MEDICAL SCIENCE

To Cite:
Khusayfan AJ, Alharbi AE, Alharbi AS, Khayyat AJ, Qutub FL, Alharbi OF, Saati BA, Shatla MM. Association between sleep quality and cardiovascular diseases risk among general population of Makkah region, Saudi Arabia. *Medical Science* 2023; 27: e260ms3078. doi: https://doi.org/10.54905/disssi/v27i136/e260ms3078

Authors' Affiliation:
[1]Associate Professor, Department of Community Medicine, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[2]Faculty of Medicine, Umm Al-Qura University, Makkah city, Saudi Arabia

[*]**Corresponding author**
Faculty of Medicine, Umm Al-Qura University, Makkah city, Saudi Arabia
Email: Drahmedkhusayfan@gmail.com
ORCID: 0009-0005-5414-0302

ORCID List

Ahmed Jafar Khusayfan	0009-0005-5414-0302
Abdullah Eid Alharbi	0000-0001-7422-9586
Abdullah Saad Alharbi	0000-0002-6946-1994
Albraa Jameel Khayyat	0000-0002-1843-4144
Fadi Luaai Qutub	0000-0003-4173-584X
Omar Furayj Alharbi	0000-0002-0413-0780
Bassam Abdullah Saati	0000-0003-3672-4994

Peer-Review History
Received: 30 April 2023
Reviewed & Revised: 04/May/2023 to 06/June/2023
Accepted: 10 June 2023
Published: 12 June 2023

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

Association between sleep quality and cardiovascular diseases risk among general population of Makkah region, Saudi Arabia

Ahmed Jafar Khusayfan[2*], Abdullah Eid Alharbi[2], Abdullah Saad Alharbi[2], Albraa Jameel Khayyat[2], Fadi Luaai Qutub[2], Omar Furayj Alharbi[2], Bassam Abdullah Saati[2], Mokhtar Mahfouz Shatla[1]

ABSTRACT

Background: Cardiovascular diseases (CVDs) are a category of illnesses that affect the heart and blood vessels and are the major cause of death and morbidity globally and locally in Saudi Arabia (SA). Risk factors for developing CVD include hypertension, diabetes mellitus, obesity and others. Sleep has an important physiological, physical and psychological role and disturbance in sleep quality or quantity is associated with adverse health effects, such as hypertension and obesity. This study aims to look for the association between sleep quality and CVD risk. *Methods:* In this cross-sectional study, Makkah's general population was given an online survey from June 2022 to August 2022 to complete. An adequate statistical analysis was performed once the data was collected. *Results:* The study shows that sleep quality scores would decrease in hypertensive participants (B = -1.08, p-value = 0.073, Lower confidence interval (CI) = -2.27), in participants eating fatty food (B = -0.85, p-value = 0.008, Lower CI = -1.48) and in participants who breathe more than normal during exercise (B = -2.02, p-value = <0.000, Lower CI = -2.49). *Conclusion:* Poor sleep quality is associated with an increase in CVD risk, such as hypertension and fatty food consumption. However, maintaining proper sleep duration and quality could serve as prevention for developing hypertension.

Keywords: Makkah, sleep quality, Cardiovascular risk, Saudi Arabia, Makkah population, lack of sleep.

1. INTRODUCTION

Cardiovascular diseases (CVDs) are groups of conditions affecting the heart and blood vessels and are the leading cause of mortality and morbidity

worldwide (WHO, 2021). It is also the leading cause of mortality in Saudi Arabia (SA), accounting for approximately 42% of total deaths (Aljefree and Ahmed, 2015). There are major risk factors that could increase the risk of developing CVD significantly, including high blood pressure (BP), high low density lipoprotein cholesterol, diabetes mellitus (DM), obesity and others (CDC, 2022).

Sleep has important physiological, physical and psychological effects, but disturbance in sleep quality or quantity is associated with adverse health effects, such as hypertension (Lo et al., 2018; Suqati et al., 2020), obesity (Fatima et al., 2016) and psychological distress (Rezaei et al., 2018). The concept of sleep quality is considered a broad concept that can be investigated subjectively through various sampling methods or objectively, as measured according to polysomnography and other techniques. A definition that encompasses all the aspects of sleep quality is challenging to obtain; however, according to (next ref here) a study, sleep quality is associated with the self-satisfaction of a person with all aspects the sleep experience (Nelson et al., 2022). Sleep experience features include sleep efficiency, latency, duration and absence of sleep interruption (Nelson et al., 2022).

There are a limited number of studies that discuss sleep quality among Saudi populations. However, the available data shows that sleep disorders appear to be prevalent among Saudi populations. Studies revealed that 3 out of 10 Saudi men (Bahammam et al., 2008) and 4 out of 10 Saudi women are at high risk of obstructive sleep apnea (Bahammam et al., 2009). Another study shows that short sleep durations (<7 hours) are prevalent among Saudi adults and longer sleep durations among Saudi adults are associated with an increase of comorbid conditions (Ahmed et al., 2017). This alone indicates the prevalence of sleep disturbance among Saudi populations.

Previous studies have shown an association between low sleep quality and increased CVD risk. A study from 2011 showed 63% that the individuals lacking sleep time and poor sleep quality. Furthermore, a 79% higher risk of coronary heart disease when compared to normal sleepers (Hoevenaar-Blom et al., 2011). This study aims to look for variables related to sleep quality that affect CVD risk in the Makkah population and to assess the sleep quality of participants and its relation to multiple CVD risk factors.

2. METHODOLOGY

This is a cross-sectional study directed toward the general population of Makkah, SA. An online survey was sent from June 2022 to August 2022, via multiple social media channels and after obtaining ethical approval from the Biomedical Research Ethics Committee at Umm Al-Qura University. Participants were selected via convenience sampling. In total, 494 participants from the Makkah province enrolled in this study. The minimum sample size for a 95% confidence interval (CI) was calculated by epi info software VER 2.1; this equaled a minimum sample size of 385 participants for Makkah's population.

The questionnaire was composed of the participant consent form followed by 38 questions. The first four questions gathered demographic data, the next 15 questions were used to evaluate sleep quality and the last 19 questions were used to assess cardiovascular risk factors. A pilot study was done on 30 participants to ensure clarity as well as simplicity. The questionnaire reliability was tested by Cronbach's Alpha revealing a value of 0.74 which indicated an acceptable reliability.

The data was collected and entered through Excel 2020 and statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software version 26. For categorical variables, frequencies and percentages were used, while the mean and standard deviation were used for numerical variables. A bivariate analysis, including the chi-square, t-test and one-way ANOVA tests, were conducted to determine the association between the variables. Multiple linear regression was executed only for the factors associated with the sleep quality score in the bivariate analysis.

3. RESULTS

We interviewed a group of people from Makkah, SA, via an online survey. A total of 494 participants were enrolled in this survey. Their demographical profiles are in (Table 1). Most participants' age groups ranged from 18 to 24-year-old ($n = 198, 40.1\%$). Male participants demonstrated the most response ($n = 271, 54.9\%$). Most participants were single ($n = 243, 49.2\%$). Furthermore, most participants were college students ($n = 334, 67.6\%$), as in (Table 1).

Figure 1 demonstrates a significant association among participants with hypertension who had less sleep quality than others (mean = 25.73, standard deviation (SD) = 6.86, P-value = 0.013). On the other hand, other risk factors, including DM, cancer, high cholesterol and angina, have shown no significant association regarding sleep quality.

Table 1 Socio-demographic data

	N (Total=494)	%
Age		
18-24	198	40.1
25-34	104	21.1
35-44	64	13.0
45-54	85	17.2
55+	43	8.7
Gender		
Male	271	54.9
Female	223	45.1
Marital status		
Married	237	48.0
Single	243	49.2
Divorced	11	2.2
Widower	3	0.6
Educational level		
University	334	67.6
High school or diploma	123	24.9
Below high school	23	4.7
Other	14	2.8

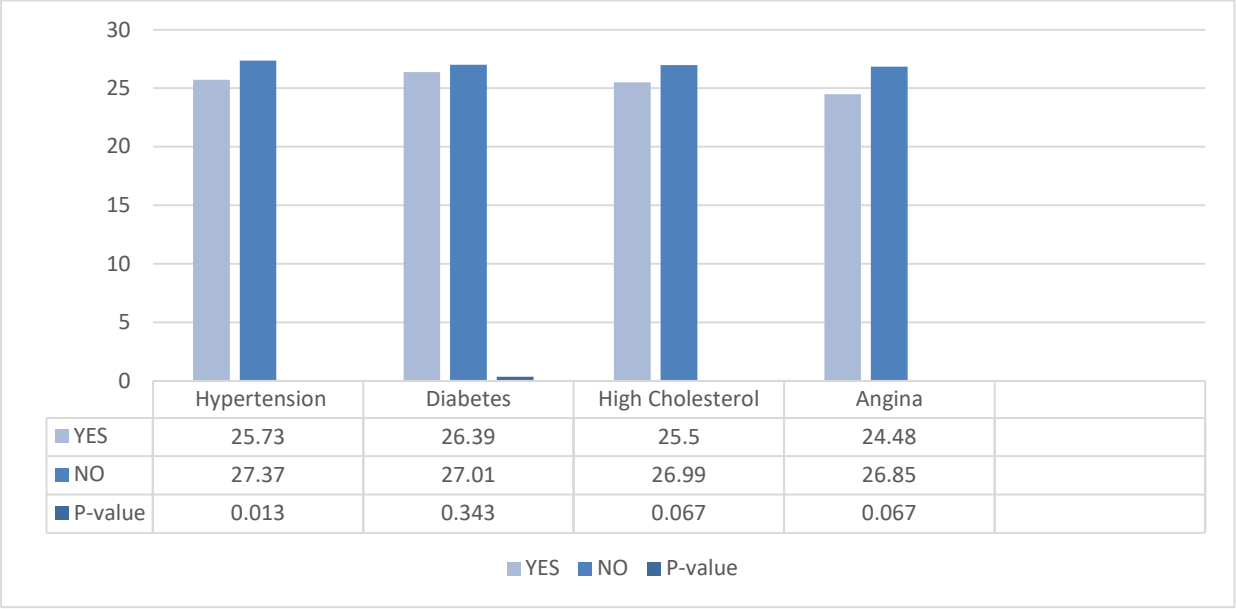

Figure 1 The relation between having a medical and/or family history of some medical conditions that are considered to be a risk factor for cardiovascular diseases and the quality of sleep scale score

With respect to Table 2, participants aged 25–34 had better sleep quality (mean = 27.96, SD = 6.48), which is in opposition to participants between 18–24 (mean = 25.61, SD = 7.40), who showed declining sleep quality. Furthermore, an association was found between cardiovascular risk factors and quality of sleep from the participants who said their diet "Rarely" (mean = 28.35, SD = 7.06) contains fatty foods. It was seen that these participants had greater sleep quality as opposed to the participants who said their diet "Always" (mean = 23.74, SD = 8.21) contained fatty food, with an estimated p-value = 0.003, which is significant.

Table 2 The relation between some cardiovascular risk factors and the quality of sleep scale score

	Mean	SD	P-value
Age			
18-24	25.61	7.40	0.063
25-34	27.96	6.48	
35-44	27.73	6.11	
45-54	27.29	7.49	
55+	27.48	7.99	
My diet contains fatty foods			
Always	23.74	8.21	0.003
Usually	25.89	7.26	
Sometimes	27.40	6.39	
Rarely	28.35	7.06	
Never	27.11	10.11	
I add salt to my food			
Always	25.86	7.56	0.101
Usually	27.75	6.72	
Sometimes	26.32	6.89	
Rarely	27.72	6.38	
Never	28.35	7.90	
When I exercise I breathe more than usual?			
Always	21.50	6.79	<0.000
Usually	24.57	6.89	
Sometimes	26.96	6.85	
Rarely	28.47	6.16	
Never	30.44	6.41	
I train at least one time a week or more			
Always	27.63	7.81	0.397
Usually	27.67	6.85	
Sometimes	26.63	6.83	
Rarely	25.95	7.08	
Never	26.37	7.37	
I measure my weight			
Always	26.48	8.18	0.802
Usually	26.25	6.95	
Sometimes	26.99	6.97	
Rarely	26.59	6.56	
Never	27.88	7.53	
Do you follow a healthy diet?			
Yes	26.83	7.07	0.842
No	26.67	7.20	
Are working in a job that requires physical activities			
Yes	25.94	7.30	0.138
No	27.00	7.10	
Did a doctor or anyone from the medical field tell you that you are obese			
Yes	26.55	7.30	0.737
No	26.78	7.11	
Have you been smoking for more than 10 years?			

Yes	26.53	7.28	0.732
No	26.84	6.92	

Additionally, participants who said "Always" (mean = 21.50, SD = 6.79) experienced increased breathing during exercise and had poor sleep quality, whereas participants who responded "Never" (mean = 30.44, SD = 6.41) had better sleep quality, which was also significant (p-value = <0.000).

Table 3 Multiple regression analysis for the risk factors that showed significant association with the quality of sleep scale score in the bivariate analysis

	B	P-value	95% CI for B	
			Upper	Lower
Hypertension	-1.08	0.073	0.10	-2.27
My diet contains fatty foods	-0.85	0.008	-0.22	-1.48
When I exercise, I breath more than usual	-2.02	<0.000	-1.55	-2.49

Table 3 show that the sleep quality score in hypertensive participants would decrease (B = -1.08, p-value = 0.073, Lower CI = -2.27). Moreover, the second variable showed a decrease in sleep quality scores (B = -0.85, p-value = 0.008, Lower CI = -1.48). Finally, the third variable also showed a decrease in their sleep quality scores (B = -2.02, p-value = <0.000, Lower CI = -2.49).

4. DISCUSSION

Our study demonstrates a correlation between low sleep quality and cardiovascular risk factors, including hypertension and eating fatty foods, which shows a decrease in sleep quality scores while other risk factors, such as DM, high cholesterol and angina, had no significant association in relation to sleep quality. Our results are consistent with those of previous studies Min et al., (2018), Kruger et al., (2014) and Ferranti et al., (2016) that found an association between unhealthy food and poor sleep quality. Moreover, a previous study in China revealed that poor sleep quality was significantly associated with higher BP (Yang et al., 2021).

Another study also showed the association between low sleep quality and an increase in BP (Grandner et al., 2018). The associations in these studies are similar to what we found in our study. In contrast, there are other studies in Ethiopia (Birhanu et al., 2020) and China (Lou et al., 2012) that showed a relationship between DM and poor sleep quality, which was non-significant to our study. The discrepancy with the studies conducted in Ethiopia and China may be due to potential confounders, such as drinking alcohol, smoking, family history of DM, obesity, body mass index and depression, all of which might play a major role in sleep quality and could change the results of the study.

Furthermore, we believe that these discrepancies might be due to sociocultural and socioeconomic differences, as well as psychosocial and behavioral factors. Interestingly, an association was found in studies done in the United States (Gangwisch et al., 2010) and Japan (Kaneita et al., 2008) between sleep duration and high cholesterol levels in adolescents. These studies found that adolescent females with low sleep duration were more likely to have high cholesterol levels. According to our research, we believe that decrease in sleep quality has an association with increased cardiovascular risk, such as hypertension. However, increasing sleep duration and quality could potentially serve as a primary preventative measure and treatment for hypertension.

Furthermore, these results help us understand how sleep quality and cardiovascular risk factors are connected and help us improve our awareness of the sleep quality of the general population of Makkah, SA, to ensure a decrease in cardiovascular risk. This study has potential limitations, such as difficulty in finding criteria of assessment for sleep quality. Moreover, we considered several socioeconomic status variables as confounding factors to investigate the independent association between sleep quality and cardiovascular risk factors. Although the data of our research were collected based on a self-reported questionnaire, the precision of the information is not accurate.

5. CONCLUSION

Our research findings showed that poor sleep quality are associated with an increase in cardiovascular risk, such as hypertension and fatty food consumption. However, maintaining proper sleep duration and quality could serve as a preventative measure for developing hypertension. Moreover, these findings help us understand the relationship between cardiovascular risks and sleep quality, allowing us to raise public awareness of this relationship among the general Saudi Arabian population.

Acknowledgment
We thank the participants who were all contributed samples to the study.

Ethical Consideration
The study was approved by the biomedical ethics committee in Umm Al-Qura University, College of medicine, Makkah, Saudi Arabia (Ethical approval number: HAPO-02-K-012-2022-06-1120).

Informed Consent
Electronic consent was obtained from all participants included in this study.

Author Contribution
Mokhtar Mahfouz Shatla: Questionnaire validation and manuscript reviewing.
Abdullah Eid Alharbi, Ahmed Jafar Khusayfan, Abdullah Saad Alharbi, Albraa Jameel Khayyat, Fadi Luaai Qutub, Omar Furayj Alharbi, Bassam Abdullah Saati: Manuscript writing, survey preparing and data collection.
Ahmed Jafar Khusayfan, Bassam Abdullah Saati: Data analysis.

Abbreviation lists
CVD: Cardiovascular Diseases
LDL: Low-density lipoprotein
SA: Saudi Arabia

Funding
This study has not received any external funding.

Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

1. Ahmed AE, Al-Jahdali F, Al AA, Abuabat F, Bin Salih SA, Al-Harbi A, Baharoon S, Khan M, Ali YZ, Al-Jahdali H. Prevalence of sleep duration among Saudi adults. Saudi Med J 2017; 38(3):276-283. doi: 10.15537/smj.2017.3.17101
2. Aljefree N, Ahmed F. Prevalence of Cardiovascular Disease and Associated Risk Factors among Adult Population in the Gulf Region: A Systematic Review. Adv Public Health 2015. doi: 10.1155/2015/235101
3. Bahammam AS, Al-Rajeh MS, Al-Ibrahim FS, Arafah MA, Sharif MM. Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi women in primary care. Saudi Med J 2009; 30(12):1572-1576.
4. Bahammam AS, Alrajeh MS, Al-Jahdali HH, Binsaeed AA. Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi males in primary care. Saudi Med J 2008; 29(3):423-426.
5. Birhanu TT, Hassen-Salih M, Abate HK. Sleep Quality and Associated Factors Among Diabetes Mellitus Patients in a Follow-Up Clinic at the University of Gondar Comprehensive Specialized Hospital in Gondar, Northwest Ethiopia: A Cross-Sectional Study. Diabetes Metab Syndr Obes 2020; 13:4859-4868. doi: 10.2147/DMSO.S285080
6. CDC. Heart Disease and Stroke 2022. https://www.cdc.gov/chronicdisease/resources/publications/factsheets/heart-disease-stroke.htm
7. Fatima Y, Doi-SaR, Mamun AA. Sleep quality and obesity in young subjects: A meta-analysis. Obes Rev 2016; 17(11):1154-1166. doi: 10.1111/obr.12444
8. Ferranti R, Marventano S, Castellano S, Giogianni G, Nolfo F, Rametta S, Matalone M, Mistretta A. Sleep quality and duration is related with diet and obesity in young adolescent living in Sicily, Southern Italy. Sleep Sci 2016; 9(2):117-122. doi: 10.1016/j.slsci.2016.04.003
9. Gangwisch JE, Malaspina D, Babiss LA, Opler MG, Posner K, Shen S, Turner JB, Zammit GK, Ginsberg HN. Short sleep duration as a risk factor for hypercholesterolemia: analyses of the National Longitudinal Study of Adolescent Health. Sleep 2010; 33(7):956-961. doi: 10.1093/sleep/33.7.956

10. Grandner M, Mullington JM, Hashmi SD, Redeker NS, Watson NF, Morgenthaler TI. Sleep Duration and Hypertension: Analysis of > 700,000 Adults by Age and Sex. J Clin Sleep Med 2018; 14(6):1031-1039. doi: 10.5664/jcsm.7176
11. Hoevenaar-Blom MP, Spijkerman AMW, Kromhout D, Berg JFV, Verschuren WMM. Sleep Duration and Sleep Quality in Relation to 12-Year Cardiovascular Disease Incidence: The MORGEN Study. Sleep 2011; 34(11):1487-1492. doi: 10.5665/sleep.1382
12. Kaneita Y, Uchiyama M, Yoshiike N, Ohida T. Associations of usual sleep duration with serum lipid and lipoprotein levels. Sleep 2008; 31(5):645-652. doi: 10.1093/sleep/31.5.645
13. Kruger AK, Reither EN, Peppard PE, Krueger PM, Hale L. Do sleep-deprived adolescents make less-healthy food choices? Br J Nutr 2014; 111(10):1898-1904. doi: 10.1017/S0007114514000130
14. Lo K, Woo B, Wong M, Tam W. Subjective sleep quality, blood pressure and hypertension: A meta-analysis. J Clin Hypertens (Greenwich) 2018; 20(3):592-605. doi: 10.1111/jch.13220
15. Lou P, Chen P, Zhang L, Zhang P, Yu J, Zhang N, Wu H, Zhao J. Relation of sleep quality and sleep duration to type 2 diabetes: A population-based cross-sectional survey. BMJ Open 2012; 2(4):e000956. doi: 10.1136/bmjopen-2012-000956
16. Min C, Kim HJ, Park IS, Park B, Kim JH, Sim S, Choi HG. The association between sleep duration, sleep quality and food consumption in adolescents: A cross-sectional study using the Korea Youth Risk Behavior Web-based Survey. BMJ Open 2018; 8(7):e022848. doi: 10.1136/bmjopen-2018-022848
17. Nelson KL, Davis JE, Corbett CF. Sleep quality: An evolutionary concept analysis. Nurs Forum 2022; 57(1):144-151. doi: 10.1111/nuf.12659
18. Rezaei M, Khormali M, Akbarpour S, Sadeghniiat-Hagighi K, Shamsipour M. Sleep quality and its association with psychological distress and sleep hygiene: A cross-sectional study among pre-clinical medical students. Sleep Sci 2018; 11(4):274-280. doi: 10.5935/1984-0063.20180043
19. Suqati AT, Basheikh M, Wali S, Sit S, Alomari AA, Alharbi RA, Yasawy MA. Sleep quality among adults and older adult who lives in Residential Care Center - RCC. Medical Science 2020; 24(101):421-428
20. WHO. Cardiovascular Diseases (cvds) 2021. https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
21. Yang Z, Heizhati M, Wang L, Li M, Pan F, Wang Z, Abudureyimu R, Hong J, Yao L, Yang W, Liu S, Li N. Subjective Poor Sleep Quality is Associated with Higher Blood Pressure and Prevalent Hypertension in General Population Independent of Sleep Disordered Breathing. Nat Sci Sleep 2021; 13:1759-1770. doi: 10.2147/NSS.S329024