

A Study Evaluate Association between Body Mass Index (BMI) and Sleep Duration & Pattern among Study Population

Pankaj Kumar¹, Abilesh Kumar²

¹SMO (Specialist Medical Officer) Department of Medicine, Sadar Hospital, Bhagalpur, Bihar, India

²Professor and HOD, Department of Medicine, JLNMCH, Bhagalpur, Bihar, India

Received: 19-01-2024 / Revised: 15-02-2024 / Accepted: 28-03-2024

Corresponding Author: Dr. Pankaj kumar

Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to correlate between Body Mass Index (BMI) and Sleep duration & pattern among study population.

Methods: The present study was conducted in the Department of Medicine, JLNMCH, Bhagalpur, Bihar, India one year and 200 subjects were included in the study.

Results: The study included 200 subjects aged 18 to 23 years, with 90 females and 110 males. Subjects had a mean BMI of 21.77 Kg/m² with std. deviation of 3.376. 43% (86) had normal BMI. 43% subjects sleep durations 5-6. There was a significant association between BMI and PSQI score ('p' value <0.05). 60% subjects had 0-5 PSQI. BMI is significantly correlated negatively with sleep duration and positively with PSQI score. PSQI is negatively correlated significantly with sleep duration.

Conclusion: There was significant negative correlation of BMI found with both sleep duration and sleep quality. It was found that short Sleep Duration and poor Sleep Quality is significantly associated with High BMI.

Keywords: Body mass index, sleep pattern, sleep quality

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Sleep deprivation impairs memory, attention, emotional control, cognition, motor responses, and work/college performance. [1-3] College students are free from parental control for the first time, yet academic and irregular schedules increase. [4-5] Unbalanced food, bad habits including drinking, smoking, and lack of sleep, and continuous mobile usage might affect kids. [6-8] Sleep is needed for proper brain and body development. [9] Young people (18-25 years old) should sleep [7-9] hours every night, according to the National Sleep Foundation, to be healthy. [10] Several studies have shown that little sleep and poor sleep quality may raise the risk of diabetes, cardiovascular disease, and obesity. [11-14] Overweight and obesity are health risks caused by improper fat buildup. Overweight and obesity kill 2.8 million people annually. Body mass index (BMI) measures obesity by comparing weight to height. WHO defines overweight as BMI 25 or higher and obesity as BMI 30 or higher. Obesity is a widespread public health concern [15,16], affecting many age groups [17,18] with various severe health effects. [19] Weight gain has economic and societal impacts as well as health ones. Studying the causes of high obesity rates affects public health. The typical causes of obesity include diet, including food quality and amount,

low-cost high-calorie meals, and inactivity. Other causes include poor sleep quality and persistent partial sleep loss. [20] Research implies low sleep duration need special attention. [21] Global sleep duration has decreased as obesity has increased. [22] High BMI is linked to short sleep in numerous cultures and age groups. [23,24] Previous research suggests sleep quality may indicate obesity severity. A meta-analysis found that poor sleep quality is linked to overweight and obesity in children, adolescents, and young adults [25], regardless of sleep length. Sleep may help regulate weight and reduce the risk of metabolic problems including insulin resistance and diabetes, according to research.²⁶

The current research aimed to link BMI with sleep duration & pattern among study participants.

Materials and Methods

The present study was conducted in the Department of Medicine, JLNMCH, Bhagalpur, Bihar, India for 1 year and 200 subjects were included in the study.

Inclusion Criteria

Medical students who had completed minimum 6 months of MBBS course and aged between 18-23 years.

Exclusion Criteria

Students were excluded if any of the following were there: any Endocrine disorders like Diabetes Mellitus, Hypothyroidism, Cushing’s disease, Polycystic Ovarian Disorder etc., family history of obesity, alcoholism, any severe painful injury in the past 3 months, any psychiatric illness or sleep disorders, those on sedatives or steroids and exam going students.

Informed written consent was taken and detailed History was recorded. Anthropometric parameters like Height and Weight were recorded. BMI was calculated using the formulae.

BMI = Weight in Kg (Height in m) ² and grading was done using ICMR guidelines.¹⁵

Assessment of sleep duration and patterns was done

by PSQI - A self-administered questionnaire, which has high Test-retest reliability and good validity. 16–18 It assesses sleep of an individual in the past 1 month. It is a 7 Component scoring index of sleep which include Subjective Sleep Quality, Sleep Latency, Sleep Duration, Efficiency, Disturbances, Medication and Daytime Dysfunction. There are 4-point scale in each component, ranging from 0 to 3, to a Global PSQI Score of 0-21 and score >5 is considered Poor Sleep Quality.

Statistical analysis was done using MS excel and SPSS v17. Chi-square test was applied to check the association of BMI with different parameters included in the study. Pearson Correlation was used to check the relationship between BMI, sleep duration and PSQI score. P value <0.05 was considered statistical significance.

Results

Table 1: Characteristics of participating students

Characteristics	N	% of participants
Age (years)		
<20	110	55
>20	90	45
Gender		
Male	110	55
Female	90	45
Body mass index		
<18.5	30	15
18.5-22.9	86	43
23-24.9	48	24
25-30	30	15
>30	6	3
Sleep durations		
<5	24	12
5-6	86	43
6.1-7	40	20
>7	50	25
Pittsburgh sleep quality index (PSQI)		
0-5	120	60
>5	80	40

The study included 200 subjects aged 18 to 23 years, with 90 females and 110 males. Subjects had a mean BMI of 21.77 Kg/m² with std. deviation of 3.376. 43% (86) had normal BMI. 43% subjects sleep durations 5-6. There was a significant association between BMI and PSQI score (‘p’ value <0.05). 60% subjects had 0-5 PSQI.

Table 2: Correlation among BMI, Sleep Duration and PSQI

Correlations	Sleep Duration	PSQI
BMI (r value)	- 0.710	0.832
‘p’ value	< 0.05	< 0.05
Sleep Duration (r value)		- 0.743
‘p’ value		< 0.05

BMI is significantly correlated negatively with sleep duration and positively with PSQI score. PSQI is negatively correlated significantly with sleep duration.

Discussion

Currently obesity has become pandemic in the world

and it poses major health threat and in India also the prevalence is increasing at an alarming rate. It is one of the major risk factors for cardiovascular [27] and metabolic disorders [28] and other adverse health outcomes, among which many are leading causes of death in the world. With emerging technologies and

advent of artificial lighting, television, internet, social media, and shift working, the sleep duration is curtailed. Because of this in our society, sleep deprivation has become a routine in approximately 25% of the population with reduced alertness. [29,30]

The study included 200 subjects aged 18 to 23 years, with 90 females and 110 males. Subjects had a mean BMI of 21.77 Kg/m² with std. deviation of 3.376. 43% (86) had normal BMI. 43% subjects sleep durations 5-6. There was a significant association between BMI and PSQI score ('p' value <0.05). 60% subjects had 0-5 PSQI. BMI is significantly correlated negatively with sleep duration and positively with PSQI score. PSQI is negatively correlated significantly with sleep duration. According to study done by Bleich, et al (2012) [31] normal weight physicians could counsel and provide better recommended obesity care to their patients than obese physicians.

The study showed highly significant positive correlation of BMI with PSQI score i.e. as the BMI increases the sleep quality decreases. These findings were similar to study done by Patel and Hu (2008)³¹ which suggested poor quality sleep induces lethargy which in turn reduces the enthusiasm to do physical activity and reduces the desire to do exercise. They also found independent association of weight gain linked to short duration of sleep. BMI showed highly significant negative correlation with sleep duration in the study. It is similar to the findings of the study done by Israel, et al (2016) [32] which showed a higher number of subjects sleeping 5 to 6 hours and a strong negative correlation of their sleep duration with BMI. This means, as the sleep duration decreases that person tends to gain weight. One of the reasons for this is depicted in the study done by Taheri, et al (2004) [33] which found out that subjects who slept less had low leptin & elevated ghrelin levels. These neuroendocrine fluctuations increase the appetite of an individual leading to weight gain. According to the study done by Perla, et al (2014) [34] poor sleep quality rather than short sleep duration, predicted overweight among young adults.

Conclusion

There was significant negative correlation of BMI found with both sleep duration and sleep quality. It was found that short Sleep Duration and poor Sleep Quality is significantly associated with High BMI.

References

1. Youngstedt SD, Goff EE, Reynolds AM, Kripke DF, Irwin MR, Bootzin RR, Khan N, Jean-Louis G. Has adult sleep duration declined over the last 50+ years?. *Sleep medicine reviews*. 2016 Aug 1;28:69-85.

2. Zielinski MR, McKenna JT, McCarley RW. Functions and mechanisms of sleep. *AIMS neuroscience*. 2016;3(1):67.
3. Ruthig JC, Haynes TL, Stupnisky RH, Perry RP. Perceived academic control: Mediating the effects of optimism and social support on college students' psychological health. *Social psychology of education*. 2009 Jun;12:233-49.
4. Arnett JJ. Emerging adulthood. *American Psychological Association*. 2006;2(6):19-17.
5. Bjorvatn B, Sagen IM, Øyane N, Waage S, Fetveit A, Pallesen S, Ursin R. The association between sleep duration, body mass index and metabolic measures in the Hordaland Health Study. *Journal of sleep research*. 2007 Mar;16(1):66-76.
6. Makarem N, St-Onge MP, Liao M, Lloyd-Jones DM, Aggarwal B. Association of sleep characteristics with cardiovascular health among women and differences by race/ethnicity and menopausal status: findings from the American Heart Association Go Red for Women Strategically Focused Research Network. *Sleep Health*. 2019 Oct 1;5(5):501-8.
7. AIDabal L, BaHamam AS. Metabolic, endocrine, and immune consequences of sleep deprivation. *The open respiratory medicine journal*. 2011;5:31.
8. Anic GM, Titus-Ernstoff L, Newcomb PA, Trentham-Dietz A, Egan KM. Sleep duration and obesity in a population-based study. *Sleep medicine*. 2010 May 1;11(5):447-51.
9. Maharjan N, Karki PK, Adhikari B, Bhaila A, Shrestha H. Association between sleep duration, sleep quality and body mass index in medical students. *Journal of Chitwan Medical College*. 2020 Dec 16;10(4):34-8.
10. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, Hazen N, Herman J, Katz ES, Kheirandish-Gozal L, Neubauer DN. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep health*. 2015 Mar 1;1(1):40-3.
11. Landolt HP, Holst SC, Sousek A, Bassetti C, Dogas Z, Peigneux P. Effects of acute and chronic sleep deprivation.
12. Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity*. 2008 Mar;16(3):643-53.
13. Vargas PA, Flores M, Robles E. Sleep quality and body mass index in college students: the role of sleep disturbances. *Journal of American college health*. 2014 Nov 17;62(8):534-41.
14. Moraes W, Poyares D, Zalcman I, De Mello MT, Bittencourt LR, Santos-Silva R, Tufik S. Association between body mass index and sleep duration assessed by objective methods in a representative sample of the adult population. *Sleep medicine*. 2013 Apr 1;14(4):312-8.

15. World health organization. Obesity.
16. Lyznicki JM, Young DC, Riggs JA, Davis RM. Obesity: assessment and management in primary care. *American family physician*. 2001 Jun 1;63(11):2185-97.
17. Kosti RI, Panagiotakos DB. The epidemic of obesity in children and adolescents in the world. *Central European journal of public health*. 2006 Dec 1;14(4):151.
18. Lobstein T, Millstone E, PorGrow Research Team. Context for the PorGrow study: Europe's obesity crisis. *Obesity Reviews*. 2007 May;8:7-16.
19. Reilly JJ, Methven EA, McDowell ZC, Hacking B, Alexander D, Stewart L, Kelnar CJ. Health consequences of obesity. *Archives of disease in childhood*. 2003 Sep 1;88(9):748-52.
20. Ko, G.T.C., Chan, J.C.N., Chan, A.W.Y., Wong, P.T.S., Hui, S.S.C., Tong, S.D.Y., Ng, S.M., Chow, F. and Chan, C.L.W., 2007. Association between sleeping hours, working hours and obesity in Hong Kong Chinese: the 'better health for better Hong Kong' health promotion campaign. *International Journal of Obesity*, 31(2), pp.254-260.
21. Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, Miller MA. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*. 2008 May 1;31(5):619-26.
22. Hoyos C, Glozier N, Marshall NS. Recent evidence on worldwide trends on sleep duration. *Current Sleep Medicine Reports*. 2015 Dec;1:195-204.
23. Magee CA, Huang XF, Iverson DC, Caputi P. Examining the pathways linking chronic sleep restriction to obesity. *Journal of obesity*. 2010; 2010(1):821710.
24. Hung HC, Yang YC, Ou HY, Wu JS, Lu FH, Chang CJ. The association between self-reported sleep quality and overweight in a Chinese population. *Obesity*. 2013 Mar;21(3): 486-92.
25. Fatima Y, Doi SA, Mamun AA. Sleep quality and obesity in young subjects: a meta-analysis. *Obesity reviews*. 2016 Nov;17(11):1154-66.
26. Sharma S, Kavuru M. Sleep and metabolism: an overview. *International journal of endocrinology*. 2010;2010(1):270832.
27. Despres JP. Abdominal obesity and the risk of coronary artery disease. *Can J Cardiol*. 1992; 8:561-563.
28. Spiegel K, Leproult R, Cauter EV. Impact of sleep debt on metabolic and endocrine function. *Lancet*. 1999;354(9188):1435-1439.
29. Wingard DL, Berkman LF. Mortality Risk Associated with Sleeping Patterns Among Adults. *Sleep*. 1983;6(2):102-107.
30. Bonnet MH, Arand DL. We are Chronically Sleep Deprived. *Sleep*. 1995;18(10):908-911.
31. Bleich SN, Bennett WL, Gudzone KA, Cooper LA. Impact of Physician BMI on Obesity Care and Beliefs. *Obes*. 2012;20:999-1005.
32. Patel SR, Hu FB. Short Sleep Duration and Weight Gain: A Systematic Review. *Obes*. 2008;16:643-653.
33. Israel M, Patil U, Smita Shinde et al. Obesity in Medical Students and its Correlation with Sleep Patterns and Sleep Duration. *Indian J Physiol Pharmacol*. 2016;60(1):38-44.
34. Taheri S, Lin L, Austin D, Young T, Mignot E. Short Sleep Duration Is Associated with Reduced Leptin, Elevated Ghrelin, and Increased Body Mass Index. *PLoS Med*. 2004; 1(3).
35. Vargas PA, Flores M, Robles E. Sleep Quality and Body Mass Index in College Students: The Role of Sleep Disturbances. *J Am Coll Health* 2014;62(8):534-541.