MAK HILL Publications Research Journal Of Pharmacology

Research Article
doi: 10.36478/makrjp.2024.3.23.27

Effects of Sleep Deprivation on Cardiovascular Health: A Cohort Study

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ABSTRACT

Young adults' cardiovascular diseases (CVDs) are becoming a more common source of morbidity and mortality. Young adults have significant difficulties that may raise their risk of CVD, especially if they are enrolled in professional programmes in college. Adolescents should be made more aware of CVD risk factors because, in spite of screening requirements, they are frequently overlooked in the younger population. The importance of sleep as a gauge of health and its influence on cardiovascular risk factors are becoming more well acknowledged. In Sree Mookambika Institute of Medical Sciences, Kanyakumari, India, a cross-sectional observational study was carried out among young individuals, ages 18-24, which were enrolled in professional courses. Participants were choosing Using multistage, systematic random sampling and snowball sampling. Utilizing a pretested questionnaire, information on cardiovascular morbidity and sleep patterns was gathered. The total prevalence of insomnia was 28.61% in the current study., where all subjects (N=371) were divided into two groups on the basis of insomnia symptoms: subjects with inadequate (N=107) and adequate sleep (N=264). 02.01%, 18.51%, 43.21% and 40.15% of insomniac were in 20-35 years, 36-50 years, 51-65 years and >65 years of age group and those with adequate sleep had 05.71%, 25.41%, 39.55% and 33.25% for the same age groups, respectively. This shows sleep adequacy declines as the age progresses with a higher prevalence of insomnia (82.41%) among the subjects >50 years. Early CVD prevention requires effective health promotion programmers that emphasize behavior and lifestyle changes. In order to lower CVD risk factors in this population, the study emphasizes the significance of early intervention and health promotion efforts. It is advised that behavior modification campaigns and community-based studies be used to encourage sound sleeping practices and shield young adults outside of college from cardiovascular illnesses.

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Key Words
Cardiovascular, adolescents, frequently requirements

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Received: 20 August 2024
Accepted: 4 October 2024
Published: 8 October 2024

Citation: R. Aashish and M.K. Suresh, 2024. Effects of Sleep Deprivation on Cardiovascular Health: A Cohort Study. Res. J. Med. Sci., 18: 23-27, doi: 10.36478/makrjp.2024.3.23.27

INTRODUCTION

Difficulty falling asleep in-spite of being in bed, multiple awakenings with trouble falling back asleep, early morning awakenings or having an un-refreshing sleep constitutes insomnia[1]. Its prevalence ranges from 10-15% among the general population[2]., however, affects about 33-50% of the adult population[3] with higher rates among divorced, separated, or widowed people, older age, females and co-morbid medical or psychiatric illness[4-6].

Sleep deprivation exerts deleterious systemic effects with detectable endocrine, immune and metabolic changes[7,8]., which contributes to total mortality, diabetes mellitus, hypertension, obesity, respiratory disorders and poor self-rated health[9,10]. The relationship between sleep duration and vascular events is U-shaped suggesting different mechanisms may operate at either end of the distribution of sleep duration[11]. Insomniac are more likely to visit hospitals and physicians., have increased absenteeism., make errors or have accidents at work., increased predisposition to depression, anxiety, substance abuse and suicide and prone to fatal road accidents[12]. King[13] found inverse association of sleep duration with incident coronary artery calcification over 5 years follow up. Self-reported short sleep and sleep complaints have been associated with an increased cardiovascular morbidity in both epidemiological[14] and case-control studies[15]. These cardiovascular events usually follow a circadian rhythm, with a high incidence of sudden death, myocardial infarction and stroke in the early morning[16].

Though insomnia can be an independent condition as a primary insomnia but it is often secondary to medications (beta-blockers, bronchodilators, calcium channel blockers, decongestants, antidepressants, thyroid hormones)., medical disorders (asthma, hyperthyroidism, prostate hypertrophy, rhinitis)., poor sleep hygiene and disorders like sleep apnea, periodic limb movements, restless legs syndrome, or circadian rhythm disorder. Various behavioral and cognitive factors such as worrying in bed, talking on the telephone at night, watching television, using computers and internets, eating, smoking, clock watching, or having unreasonable expectations of sleep duration may further contributes to insomnia[17]. Gillin[18] believes multiple unsuccessful attempts to control thoughts, images and emotions provides an automatic nocturnal trigger for anxiety and arousal which further worsen the situation that can persist indefinitely.

Sleep is an essential indicator of well-being and health in humans. Recent studies suggest that chronic insomnia or an altered sleep cycle can exacerbate some cardiovascular risk factors, such as the development of diabetes, high blood pressure, weight gain, obesity and an elevated resting heart rate[19]. It has been proposed that maintaining a healthy sleep pattern is associated with reduced risks of CVDs[20]. Given the ongoing epidemiological transition to non-communicable and lifestyle diseases, including CVDs, it becomes pertinent to study the burden, if any, among young adults.

Young adults pursuing professional courses in colleges constitute an important and understudied population in India, as they are exposed to distinct lifestyle situations, behaviors and factors that may influence their risk of developing CVD. In the state of Uttarakhand, there is a lack of published scientific research focusing on young adults concerning their socio-demographic, behavioral and epidemiological perspectives.

MATERIALS AND METHODS

The Sree Mookambika Institute of Medical Sciences in Kanyakumari is where this survey was carried out. Before the study began, institutional ethical committee approval was secured and all recruited subjects provided informed written consent. Responses to the item "Have trouble falling asleep" on a 4-point Like rt scale were used to determine symptoms of insomnia. "Are you having trouble falling back asleep at night., Do you wake up too early in the morning and find it difficult to fall back asleep., Do you take sleeping pills or other medication to help you fall asleep" An insufficient sleep with "frequent" answers to any of these four questions was identified as insomnia.

Study instruments, inclusion/exclusion standards, and statistical analysis Young adults who were willing to participate and present at the time of data collection, ages 18-24, were included in the study. Excluded from the data collection were those who declined to participate and those who were not present. The study participants were given a pretested, predesigned tool to collect data. Microsoft Excel 2007 (Microsoft Corp., Redmond, WA, USA) and SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA) were used to compile, tabulate and analyse all of the data that had been gathered. Each variable's percentage was determined, and the Chi-square test was used to determine whether a discovery or association was statistically significant. It was believed that the significance level would be $p<0.05$.

RESULTS AND DISCUSSIONS

The total prevalence of insomnia was 28.61% in the current study., where all subjects (N=371) were divided into two groups on the basis of insomnia symptoms: subjects with inadequate (N=107) and adequate sleep (N=264). Table 1 shows 02.01%, 18.51%, 43.21% and 40.15% of insomniac were in 20-35 years, 36-50 years, 51-65 years and >65 years of age group and those with

adequate sleep had 05.71%, 25.41%, 39.55% and 33.25% for the same age groups, respectively. This shows sleep adequacy declines as the age progresses with a higher prevalence of insomnia (82.41%) among the subjects >50 years.

Table 1: Comparisons of Socio-Demographic Variables in all the Subjects

Category	Inadequate sleep (107)	Adequate sleep (264)	X^2 value
Age (years)			
20-35	02.01	05.71	6.31
36-50	18.51	25.41	
51-65	43.21	39.55	
>65	40.15	33.25	
Sex			
Male	48.41	51.34	.28
Female	53.55	50.63	
Education			
No/Little	37.06	30.11	4.32
Primary	33.92	30.51	
Secondary	26.81	37.20	
Graduation	05.11	06.13	
Socio economic status			
Middle	61.80	65.94	.55
Upper	40.13	36.02	
Occupation			
Unemployed	76.21	69.51	2.56
Employed	25.71	32.44	

Table 2 depicts a statistically significant stress had predisposed the subjects to insomnia (28.86%., P<.001) than adequate sleep (16.32%., P<.001). Similarly, sedentary lifestyle had shown contribution to insomnia (72.11%) than sound sleep (62.40%). Furthermore, insomniacs (38.110%) were more frequently reported with a positive family history as compared to subjects with adequate sleep (33.24%). However, subjects under the effects of alcoholic beverages had reported more sound sleep (25.42%) than insomnia (18.50%).

Table 2: Comparison of Risk Factors in Subjects with Inadequate and Adequate Sleep

Category	Inadequate Sleep (107)	Adequate Sleep (264)	X^2 value
Body mass index (kg/m2)			
Normal	51.50	41.53	5.31
Overweight	28.82	40.34	
Obesity	22.64	21.06	
Alcohol consumption			
Current	18.50	25.42	2.91
Never/Ex	83.49	76.57	
Dietary habits			
Vegetarian	60.81	61.61	.03
Nonvegetarian	41.23	40.36	
Stress levels			
Significant	29.85	16.32	9.30
Insignificant	72.11	85.61	(<.001)
Physical activity			
Adequate	29.82	39.54	3.94
In adequate	72.11	62.40	

Reveals a statistically significant relation between insomnia and hypertension (60.81%., P<.05). Contrarily, the prevalence of metabolic syndrome, hyperglycemia, hyperlipidemia and obesity was approximately the same in both compared groups which shows no effects of sleep deprivation on these variables.

The total prevalence of insomnia was 27.64% in the current study which is found similar to Le Blanc *et al.* (30.70%)[21]. However, Wong [5] and Beck [25] have found a prevalence of 39.4% and 15.80% in their study population, respectively. This variation might be regarded to differing definitions and time frames used for estimation of insomnia among the study population. Furthermore, biases related to diagnostic criteria, interviewing techniques or methodology aspects might have accounted for the gaping discrepancy between the study findings.

An increase in insomnia (Table 1) as age advances from >50 years was found supported by Xiang[4]. Stressful life events related to retirement, supporting children and taking care of parents, progressive physical inactivity, social life dissatisfaction and concurrent medical and psychiatric problems might be responsible for this rising trend[6-10]. Higher prevalence of insomnia in females than males in the current study has been found consistence to Wong[5]. which might be contributed to the differences in the prevalence of psychiatric morbidities, symptom endorsement, gonadal steroids, socio-cultural factors and coping strategies among both sexes. Ohayon[23] proposed the female/male ratios for insomnia reached their peak after 45 years of age with an underlying menopausal state and increased chronic physical conditions. However, Cappuccio[24] analyzed no gender differences in association with sleep durations and cardiovascular outcomes.

A relation of insomnia with low education level in the present study has been persistence to other studies[4-24]. However, various factors like sedentary jobs, physical inactivity, high mental stress, rich diet, smoking and medical conditions predispose the upper social class to a higher prevalence of insomnia as observed in the current study. Gellis[25]. indicated individuals of lower household and education was significantly more likely to experience insomnia even after accounted for ethnicity, gender and age. Furthermore, Moore[26]. observed higher education level was associated with higher income, higher sleep quality, lower psychological distress and better physical health after controlling for age, gender, ethnicity and prior health status.

A predisposition of unemployment, including retirement, to insomnia in the present study was found supported by Lallukka[27]. The associations between sleep and retirement are complex due to the removal of work-related stressors., however sleep adequacy among disability retirees is poor before and after retirement[27]. Conversely, Utsugi[28]. indicated occupational stress as a possible risk factor for insomnia and short sleep. Furthermore, Dahlgren[29] demonstrated a workweek with a high workload and stress increases work hours and sleepiness, impairs sleep and affects the diurnal cortisol secretion pattern which subsequently result in unwinding., difficulty

Table 3

Category	Inadequate sleep (107) Normal	Adequate sleep (264)	X^2 value	Category	Inadequate sleep (107) Diseased	Adequate sleep (264)	X^2 value
Metabolic Syndrome	81.40	20.55		78.93	23.02	.25	
Hypertension	41.22	60.81		55.70	46.21	6.31(<.05)	
Hyperglycemia	76.23	25.72		77.31	24.60	.07	
Obesity	79.32	22.68		80.91	21.04	.11	
Hyperlipidemia	75.21	26.70		73.05	28.94	.20	

falling asleep even on feeling sleepier., transient insomnia and possibly, to chronic insomnia in the long term. Several analogous studies have shown that, in comparison to seven to eight hours of sleep, both shorter and longer sleep durations are related to risk factors for CVD. These risk factors include diabetes, high blood pressure and obesity[30,31]. A similar study by Shankar *et al.* reported a correlation between insufficient rest or sleep and CVD (OR 1.55-1.79)[32]. Furthermore, it has been estimated that 7.5% of Asian Indians suffer from obstructive sleep apnea (OSA) in western India. There is mounting evidence that OSA is independently linked to obesity, hypertension and an increased risk of CVD and mortality[33-35]. A study conducted by Chen *et al.* among 125 individuals with heart failure investigated self-reported health related quality of life and sleep problems. The Pittsburgh sleep quality index (PSQI) was used and the mean score was 9.06±0.93. The study categorized 74.4% of the participants as poor sleepers[36]. These findings corroborate the findings of our study and strongly support the idea that insufficient sleep over an extended period is associated with an increased risk of acquiring CVDs. The research question addressed in the present study is novel, as there have been few studies conducted in a similar context with young adult students pursuing professional courses in Uttarakhand, India. To that end, the initiative, irrespective of the magnitude of the disease burden, is significant and will serve as an important precedent for further research considering the potential rise of lifestyle diseases across age groups. However, a few limitations of this study include a relatively small sample size, a cross-sectional study design and the use of self-reported scales for data collection. Nevertheless, we believe that the study lays a good foundation for further large-sample cohort studies to further investigate the potential determinants of cardiovascular health in this age group.

CONCLUSION

This association between insomnia and stress and hypertension raises the risk of cardiovascular disease and helps to explain the association observed in previous epidemiological research. Therefore, those who regularly report getting less than six hours of sleep per night should be considered to be in a greater risk category and necessary interventions should be started by determining the links between this condition and unemployment, low education, sedentary lifestyles, females and advancing age.

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