



SLEEP DISORDERS AS CARDIOVASCULAR DISEASE RISK FACTOR: AN EVIDENCE BASED STUDY

Physiotherapy

**Dr Yashasvi
Obhaliya**

Tutor, MPT, Cardio-Respiratory disorders, RIMS, Raipur, Chhattisgarh-492001.

**Dr Brajendra
Kumar**

Professor And Hod, Department Of Gen Medicine, Zmch, Dahod, Gujarat-389151.

ABSTRACT

Sleep can be defined as "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. The regulation of sleep is processed by the homeostatic physiology of the circadian rhythm, the sleep/wake cycle. Cardio-vascular diseases remain the leading cause of mortality and morbidity for both men and women worldwide. Sleep apnea and cardio vascular diseases have common risk factor such as obesity, hypertension, and diabetes mellitus type II. The main aim of the study was to estimate the risk for cardiovascular morbidity and mortality as increased sleep disturbance. last 6 years article from different search engine which were free access and in English language were included and reviewed. The review concluded that sleep is major alone risk factor for cardiovascular diseases. It conclude that not only sleep duration but also quality of sleep give impact on individual cardiorespiratory health. Moreover sleep apnea, obstructive sleep apnea, Insomnia are also contribute in disease prevalence as major risk factor.

KEYWORDS

Sleep, Sleep Duration, Sleep Quality, Cardiovascular Disorders, Cardiovascular Risk Factor, Sleep Apnea

INTRODUCTION

Sleep can be defined as "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. Sleep is characterised by low physical activity levels and reduced sensory awareness. Multiple brain areas namely thalamus, hypothalamus (suprachiasmatic nucleus) and pons work together to control sleep-wake cycles. During sleep several endocrine glands secrete and regulate hormones which are melatonin, follicle stimulating hormone luteinising hormone and growth hormone. [1][2][3][4][5]

The regulation of sleep is processed by the homeostatic physiology of the circadian rhythm, the sleep/wake cycle. Circadian rhythm is the 24-hour internal clock in our brain that regulates cycles of alertness and sleepiness by responding to light changes in our environment. Our physiology and behaviour are shaped by the Earth's rotation around its axis. This biological circadian system has evolved to help humans adapt to changes in our environment and anticipate changes in radiation, temperature, and food availability. Without this endogenous circadian clock. [6] national sleep foundation recommended 7 to 9 hour sleep for aged 26 to 64 years, and 7 to 8 hours for > 65 years. [7]

Cardio-vascular diseases remain the leading cause of mortality and morbidity for both men and women worldwide, [8] The number of Cardiovascular death is projected to increase to more than 24 million by 2030, resulting in a huge disease burden. Poor life style and behaviour are believed to be the leading cause of cardiovascular diseases. People spend one third of their lifetime asleep and approximately one third of the general population regularly suffer from sleep related problem.[9]

Unhealthy sleep behaviour include short or long sleep duration, excessive day time sleepiness, snoring, late chronotype insomnia, sleep apnea. These sleep behaviour are typically correlated and may affect in a concerted manner; and modifications in one sleep behaviour usually lead to compensatory changes in other sleep behaviours.[10]

Sleep apnea and cardio vascular diseases have common risk factor such as obesity, hypertension, diabetes mellitus type II. Intermitant hypoxia triggered by apniatic event during sleep apnea phase and abrupt reduction of the intrathoracic pressure and augmentation of the sympathetic tone contribute pathogenesis of cardio vascular diseases.[7]

Whether adults sleep the recommended hours is influenced by cultural, social, psychological, behavioral, pathophysiological, and environmental influences.[16,17] Sleep duration may be reduced because of irregular working and shift-work patterns and round-the-clock availability of commodities of modern society.[7]

Association between unhealthy sleep problems (sleep apnea) and cardiovascular disease may attributed either a clustering of risk factors present in both the condition or a real casual risk factor.[11] current guidelines for risk reduction of cardiovascular diseases make limited recommendation about quality or duration of sleep. However guideline make no specific reference with regard to sleeping beyond the recommended limit.[7]

The main aim of the study was to estimate the risk for cardiovascular morbidity and mortality as increased

MATERIAL AND METHODS

MATERIALS AND METHODOLOGY

Articles were reviewed from different search engines like Research Gate, PubMed and Google Scholar using KEY WORDS: sleep, sleep duration, sleep quality, cardiovascular disorders, cardiovascular risk factor, sleep apnea



Articles of last 6 years (2018-2022) and in English language (n=35)

Articles in full text and Free open access (n= 20)

Type of article: match inclusion criteria (n= 09)



Total articles 09 were reviewed.

Inclusion Criteria:

- Articles of last 6 years.
- Articles available in English language, full text articles and Free open access.
- Meta analysis, cohort study, systemic review. Patients with breathing issue during sleep, insomnia, heart disease,

Exclusion Criteria:

- Patient with any other psychological illness.
- Patient with any neurological condition.

Review Of Literature:

AUTHOR/YEAR OF PUBLICATION	TITLE	TYPES	METHODOLOGY	CONCLUSION
Y. Yeghiazarians, B.L. Devin et al. 2023.[12]	Obstructive sleep apnea and cardio vascular diseases.	A Scientific Statement From the American Heart Association		Obstructive sleep apnea increases the risk of all causes and cardio vascular mortality.
S. Lee, Christina X. Mu. et al. 2023[13]	Sleep health composites are associated with the risk of heart disease across sex and race	Comparative study	Objective and subjective data measurement. 6,820 adults who provided self-report sleep data and 663 adults who provided both self-report and actigraphy sleep data.	There is a difference in the prevalence of heart disease and sleep health problem by sex and race. The link between sleep health and heart disease was not moderate by sex and race.

AUTHOR/YEAR OF PUBLICATION	TITLE	TYPES	METHODOLOGY	CONCLUSION
F. Wang, S.Boros et al.2019 [14]	The effect of physical activity on sleep quality: a systematic review	a systematic review	Two search engines, PubMed and Scopus, were used to identify studies for inclusion from January 2010 to June 2018. They used the term 'sleep quality' AND 'physical activity' OR 'sleep quality' AND 'exercise' to search as key words.	Moderate exercise showed more promising outcome on sleep quality than vigorous exercise.
M. Fan, D.Sun et al , 2019[10]	Sleep patterns, genetic susceptibility, and incident cardiovascular disease: a prospective study of 385 292 UK biobank participants	A prospective study	Total subject: 385292 Review after 8.5 years: 7280 4667 have both CHD AND STROKE	In this large prospective study, a healthy sleep pattern was associated with reduced risks of CVD, CHD, and stroke among participants with low, intermediate, or high genetic risk.

AUTHOR/YEAR OF PUBLICATION	TITLE	TYPES	METHODOLOGY	CONCLUSION
K. Archontogeorgis, A. Voulgaris et al. 2018 [11]	Cardiovascular risk Assessment in a cohort of newly diagnosed patient with obstructive sleep apnea syndrome(OSAS)	a Cohort study	Subjects:- 393 (male-288, Female-205) Time: singing program once a week and home practice for ten weeks. Outcome measures: polysomnography, apnea-hypopnea index (AHI), Oxygen desaturation index (ODI), blood sample (Fasting blood glucose, triglycerides, total cholesterol, and high- and low-density lipoprotein were calculated by a random-access chemistry analyzer) , Coronary Risk Evaluation (SCORE) and the Framingham Risk Score (FRS).	10 years risk for cardiovascular morbidity and mortality seems to increase with severity of OSAS
John s. floras, 2018 [15]	Sleep Apnea and Cardio-Vascular disease: An enigmatic factor	Review Study		SA will remain a clinically clandestine threat to homeostatic cardiovascular rhythms and an enigmatic cardiovascular risk factor.

AUTHOR/YEAR OF PUBLICATION	TITLE	TYPES	METHODOLOGY	CONCLUSION
C.S. Kwok, G. Kulgowski, et al. 2018 [7]	Self-Reported Sleep Duration and Quality and Cardiovascular Disease and Mortality: A Dose-Response Meta-Analysis	Meta analysis	searched MEDLINE and EMBASE for these studies and extracted data from identified studies. 30 studies with >1 000 000 participants, included.	the significant association between deviations in sleep duration and both mortality and adverse cardiovascular outcomes. National guidelines should consider advocating this as the recommended sleep duration. they also found evidence that sleep duration above the recommended level of 7 to 8 hours was associated with a moderate degree of harm compared with sleeping less than the suggested duration. the greater the divergence from the recommended durations of sleep, the greater the association for cardiovascular harm and mortality.

AUTHOR/YEAR OF PUBLICATION	TITLE	TYPES	METHODOLOGY	CONCLUSION
X.Q. Lao, X. Ziu, et al. 2018 [9]	Sleep Quality, Sleep Duration, and the Risk of Coronary Heart Disease: A Prospective Cohort Study With 60,586 Adults	A Prospective Cohort Study	60586, 40 year or older individuals Outcome measures: self-administrative questionnaire for sleep duration and quality, Events of coronary heart disease	Based on the study they concluded that both short sleep duration and poor sleep quality are associated with risk of coronary heart disease.
S.M. Bertisch, B.D. Pollock, et al. 2018 [8]	Insomnia with objective short sleep duration and risk of incident cardiovascular disease and all-cause mortality: Sleep Heart Health Study	a time-to-event analysis	Questionnaires and at-home polysomnography (PSG) were performed between 1994 and 1998. Participants were followed for a median of 11.4 years (Q1-Q3, 8.8–12.4 years) until death or last contact	Insomnia or poor sleep with PSG-short sleep was associated with higher risk of incident CVD. Future studies should evaluate the impact of interventions to improve insomnia with PSG-short sleep on CVD.

RESULTS

Based on the evidence it can be said that quality and duration of sleep affect the health of heart and lungs and lead to coronary heart diseases, and vascular diseases.

Sleep apnea can worsen the heart disease and cardiovascular disease can worsen obstructive sleep apnea syndrome vice-versa.

Recommended duration of sleep is necessary for fitness and health.

DISCUSSION

The exact mechanisms that underlie the association between sleep and CVD and mortality are not fully understood. Short sleep duration has been shown to increase levels of leptin and ghrelin, which leads to increased appetite, caloric intake, reduce energy expenditure, and facilitates the development of obesity and impaired glycemic control. Cortisol also increases with reduced sleep, and altered growth hormone metabolism may increase CVR. Low-grade inflammation occurs with reduced sleep, which may be associated with CVD and cancer. Long sleep duration may be associated with an increased risk of CVD because of an adverse CVR factor profile or prevalent comorbidities that lead to fatigue, such as chronic inflammatory disorders and anemia. Depressive symptoms, low socioeconomic status, unemployment, and low physical activity are also associated with long sleep duration, which may confound the association of long sleep with morbidity and mortality.[7]

Insomnia with objective short sleep duration is a unique phenotype that is associated with higher CVD risk. dysregulation of the hypothalamic–pituitary–adrenal axis and glucose metabolism and alterations in cardiovascular autonomic control, as well as abnormal brain metabolism.[8]

During obstructive sleep apnea, Each apneic episode ordinarily lasts a minute or less but when repeated hour by hour, night after night, for years or decades, the hemodynamic, autonomic, chemical, and inflammatory disturbances elicited can exert long-term aftereffects on the heart, brain, circulation, and metabolism. Thus, apneas can trigger events during sleep, and cardiovascular events can accrue long after apneas cease on awakening. Mismatch between myocardial oxygen delivery during apnea and the metabolic requirements imposed by acute increases in intrathoracic and systemic arterial pressure render the heart vulnerable to nocturnal ischemia, myocardial infarction, and ventricular arrhythmias. Sensitization of the carotid body by recurrent hypoxia will amplify further the magnitude of sympathetic outflow. Chronic activation of the sympathetic nervous system underlies the pathophysiology of a range of cardiometabolic disorders; its magnitude predicts cardiovascular morbidity, foreshortened lifespan, and sudden cardiac death.[15]

Japanese study observed that sleep disturbances were associated with a higher risk of later-onset of type 2 diabetes mellitus. In addition, it is unclear whether abnormal sleep is a marker of undiagnosed prevalent CVDs or of early/latent disease that subsequently manifests in adverse cardiovascular outcomes and death.[7]

short sleep may trigger low-grade inflammation and lead to an increase in stress response in the hypothalamic- pituitary-adrenal axis, which may result in elevated blood pressure, interrupted blood flow, and increased risk of cardiovascular disease.[12] above all the mechanism that cause after sleep disturbances lead to cardio vascular disease.

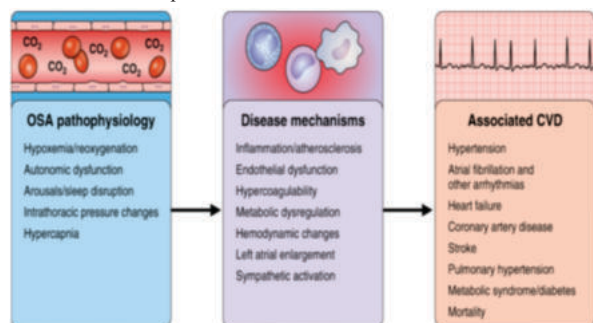


Figure 1: cardio-vascular complication of obstructive sleep apnea

CONCLUSION

From above all mentioned article which were reviewed from last 6 years concluded that, sleep is major alone risk factor for cardiovascular diseases. It conclude that not only sleep duration but also quality of sleep give impact on individual cardiorespiratory health. Moreover sleep apnea, obstructive sleep apnea, Insomnia are also contribute in disease prevalence as major risk factor.

Future recommendation:

- Further research aimed at elucidating the metabolic and vascular correlates of insomnia or poor sleep and short sleep will improve our understanding of the CVD risk.
- Importance of considering sleep duration and sleep quality together when developing strategies to improve sleep for cardiovascular disease prevention.
- the effect of vigorous Physical Activity on sleep quality and duration, type of exercise and intensity of exercise should specifi.
- After covid fatigue affect the sleep and cardiovascular health.
- Sleep management include in physiotherapy rehabilitation.

Limitation:

- current study is evidence based, which limits our ability to examine the effects of sleep health on heart disease risk over time
- other major risk factor for cardiovascular diseases were not taken consideration.
- Comorbidity of the disease not taken under consideration
- Psychological illness were excluded which is major reason for having sleep disturbance
- Treatment for the cause was not taken under consideration.

REFERENCES

1. Brinkman JE, Sharma S. Physiology, sleep. InStatPearls [Internet] 2019 Mar 16. StatPearls Publishing.
2. ↑ Luppi PH, Fort P. Sleep–wake physiology. In Handbook of Clinical Neurology 2019 Jan 1 (Vol. 160, pp. 359–370). Elsevier.
3. ↑ Hardebrand R, Pandi-Perumal SR, Cardinali DP. Melatonin. The international journal of biochemistry & cell biology. 2006 Mar 1;38(3):313–6.
4. ↑ ¹Christensen AS, Clark A, Salo P, Nymann P, Lange P, Prescott E, Rod NH. Symptoms of sleep disordered breathing and risk of cancer: a prospective cohort study. *Sleep*. 2013 Oct 1;36(10):1429–35.
5. Smiley A, Wolter S, Nissan D. Mechanisms of Association of Sleep and Metabolic Syndrome. *J Med-Clin Res & Rev*. 2019;3(3):1–9.
6. Khan S, Nabi G, Yao L, Siddique R, Sajjad W, Kumar S, Duan P, Hou H. Health risks associated with genetic alterations in internal clock system by external factors. *Int J Biol Sci*. 2018;14(7):791–798. [PMC free article] [PubMed]
7. Kwok, C. S., Kontopantelis, E., Kuligowski, G., Gray, M., Muhyaldeen, A., Gale, C. P., ... & Mamas, M. A. (2018). Self-reported sleep duration and quality and cardiovascular disease and mortality: a dose-response meta-analysis. *Journal of the American Heart Association*, 7(15), e008552.
8. Bertisch, S. M., Pollock, B. D., Mittleman, M. A., Buysse, D. J., Bazzano, L. A., Gottlieb, D. J., & Redline, S. (2018). Insomnia with objective short sleep duration and risk of incident cardiovascular disease and all-cause mortality: Sleep Heart Health Study. *Sleep*, 41(6), zsy047.
9. Lao, X. Q., Liu, X., Deng, H. B., Chan, T. C., Ho, K. F., Wang, F., ... & Yeoh, E. K. (2018). Sleep quality, sleep duration, and the risk of coronary heart disease: a prospective cohort study with 60,586 adults. *Journal of Clinical Sleep Medicine*, 14(1), 109–117.
10. Fan, M., Sun, D., Zhou, T., Heianza, Y., Lv, J., Li, L., & Qi, L. (2020). Sleep patterns, genetic susceptibility, and incident cardiovascular disease: a prospective study of 385 292 UK biobank participants. *European heart journal*, 41(11), 1182–1189.
11. Archontogeorgis, K., Voulgaris, A., Nena, E., Strempela, M., Karailidou, P., Tzouveleki, A., ... & Steiropoulos, P. (2018). Cardiovascular risk assessment in a cohort of newly diagnosed patients with obstructive sleep apnea syndrome. *Cardiology Research and Practice*, 2018.
12. Parish, J. M., & Somers, V. K. (2004, August). Obstructive sleep apnea and cardiovascular disease. In *Mayo Clinic Proceedings* (Vol. 79, No. 8, pp. 1036–1046). Elsevier.
13. Lee, S., Mu, C. X., Wallace, M. L., Andel, R., Almeida, D. M., Buxton, O. M., & Patel, S. R. (2022). Sleep health composites are associated with the risk of heart disease across sex and race. *Scientific reports*, 12(1), 2023.
14. Wang, F., & Boros, S. (2021). The effect of physical activity on sleep quality: a systematic review. *European Journal of Physiotherapy*, 23(1), 11–18.
15. Floras, J. S. (2018). Sleep apnea and cardiovascular disease: an enigmatic risk factor. *Circulation*