(Statistically Significant)

Among normal weight participants 1.1% were hypotensive, 59.7% were normotensive and 39.2% were prehypertensive/hypertensive. Among overweight and obese participants 0.0% were hypotensive, 32.0% were normotensive and 68.0% were prehypertensive/hypertensive. There was a statistically significant increase in the percentage of prehypertension/hypertension among overweight/obese people with a p value of <0.001 and Chi square of 43.964.

DISCUSSION

There has been a constant increase in the prevalence of short sleep in the world in the last few decades with

percentage of people reporting less sleep in world rising from 8 percent in 1942 to 26 percent in 2004 and almost to 38 percent presently. However there is considerable variation in the prevalence of sleep deprivation in different countries.¹²

The present observational, cross sectional study was conducted with an aim to explore a possible relationship of sleep duration with BMI and blood pressure. A total of 500 subjects comprising of 312 (62.4%) females and 188 (37.6%) males in the age group of 18-30 years participated in the study. Self reported sleep duration and measured blood pressure, height and weight were used in the study.

In our study the mean BMI was high in short sleepers. It was 23.3 in short sleepers as compared to 21.82 for normal sleepers and 22.06 for long sleepers. This study showed a statistically significant increase in the prevalence of overweight/obese subjects among short sleepers. The prevalence of overweight/obese among short sleepers was quite high at 34.4% as compared to 11.7% and 15.2% among normal sleepers and long sleepers respectively. This increase in the presence of overweight/obese among short sleepers was significant statistically with CHI square of 36.28 with a P. value <0.001.

This data is in accordance with the results from several previous studies (cross sectional, longitudinal and experimental) carried in different age groups.¹³⁻¹⁵ Also in conformity with previous reports, the relationship between sleep duration and BMI shows a U shaped curvilinear pattern, where BMI increases in subjects with sleep duration below 6 hours and above 8 hours.^{16,17} However, the association in our study was stronger for short sleep duration in comparison with longer sleep durations.

The effect of short sleep as a risk factor of higher BMI has been a matter of much interest, given the public health concerns associated with it. Several large population studies have identified significant relationship between short sleep duration and metabolic disturbances across all age groups and in several ethnic groups.^{17,18} The suggested biological mechanisms underlying the association of short sleep duration with elevated BMI is varied. Insufficient sleep leads to changes in satiety and hunger hormones with higher circulating levels of hunger stimulating hormone ghrelin, and decreased levels of satiety hormone leptin.¹⁸

The results from present study show statistically significant association between short sleep and elevated blood pressures Chi-square=10.808; P-value=0.029 (Statistically Significant). Our study was in conformity with studies done by Alexandros et al who observed that usual sleep duration above or below the median of 7 to less than 8 hours per night is associated with an increased prevalence of hypertension, particularly at the extreme of less than 6 hours per night.¹⁹ Another study by Mi-Yeon Song et al also demonstrated that adult premenopausal woman with 6–8 hours of proper sleep showed the lowest prevalence of high blood pressure.²⁰ This research confirmed that shorter the sleeping hours, greater the prevalence of high blood pressure in adult premenopausal women. A mechanism explaining a connection between sleeping hours and BP is that an elevation in BP in people with both normal and high BP occurs due to excessive invigoration of the sympathetic nerve after short term sleep deprivation.²⁰

Our study also showed that among normal weight participants 1.1% were hypotensive, 59.7% were normotensive and 39.2% were prehypertensive/

hypertensive. Among overweight and obese participants 0.0% were hypotensive, 32.0% were normotensive and 68.0% were prehypertensive/hypertensive. There was a statistically significant increase in the percentage of prehypertension/hypertension among overweight/obese people with a p value of <0.001 and CHI square of 43.964. Similar studies were done by Linerman et al which showed that the association between body mass index and blood pressure was consistent and positive across more than 20 000 subgroups of 1.7 million Chinese adults and was only substantially affected by treatment with antihypertensive medication.²¹

Since BMI is log-linearly associated with hypertension, any amount of reduction in BMI at population level can reduce the burden of hypertension at a large scale. Early diagnosis and treatment of hypertension is crucial for reducing NDC burden in South Asian countries.²²

CONCLUSION

In conclusion, this study showed a statistically significant increase in the prevalence of elevated blood pressure and overweight/obese subjects among short sleepers. There was an inverse relationship of prevalence of overweight/obesity and elevated blood pressure with short sleep duration. There was also a statistically significant increase in the percentage of prehypertension/hypertension among overweight/obese people with a p value of <0.001 and CHI square of 43.964.

Increasing sleep time (following normal sleep time 6-8 hours) might be a novel approach to obesity prevention and prevention of increase in blood pressure caused by sleep deprivation and this strategy should become the target of public health policy. Large-scale studies are needed to further investigate the casual association between short sleep with physical health and cognitive issues.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of Government Medical College and Associated hospitals Srinagar, India

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