

Association between Sleep Duration and Blood Pressure in AdolescentsVandana Bhoi¹, Y Srinivasu², Raju. H Patil³, Anil Bhoi^{4*}¹Professor, Dept of Community Medicine, Prakash Institute of Medical Sciences & Research²Assistant Professor, Dept of Cardiology, Government Medical College³Associate Professor, Dept of Community Medicine, Prakash Institute of Medical Sciences & Research⁴Professor & Head, Dept of Pediatrics, Krishna Institute of Medical Sciences & Research

Received: 21-10-2023 / Revised: 24-11-2023 / Accepted: 29-12-2023

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Conflict of interest: Nil

Abstract:

Hypertension is a widespread public problem, and the relationship between sleep state and hypertension has been considered as a risk factor. However, the findings have been inconclusive. The objective of this study is to thoroughly examine the relationship between the amount of sleep a person gets and the occurrence of hypertension.

Materials and Methods; We evaluated 182 adolescents. The sleep duration was assessed by calculating the discrepancy between the self-reported regular bedtimes and wake-up times. Adolescents were categorized into three groups: less than 6 hours, 6 to 8 hours, and more than 8 hours. The National High Blood Pressure Education Program Working Group on High Blood Pressure in Adolescents' guidelines were followed for measuring blood pressure using the auscultatory method, and blood pressure was classed as high if it was either systolic or diastolic.

Results: Systolic and diastolic blood pressure were measured in our research between participants who slept for less than six hours and those who slept for six to eight hours. $P = 0.84 > 0.05$ and $P = 0.53 > 0.05$ have been found, which is insignificant. The study found that mean \pm SD for systolic BP 125.62 ± 12.89 at <6 h sleep duration and 122.34 ± 11.5 at $6-8$ h' sleep duration with $P > 0.05$ which is not significant. Like this mean \pm SD for diastolic BP 81.41 ± 12.36 at <6 h sleep duration and 82.35 ± 7.54 at $6-8$ h' sleep duration with $P > 0.05$ which is not significant.

Conclusion: However, the current investigation was unable to establish a statistically significant correlation between the duration of sleep and hypertension.

Keywords: Sleep Duration, Blood Pressure, Adolescent, Hypertension.

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Introduction

Sleep is an important physiological process that accounts for around one-third of our lives. The typical time of nightly sleep has reduced significantly as a result of the faster pace of modern living. Sleep is a critical physiological process that significantly influences health, development, and growth throughout infancy and adolescence. [1]. Paciência et al. [2] emphasize that physiological changes occur in sleep patterns during adolescence. According to their research, the mean daily sleep duration among adolescents varies between nine hours at age 13 and 8.25 hours at age 17. Insufficient sleep is becoming a global problem. Stress and competitive lifestyle have taken a toll on the quality of sleep and sleep duration both [3]. But in addition to physiological concerns, behavioral difficulties like using electronics mostly at night and societal issues like the fast-paced nature of modern life have also led to a decrease in the average amount of sleep, particularly among teens. [4] According to the

Healthy Lifestyle in Europe by Nutrition in Adolescence research (HELENA), a multicenter research involving teens, 33% of participants aged 12 to 17 reported sleeping fewer than 8 hours per night on average [5].

The evidence about the importance of normal and disturbed sleep have come up as modifiable factors in the pathophysiology of hypertension. Sleep disorders and sleep abnormalities such as sleep apnea and insomnia can lead to the development of hypertension [6]. Multiple studies have already demonstrated that the duration of sleep is a significant risk factor for the onset of hypertension and other cardiometabolic illnesses in individuals of all ages, including children, adolescents, and adults. [7,8]. Multiple biological pathways are proposed to be causally linked to the association between sleep duration and increased blood pressure. Reduced sleep duration leads to heightened activity of the sympathetic nervous system. Hypervigilance, or

excessive activity of the central nervous system, affects the sudden rise in sympathetic activity, the activation of the hypothalamic-pituitary-adrenal axis, and the renin-angiotensin-aldosterone system, leading to elevated blood pressure. [9]. Previous research revealed that environmental and genetic variables contributed to the development of hypertension. Some lifestyle choices have an impact on the prevalence of hypertension, including drinking, smoking, eating too much salt, and getting too little sleep. [10]. People who sleep for less than six hours a night are more probable to have hypertension, which is linked to habitually having lower sleep durations than the median of 7–8 hours. [11]. Several research have indicated that an extended duration of sleep is also considered a risk factor for hypertension. [12]. Obstructive sleep apnea (OSA) is frequently associated with hypertension; in fact, it is estimated that 30–40% of hypertensive patients also have OSA, and around 50% of OSA patients have hypertension. [13]

Only a few of the studies have included duration of sleep in the development of hypertension in adults. The young adults are not left behind in the modern world and are getting less sleep due to career aspirations further disturbed by exposure to mobile phones, internet, and social media. They are also exposed to sleep disturbances due to the change in place of living when they come to hostels in the college. There are reports available from Indian population which show effect of sleep on BP but no study has evaluated the sleep duration and its effects on health among young adults. The study on young adults, majority of whom have just left their houses and come for studies at a new place leading to a change in their living places, eating places, and study schedule along with sleeping environment provides an excellent opportunity to study these changes and their effect on the health. This study was thus planned with the aim to find the relationship between duration of sleep and hypertension in young adults.

Materials and Methods

The present cross-sectional study was performed on 182 young adults participating voluntarily in the Department of Community Medicine at Prakash institute of medical sciences. Informed consent was taken in the language of understanding from all the participants, entailing the study purpose, and ensuring the confidentiality of the results. People who filled out the working proforma and answered the questions about their sleep time were used to collect the data. A thorough history taking and physical check were used to get a lot of information.

Inclusion Criteria

Self-administered questionnaires were given out as part of the examination. These questionnaires covered information on social, demographic, and

behavioral aspects, as well as information on individual and family history of disease. All voluntary participating subjects with no previous or current history of any illness or any drug intake were included in the study.

Exclusion Criteria

Exclusion from the research was based on the following criteria.

- Any history of endocrine disorder, neurological or psychiatric disorder, diabetes mellitus and hypertension
- Any chronic illness

Sleep Duration Assessment

Sleep duration was estimated based on the difference between the usual bedtime ('What time do you usually go to bed?') and wake-up time ('What time do you usually wake up?') for weekdays when college is in session. The sleep duration data were collected through the answers to the questionnaire provided in the working proforma provided to the participants. Sleep duration was categorized into three classes: <6h; 6-8h and >8 hrs. per day.

For sleep quality assessment, a Basic Nordic Sleep Questionnaire was used. Participants answers were categorized on a five-point Likert scale ranging from 1 to 5. The questions inquired into sleeping habits for the past 3 months.

Assessment of BP

The National High Blood Pressure Education Program Working Group on High Blood Pressure in Adolescents recommended that qualified physicians or nurses monitor blood pressure (BP) in the right arm using the auscultatory technique and a standard mercury sphygmomanometer. After a 10-minute rest period, two measures were made, and the average was determined. A third measurement was taken and the average of the two closest measures was computed if there was a discrepancy of 4-5 mm Hg between the two measurements. According to the definition of hypertension, it may be defined as a systolic blood pressure value of ≥ 140 mm of Hg and diastolic blood pressure value of ≥ 90 mm Hg. As per the World Health Organization guidelines, prehypertensive state was defined as systolic BP of 120–139 mm of mercury (mm Hg) and a diastolic BP of a value from 80 to 89 mm Hg. Normal systolic BP was taken as 120 mm of Hg and 80 mm of Hg for the normal diastolic BP.

Statistical Analysis: Appropriate statistical method in the form of Student's paired t-test was employed to test the significance of different parameters in the group. The Chi-square test was applied for testing the association between the two groups.

Results

For this purpose, 182 of the participants were selected out of 270 students based on the criteria used for inclusion and exclusion of the participants. The age of the participants was found to be ranging from 18 years to

26 years with maximum number of them belonged to $20 \leq 22$ years of age [Table 1]. Out of 182 participants, there were 96 males and 86 females.

Table no 1 show that Mean age ranged from 18 to 25 years old with mean \pm SD 21.02 ± 1.03 for participants with sleep duration 8 h. Comparing the mean age of participants with duration of sleep (0.05), and for the age between sleep durations likewise mean \pm SD 21.15 ± 1.45 for participants with duration of sleep >8 h. Comparing the mean age of participants with duration of sleep <6 h and 6–8 h, Student's t-test revealed similar ($P > 0.05$), and for the age between sleep durations <6 and 6–8 h duration, the means did not differ statistically. Similarly comparing the mean age of the participants with

sleep duration 8 h, Student's t-test revealed similar value ($P > 0.05$) which for both sleep durations did not differ statistically. Comparing the mean age of participants with sleep duration 6–8 and >8 h Student's t-test revealed that similar ($P > 0.05$) age between both sleep duration (6–8 and >8 h duration) means did not differ statistically. No significant difference was seen in systolic BPs and diastolic BPs between sleep duration 8 h between 6–8 and >8 h [Table 3]. In our study, systolic BP and diastolic BP in the participants with sleep duration <6 h compared with participants with 6–8 h' sleep duration. $P = 0.53 > 0.05$, and $P = 0.84 > 0.05$ found, which is insignificant. The study found that mean \pm SD for systolic BP 125.62 ± 12.89 at <6 h sleep duration and 122.34 ± 11.5 at 6–8 h' sleep duration with $P > 0.05$ which is not significant. Like this mean \pm SD for diastolic BP 81.41 ± 12.36 at <6 h sleep duration and 82.35 ± 7.54 at 6–8 h' sleep duration with $P > 0.05$ which is not significant [Table 4].

Table 1: Distribution based on Age and Gender.

Age (years)	Male (no)	Female (no)	Total (no)	Percentage (%)
18 \leq 20	21	29	50	25.96
20 \leq 22	62	53	115	65.43
22 \leq 24	11	3	14	6.80
>24	2	1	3	1.81
Total	96	86	182	100

Table 2: Scarification between age and sleep duration

Sleep Duration	Mean	SD
<6 hrs	21.02	1.03
6-8hrs	19.05	1.82
>8 hrs	21.15	1.45

Table 3: Sleep duration and hypertension

Sleep Duration	Control (no)	Prehypertension (no)	Hypertension (no)
<6 hrs	44	14	20
6-8hrs	69	13	13
>8 hrs	14	1	02

Table 4: Relationship between Blood pressure and sleep duration

S.No	Sleep Duration	SBP Mean \pm SD	DBP Mean \pm SD	P value
1	<6 hrs	125.62 \pm 12.896	81.41 \pm 12.36	0.53
2	6-8hrs	122.34 \pm 11.5	82.35 \pm 7.54	0.84
3	>8 hrs	129.23 \pm 15.81	83.23 \pm 11.32	0.71

Discussion

An increased likelihood of cardiovascular disease is associated with hypertension. Along with it, it can cause peripheral vascular disease, renal impairment, visual impairment, retinal hemorrhage, and heart failure. [14]. The purpose of this study was to investigate the correlation between hypertension and sleep duration in detail. In our study, systolic BP and diastolic BP in the participants with sleep duration <6 h compared with participants with 6–8 h' sleep duration. $P = 0.53 > 0.05$, and $P = 0.84 > 0.05$ found, which is insignificant. The study found that mean \pm

SD for systolic BP 125.62 ± 12.89 at <6 h sleep duration and 122.34 ± 11.5 at 6–8 h' sleep duration with $P > 0.05$ which is not significant. Like this mean \pm SD for diastolic BP 81.41 ± 12.36 at <6 h sleep duration and 82.35 ± 7.54 at 6–8 h' sleep duration with $P > 0.05$ which is not significant.

The results of the present study were consistent with the studies of Shaikh et al. 2009. [15] In their study on Gujarati, Indian adolescents could not find any association of sleep duration with the arterial BP. Likewise, our study did not show effect on sleep

duration on BP significantly. They found mean \pm SD for systolic BP for inadequate and adequate sleep durations as 116 ± 10.5 and 116 ± 10 , respectively. Like this mean \pm SD for diastolic BP with inadequate sleep duration and adequate sleep duration 74 ± 7.4 and 73 ± 7.7 , respectively. The findings in this study could be attributed probably to the reason that when sleep is inadequate, it does not affect the cardiovascular autonomic balance at rest. The study conducted by Azadbakht et al. in the year 2013 also found no significant association between BP and the duration of sleep [16] as suggested by our present study. A study of Culver et al. in young adults demonstrated that irregularity of sleep duration found to be related with high BPs. [17] In their study, they found that it is not the sleep duration, but the sleep irregularity is associated with high BP in young adults. This is not similar to our study as sleep irregularity was not assessed in the present study. The early identification of the youngsters with hypertension is of value as they can be given appropriate treatment. Early prevention of hypertension in them has significant health and economic benefits [18].

There are reports that in young Americans, the prevalence of cardiometabolic diseases increases if they sleep <7 h in night. [19] Kripke et al. [20] in their study also found increase in mortality if sleep duration was <7 h per night after adjusting for age and pre-existing condition of health. In few studies, it has been observed that risk of hypertension increases twofold if sleep duration is <5 h per night. [21] The authors Yang et al. [22] in their study suggested that there is increase in mortality for each hour less of sleep. Therefore, it becomes clear that BP increases with reduction in sleep duration. More recently insufficient sleep is being considered a risk factor leading to hypertension in children and adults. Van Ryswyk et al. in 2018 demonstrated that not only sleep duration but other factors associated with sleep such as sleep disorder, sleeping problem have contribution in the development of hypertension. [23] This study also suggests investigating other contributory factors for hypertension apart from sleep duration as suggested by our study also. Adámková et al. in a study analyzed BPs in adults and concluded that BPs both systolic and diastolic were not found associated with sleep duration significantly. [24] These results correlate with our study ($P > 0.05$).

Conclusion

There was no statistically significant relationship between sleep duration and hypertension in this research. However, in short sleep duration in the 8 h sleep duration, however found to be insignificant statistically. The study suggests that more research should be done to find out if young people have high blood pressure. More longitudinal studies are required further in future to analyze that besides

sleep duration there could be other factors, that play a role in raised BPs.

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