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"NIGHT SLEEP DURATION AND RISK OF LIPID PROFILE ABNORMALITY IN NATIVE GUJARATI POPULATION"

Cardiology

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ABSTRACT

The association between sleep duration and serum lipid profile is unclear in the adult population. The aim of this study was to investigate and evaluate the relationships between sleep duration and levels of serum total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol (HDL-C) and triglycerides in adult gujarati population. A total of 1011 patients of age >18 years were included in this study and divided into 3 subgroups based on the duration of sleep. The lipid profile of these patients were analyzed and compared. The results indicated that long (≥9 hours) and short (≤5 hours) sleeping durations are associated with an increased risk of low HDL-C, High TC, LDL-C and TG level. This association was observed independent of age, sex and BMI. This study highlights the importance of optimum sleep with respect to lipid profile abnormalities and could be helpful in curbing the increasing incidence of dyslipidemia in this population.

KEYWORDS

INTRODUCTION:

Dyslipidemia is characterized by high levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG) and low levels of high-density lipoprotein cholesterol (HDL-C), and it increases the risk of cardiovascular disease (CVD) [1, 2] and hence remains an important issue in the field of health promotion and disease prevention.

Short or long sleep durations have been reported to be associated with a higher risk of obesity [3, 4], hypertension [5, 6], diabetes mellitus [7-9], CVD [10-11] and atherosclerosis [12].

In fact, the mechanisms underlying these relationships are still unclear. In recent years, several studies have examined the links between sleep duration and risk factors for CVD, including lipids [13–23]

To prevent CVD, it is important to identify and improve the risk factors (including sleep duration) associated with serum TG, HDL-C or LDL-C levels.

However, the findings have been inconsistent. Cross-sectional associations have been found between short sleep duration and lower HDL-C levels in adult American women with type 2 diabetes [21] and adult Japanese women from the general population [13]. Little is known about the longitudinal relationships among factors.

The Aims and Objectives of this study aimed to explore the association between sleep duration and each lipid profile abnormality stratified by age and sex.

MATERIAL AND METHODS

Study Design And Participants

This study was a cross-sectional study involving 1011 participants (Men,Women: Age: >18years) in the Native Gujarati population attending the SVP HOSPITAL during the study period. (September 2021 to April 2023)

Inclusion Criteria

- Gujarati native population.
- Age above 18 years (Both Gender)
- All apparently healthy patients presenting to the SVP Hospital for Health Checkups/OUTPATIENT DEPARTMENT/Geriatric clinic and willing to participate in the study.

Exclusion Criteria

- Cardiac diseases like hypertension, ischemic heart disease, and heart failure, any endocrine disorders [diabetes mellitus (DM), thyroid disorders, and Addison's disease],
- Chronic kidney disease,
- Chronic liver failure,
- Patients on cholesterol-lowering drugs
- Patients on antiplatelet drugs
- Addiction (smoker, alcoholic, tobacco chewer)
- A detailed history including previous morbidity/drug history was taken, and anthropometric measurement and clinical examination were carried out.

Anthropometry:

Height and weight measurements were taken, BMI was calculated in all study participants by standard Quetelet Index current weight (kg)/height (m^2) method and categorised based on WHO [24] recommendations; [(< 18.5kg/m2 -underweight; 18.5-24.9 kg/m2 - normal; 25.0-29.9 kg/m2 - overweight; ≥30.0 kg/m2 - obese)]. Body weight and standing height were measured according to consolidated technical standards and criteria.

Assessment of Sleep Duration

Sleep duration data were collected via self-reported answers to the question "How many hours of sleep have you had on an average at night in the preceding 1 month (excluding the times lying on the bed without sleeping)?" Adapted from the Pittsburgh Sleep Quality Index (PSQI), [25] and divided sleep durations into three groups according to the responses: ≤5 hours, 6 to 8 hours, and ≥9 hours.

Biochemical Analysis:

Baseline venous blood samples after a minimum of 8-h overnight fast were collected for estimation of biochemical tests from all enrolled study participants.

Biochemical analyses were performed and processed using ADVIA 1800 automated analyzer (Siemens Healthcare Diagnostics, USA). Venous blood samples were transported to the central laboratory of the hospital for lipid panel [total cholesterol (TC), high-density lipoprotein (HDL), triglycerides (TG), Direct low-density lipoprotein (LDL), and calculated very-low-density lipoproteins (VLDL)] measurement by homogeneous enzymatic colorimetric assay without precipitation was used.

Each lipid profile abnormality was defined According to the Adult Treatment Panel III guideline (ATP III).[26]

Statistical Methods

Data Analysis Tools

All data was entered into Microsoft Office Excel (Office version 365) in a spreadsheet and checked for errors and discrepancies. Data analysis was done using Windows based 'MedCalc Statistical Software' version 20.014 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.rorg; 2021).

Data Presentation

Data for the different parameters are expressed as means with standard deviation (SD) along with 95% confidence intervals (C.I.). Median and interquartile range (IQR) are also presented for the BMD data. Discrete and nominal data are presented as numbers with percentages.

Statistical Analysis

- The comparison of different sub-groups based on gender and sleep patterns are analyzed using one-way analysis of variance (ANOVA).
- Comparisons of nominal data are analyzed using the chi-square test.
- All analysis is done using two-sided tests at alpha 0.05 (95% confidence levels).

RESULTS

The baseline characteristics of the study participants are shown in Table1.

Table 1: Demography of patients in the study (n=1011)

	No.	% (n=1011)
Gender		
Male	659	65.2
Female	352	34.8
Age group		
18 - 20 yrs.	19	1.9
>20 - 30 yrs.	69	6.8
>30 - 40 yrs.	151	14.9
>40 - 50 yrs.	318	31.5
>50 - 60 yrs.	305	30.2
>60 - 70 yrs.	109	10.8
>70 - 80 yrs.	40	4.0
BMI category		
Underweight	27	2.7
Normal weight	409	40.5
Overweight	398	39.4
Obese	177	17.5
Total	1011	100.0%

The mean age of the participants was 48.57 years (range 18–80years), and 65.2% were men and 34.8% were women. (Table 2)

Table 2: Descriptives for demography of the patients (n=1011)

				95% C.I. for Mean			
	N	Mean	SD	Lower	Upper	Min.	Max.
Age (yrs.)	1011	48.57	12.27	47.81	49.32	18	80
Height (cm)	1011	161.08	8.25	160.57	161.59	60	193
Weight (kg)	1011	67.89	12.50	67.12	68.66	14	128
BMI(Kg/sq.m)	1011	26.19	4.69	25.90	26.48	12.35	49.77

The percentages of participants who reported sleeping for ≤5 h, 6 h to 8 h, and ≥9 h per night were 24.6, 68 and 7.4%, respectively. Table 3 shows the association between sleep duration and serum lipid level.

Table 3: Descriptives for lipid profile parameters in different sleep duration

		N	Mean	SD	95% C.I. for Mean		Min	Max	ANOVA	
					Lower	Upper			F	p
Total Cholesterol	≤5 hrs.	249	166.01	58.89	161.59	170.42	40	648	3.703	0.025
	6 - 8 hrs.	687	155.19	51.42	148.77	161.61	13	476		
	≥9 hrs.	75	156.33	64.74	141.44	171.23	43	461		
	Total	1011	162.63	57.76	159.06	166.19	13	648		
Triglycerides	≤5 hrs.	249	149.04	109.24	135.41	162.68	17	810	4.137	0.016
	6 - 8 hrs.	687	126.88	79.50	108.59	145.17	37	415		
	≥9 hrs.	75	163.67	123.67	154.40	172.93	21	1753		
	Total	1011	157.34	117.88	150.06	164.61	17	1753		
HDL-C	≤5 hrs.	249	37.19	12.44	36.26	38.13	1	127	0.953	0.386
	6 - 8 hrs.	687	39.44	13.71	36.73	42.15	4	82		
	≥9 hrs.	75	37.34	16.89	34.46	42.23	5	98		
	Total	1011	37.59	13.13	36.77	38.40	1	127		
LDL-C	≤5 hrs.	249	117.01	52.59	113.07	120.95	1.6	333.0	6.034	0.002
	6 - 8 hrs.	687	104.37	45.84	98.65	110.09	1.2	249.0		
	≥9 hrs.	75	107.21	59.41	93.54	120.88	13.0	345.6		
	Total	1011	113.17	51.81	109.97	116.37	1.2	345.6		
VLDL-C	≤5 hrs.	249	32.43	24.07	30.63	34.24	1.6	350.6	3.489	0.031
	6 - 8 hrs.	687	25.78	15.72	22.16	29.39	7.4	83.0		
	≥9 hrs.	75	29.84	21.85	27.12	32.57	5.8	165.0		
	Total	1011	31.30	23.08	29.88	32.73	1.6	350.6		
Cholesterol/ HDL-C Ratio	≤5 hrs.	249	4.50	3.00	4.12	4.87	0.4	39.0	1.702	0.183
	6 - 8 hrs.	687	5.12	5.25	4.73	5.51	1.5	97.8		
	≥9 hrs.	75	4.74	2.89	4.08	5.41	1.9	21.0		
	Total	1011	4.94	4.65	4.65	5.23	0.4	97.8		
LDL-C/ HDL-C Ratio	≤5 hrs.	249	2.98	1.89	2.74	3.21	0.0	23.8	3.841	0.022
	6 - 8 hrs.	687	3.45	2.65	3.25	3.65	0.0	49.4		
	≥9 hrs.	75	3.08	1.56	2.72	3.44	0.8	7.9		
	Total	1011	3.31	2.43	3.16	3.46	0.0	49.4		

Table 4 shows lipid profile abnormality with different sleep duration.

Table 4: Lipid profile abnormality and Sleep (n=1011)

	≤5 hrs. (n=249)		6 – 8 hrs. (n=687)		≥9 hrs. (n=75)		Chi-square test	
	No.	%	No.	%	No.	%	$\chi 2$	p
High TC	68	27.3%	100	14.6%	14	18.7%	4.769	0.029
Low HDL-C	160	64.3%	388	56.5%	50	66.7%	5.298	0.021
High LDL-C	95	38.2%	170	24.7%	27	36.0%	8.678	0.003
High TG	84	33.7%	282	41.0%	21	28.0%	7.950	0.005

	Correlation	
	r	p
High TC	0.368	0.030
Low HDL-C	0.472	0.021
High LDL-C	0.292	0.003
High TG	0.588	0.005

DISCUSSION

This cross-sectional study demonstrated that Short (≤5 h) as well as Long(≥9h) sleep duration was associated with significantly increased risk of low HDL-C , High TC, LDL-C and TG level [p value <0.05]. This association was observed independent of age, sex and BMI.

Several studies have reported the associations between serum lipid

profiles and sleep duration, although the results of these studies have been inconsistent [13-15, 20, 22, 27]. A National Health and Nutrition Survey in Japan showed a U-shaped (≤5 h, ≥9 h) relationship between sleep duration and a high level of TG and between sleep duration and a low level of HDL-C [13]. Consistent with this finding, a study from the China Health and Nutrition Survey (2009) involving 8574 adults showed that both shorter (≤6 h) and longer (≥10 h) sleep durations were associated with higher risks of abnormal serum lipid profiles [20]. However, two cross-sectional studies conducted in the USA and Japan showed that self-reported sleep duration was not associated with hypercholesterolemia [22, 27]. On the other hand, the Kansai Healthcare Study in Japan reported that moderate (5–7 h) and/or long (≥7 h) sleep durations decreased the risk of future low HDL-C and high TG levels [14]. Additionally, Juliana C. Chan et al. concluded that long (> 9.25 h) sleep duration was associated with lower risks of high TC and LDL-C in children and adolescents [15]. A recent analysis of 2705 participants from the National Health and Nutrition Examination Survey showed that short sleep duration was associated with low HDL cholesterol [28]. In contrast, long sleep durations were found to be associated with low HDL-C levels among a Korean adult population from the Korean National Health and Nutrition Examination Survey [18]. A survey from the Coronary Artery Risk Development Study involving 503 black and white adults aged 32–51 years showed that long sleep duration was associated with increased future TC levels and TG levels but not with HDL-C [17].

Differences in the age distribution of the study population, lifestyle, socioeconomic status, incomplete control for confounding factors, or different categorization and cutoff points of sleep duration may explain the inconclusive associations thus far. Several studies have found sex differences in the associations between sleep duration and abnormal serum lipid levels [19, 20]. Results from the National Health Interview Survey 2008 found sex differences in the association between sleep duration and hypercholesterolemia, with a positive association found between sleep duration ≤5 h and hypercholesterolemia in women and an inverse association found between sleep duration ≥8 h and hypercholesterolemia in men[19]. Data from the China Health and Nutrition Survey (2009) showed that both short and long sleep durations were associated with higher risks of abnormal serum lipid profiles in women but not in men [20].

However, the present study found no significant interaction between sleep duration and sex with respect to abnormal serum lipid levels and showed that no significant differences occurred in the sleep duration pattern between men and women.

Additionally, the current study found no significant interaction between sleep duration and age with respect to abnormal serum lipid levels. Further research is needed to investigate the association between sleep duration and serum lipid levels.

Study Limitations

- First, as participants belong to Gujarat, the cohort is not nationally representative and the generalizability of the current results to other geographic regions and to people of other racial/ethnic groups is not known.
- Second, data on sleep quality, such as difficulty falling asleep, excessive daytime sleepiness, and obstructive sleep apnea (OSA), were not collected in the current study.
- Third, the proportion of individuals in the Long (≥9h) sleep duration is very small compared with the proportions in other categories.
- Fourth, sleep duration data were collected through self-reported questionnaires. The use of more precise measures of sleep-related variables, such as polysomnography, may reduce variability.
- Finally, the current study was an observational study and we investigated only the association between baseline sleep duration and risk of dyslipidemia.
- Thus, we did not consider changes at each time point in sleep duration. Indeed, any subsequent alterations in sleep duration may lead to a nondifferential misclassification and potential underestimation of the sleep–dyslipidemia association.

CONCLUSIONS

In conclusion, the results of this study indicate that long and short sleep duration is associated with a low HDL–C, high LDL-C, TC and TG levels among the Gujarati population. The amount of sleep might play a key role in the risk of lipid profile abnormalities. Encouraging and supporting individuals to pursue 6 to 8 h of sleep per night may have significant beneficial effects towards stemming the growing incidence of dyslipidemia in Gujarat.

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