ORIGINAL RESEARCH ARTICLE

To Determine the Predictors for Sleep Quality in Young Adults Using Modifiable Lifestyle Factors for Noncommunicable Diseases: A Cross-sectional Study

Dimple Rawat[1], Anshu Sharma[2], Arti Gulati[3], Amit Kumar[4], Ram Sagar[5]

Abstract

Aims: To determine the predictors for sleep quality in young adults using modifiable lifestyle markers for noncommunicable diseases (NCDs) among adults aged 20–40 years.

Materials and methods: An exploratory study was conducted in New Delhi among 100 young adults aged 20–40 years in the year 2018, using a convenience sampling method. Body composition was assessed using Tanita UM-075. The relationship between the variables was measured with Spearman correlation analysis. Multivariable logistic regression analysis was conducted to determine the predictors for poor sleep quality. The receiver operating characteristics (ROC) curve was used to determine the predictive accuracy of the model.

Results: Among all, 57% had sound quality sleep followed by 43% with disturbed; 23% were highly stressed, 71% moderately, and 6% low stressed. Significant correlation between sleep quality and risk factors for NCDs like body mass index (BMI) ($r = 0.8111$, $p < 0.001$), waist circumference ($r = 0.6661$, $p < 0.001$), body fat percentage ($r = 0.3692$, $p = 0.002$), visceral fat ($r = 0.68$, $p < 0.001$), stress score ($r = 0.092$, $p = 0.36$), muscle mass (MM) ($r = 0.36$, $p = 0.0002$). High BMI was observed to be an independent predictor for disturbed sleep quality (odds ratio 4.31, 95% CI 1.98–9.38). The area under the curve for the prediction of sleep quality was observed 0.97% using a combination of BMI, MM, duration of sleep.

Conclusion: High BMI was observed to be an independent predictor (4.31 times higher) for the disturbed sleep quality.

Clinical significance: Lifestyle modifiable factors should be looked upon when dealing with patients with disturbed sleep quality.

Keywords: Anthropometry, Body composition, Noncommunicable disease, Sleep quality.

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Highlights

- High BMI could be a predictor for the disturbed sleep quality
- Disturbed sleep quality is a risk factor for developing NCDs

Introduction

Nutrition, exercise, and sleep are the major three pillars on which a healthy and happy life is based. As we spend about a third of our lives sleeping, it forms a large, important, and familiar part of everyone's life. We are born with an average life expectancy of 85 years minimum and around 122 years maximum, however, because of drastic lifestyle changes our life expectancy has decreased more due to noncommunicable diseases (NCDs) than due to infectious diseases; a majority of which are under control.

Presently, NCDs all over the world are the leading cause of death and disability. They progress slowly and gradually, over a long time and hence are chronic in nature. Cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers are examples of the most common NCDs. They are the biggest cause of mortality across the world. According to the Global Status Report, in 2012, out of 56 million deaths, 38 million deaths (68%) occurred due to NCDs of which more than 40% were premature, occurring before the age of 70 years. Approximately 80% of these NCD diseases occur in low and middle-income countries.[1]

Over the last 2 decades, sleep deprivation has become one of the biggest public health problems worldwide.[2] According to the National Health Portal of India (2018), inadequate or unsatisfactory sleep is becoming a serious health issue of modern living. The rush to meet the targets in the work, nuclear family, lifestyle, urbanization, frequent travel to different time zones, shift work, a long-distance journey between home and workplace are all contributing towards ill health and becoming a slow killer.[3] Sleep is one of the basic necessities for healthy living. Sound and adequate sleep help in improving the quality of life.

Many studies have been carried out to determine the association between sleep quality and body mass index (BMI). The results from some studies indicate an association between the two leading to an increased likelihood of being overweight/obese, while

[1,3]Department of Clinical Epidemiology Unit, AIIMS, New Delhi, India

[2]Department of Food and Nutrition, Institute of Home Economics, New Delhi, India

[4]Department of Neurology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India

[5]Department of Genetic Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland, United States of America

Corresponding Author: Anshu Sharma, Department of Food and Nutrition, Institute of Home Economics, New Delhi, India, Phone: +91 9810117301, e-mail: anshusharma2006@gmail.com

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others reported no association. The population of young adults is at a higher risk since it goes through lifestyle changes in terms of settling down in personal and professional life, extensive electronic media use, and academic demands, which can potentially lead to insufficient and disturbed quality sleep,[4] often accompanied with poor diet[5] and lack of physical activity.[6] However, more studies need to be carried out to determine the simultaneous association between sleep duration and sleep quality with BMI in young adults. Thus, the present study was planned to determine the predictors for sleep quality in young adults using modifiable lifestyle factors for NCDs.

Study Rationale

There is increasing evidence showing that short sleep duration and disturbed sleep quality are associated with cardiovascular disease. However, there is little or no information (to the best of our knowledge), on if there is any prediction model for sleep quality in young adults using modifiable lifestyle factors for NCDs.

Materials and Methods

The study protocol was approved by the Institutional Ethics Committee of the Institute of Home Economics, University of Delhi (Ethics reference number: **IHE/2017/1859**).

Eligibility Criteria

All the subjects who were aged between 20 and 40 years and were willing to participate were included in the study. Individuals with confirmed NCDs, physical challenges, and pregnant and lactating mothers were excluded from the study.

Study Design and Participants

The present study was an exploratory study done in New Delhi among 100 young adults (50 males and 50 females) aged 20–40 years in the year 2018, using a convenience sampling method.

Locale of Investigation

This cross-sectional study was carried out in urban areas of the New Delhi region.

Anthropometry Assessment

Height

An anthropometric stadiometer was used for taking the height. The stadiometer had a sensitivity of 0.1 cm. The subjects were made to stand on a flat surface, without shoes. To avoid errors, the readings were taken in duplicate. The head was positioned that the Frankfurt plane is horizontal, feet together, knees straight, heels, buttocks, and shoulder blades in contact with the vertical surface of wall and arms hanging at the site owner relaxed manner. The accuracy of the tape in the stadiometer was tested against a standard steel tape. The accuracy of the unwinding of the tape was checked by checking whether the zero and 200 cm marks lie against the red line on the windows when the tape is fully wound and fully unwound.

Weight

Tanita-UM075 was used to measure the weight of the participants. Standardization of the instrument was done every week to take care of zero error and minimize intra-investigator error. The subject was asked to stand on the weighing balance without shoes and with minimum clothing. The subject had to look straight with hands-on sides while the investigator took the reading.

Body Mass Index

BMI was calculated using the standard metric formula (weight in kgs/height in meters).[2]

Waist Circumference

Waist circumference (WC) was measured using a nonstretchable fiber-glass tape. The WC measurement was made at minimal inspiration to the nearest 0.1 cm, midway between the last rib and the iliac crest.

Body Composition

Tanita UM075 was used to assess the body composition of the subjects. It can weigh up to 150 kg and has percent body fat increments of 0.1%. Tanita is based on bioelectrical impedance analysis (BIA). With BIA one can get a quick overview of the fat percentage, visceral fat (VF), muscle mass (MM), etc., in a body. It's a fast and safe technique that's become very popular for its ease of use. All necessary precautions were taken before taking these readings.

Sleep Duration Assessment

In this present study, a 1-week follow-up was done with the subjects to collect data on their self-reported sleep duration and quality of sleep. For continuously 1-week, data were collected via WhatsApp/email/text messages. Data regarding their quality of sleep were collected by rating their last night's sleep on a likelihood scale that it was a sound or disturbed sleep. Online media was used to collect data as it is economical, time-effective, user friendly, and easily accessible.

Stress Profile Assessment

The stress profile was assessed using perceived stress scale (PSS) by Cohen. PSS scale is a self-report measure of stress. On this scale, each item is rated on a 5-point scale ranging from never (0) to almost always (4). Positively worded items are reverse scored, and the ratings are summed, with higher scores indicating more perceived stress.

Data Analysis

The information obtained from the participants was consolidated and analyzed using suitable statistical formulas and tests. Data were entered and analyzed using STATA. $p < 0.05$ is considered as the degree significant association. To examine the association of sleep quality with BMI, WC, body fat percentage (BF%), VF, MM, and Perceived Stress; Spearman correlation analysis was used. Multivariable logistic regression analysis was conducted to determine the predictors for disturbed sleep quality. ROC curve was used to determine the predictive accuracy of the model.

Results

The selected sample ($N = 100$) was in the age-group of 20–40 years. Of these, 64% were not married whereas 36% were married. In the present study, the majority of subjects belonged to the student category (29%) followed by private job (27%), government job (26%), homemaker (10%), self-employed (7%), and only 2% were found to be involved in the business. About two-thirds of the subjects belonged to nuclear families and one-third lived in joint families.

None of the subjects was illiterate. About 14% of them had education till school level, 38% were graduates, and 48% were postgraduates.

A summary of the data giving the health profile of the subjects is shown in Table 1. In the present study, it was observed that 69% of the subjects were either overweight or obese, 28% had normal BMI, and 3% were underweight (according to Asian Classification for BMI). About 57% of the subjects had high WC and hence were at risk of developing NCDs.

A detailed body composition analysis of the subjects (as assessed by Tanita UM-075—based on bioelectrical impedance) indicated that about 53% had normal fat percentage whereas 40% of them were overfat. The data also indicated that 15% of the subjects had high VF.

As per the guidelines given by National Sleep Foundation, 81% of all subjects had less than 7 hours of sleep followed by 18% having 7–9 hours and only 1% of the subject had the sleep of more than 9 hours. Among all, 43% of subjects were having a disturbing quality of sleep.

Almost two-thirds of the subjects (71%) were found to be in the moderately stressed category.

Univariate logistic regression analysis (Table 2) suggested that the two groups—namely, with sound sleep and disturbed sleep, were balanced in terms of gender ($p = 0.8419$), age ($p = 0.4679$), and Perceived Stress ($p = 0.3648$).

Significant differences between sound sleep and disturbed sleep were observed for self-reported sleep duration ($p = 0.009$), BMI ($p < 0.001$), WC (<0.001), body fat percentage (BF%) (0.0002), VF (<0.001), MM (0.0002). A high correlation was observed between the BMI and WC, self-reported sleep duration, and BF% (Fig. 1A).

The multivariable model included the BMI, MM, and VF for the determination of independent predictors for sleep quality (Table 3). It was observed that BMI was an independent predictor for sleep quality with an odds ratio (OR) of 4.31 and 95% CI 1.98–9.38 (Table 3). This model was observed to have a predictive accuracy of 97% as shown by the area under the curve (Fig. 1B). Stratified analysis was carried out keeping gender as the strata. Remarkable 9.19 times higher odds to develop disturbed sleep quality was noted in the case of male subjects with high BMI while in female subjects, 3.14 times higher probability to develop disturbed sleep quality was observed with higher BMI (Table 4).

Table 1: Percent distribution of basic descriptive health parameters of the study participants ($N = 100$)

Distribution of subjects according to their BMI (as per Asian BMI classification)	
Underweight	3
Normal	28
Overweight	19
Obesity	50
Distribution of subjects based on their waist circumference	
Normal	43
At risk	57
Distribution of subjects based on their body fat percentage (Tanita-UM075 manual)	
Underfat	7
Normal	53
Overfat	40
Obese	—
Distribution of subjects based on their visceral fat (Tanita-UM075 manual)	
Normal	85
At risk	15
Self-reported sleep quality of 1 week of the subjects	
Sound Sleep	57
Disturbed Sleep	43
Self-reported sleeping pattern (no. of hours per day) of 1 week of the subjects	
<7 hours	81
7–9 hours	18
>9 hours	1
Distribution of subjects based on their stress score	
Low stress	6
Moderate stress	71
High stress	23

Table 2: Univariate analysis to determine the predictors for the sound quality of sleep and disturbed quality

Predictors	*Sound sleep (n) ± SD*	*Disturbed sleep (n) ± SD*	*p value*
Gender	57 ± 0.50	43 ± 0.50	0.84
Age	26.92 ± 5.29	28.16 ± 6.42	0.46
Self-reported sleep duration	6.29 ± 1.20	5.67 ± 0.83	0.0092
Body mass index (BMI)	22.53 ± 2.56	29.27 ± 3.06	0.000
Waist circumference (WC)	76.57 ± 14.11	93.35 ± 10.09	0.000
Body fat percentage (BF%)	23.17 ± 9.93	30.28 ± 9.09	0.0002
Visceral fat (VF)	5.19 ± 3.23	11.09 ± 2.70	<0.001
Muscle mass (MM)	43.51 ± 11.10	52.65 ± 11.26	0.0002
Perceived stress score (PSS)	21.07 ± 5.47	22.35 ± 4.55	0.36

Table 3: Multivariate analysis to determine the independent effect of predictor for the poor quality of sleep

Predictors	*Odds ratio*	*95% CI*	*p value*
Body mass index (BMI)	4.31	1.98–9.38	<0.001
Muscle mass (MM)	0.94	0.86–1.03	0.86
Visceral fat (VF)	0.99	0.71–1.40	0.99

Table 4: Multivariate analysis gender-wise

	Odds ratio (95% CI)	
Predictors	*Male*	*Female*
Body mass index (BMI)	9.19 (1.97–42.77); $p = 0.005$	3.14 (1.06–9.29); $p = 0.038$
Muscle mass (MM)	0.97 (0.73–1.27); $p = 0.835$	0.83 (0.58–1.18); $p = 0.310$
Visceral fat (VF)	0.64 (0.27–1.52); $p = 0.316$	1.28 (0.83–1.96); $p = 0.257$

	Age	Sleep in hs	Quality	Gender	WC	BFP	BWP	VF	MM	WTH	BINI	SS
Age	1.0000 100											
Sleep in hs	0.0626 100 0.5358	1.0000 100										
Quality	0.0734 100 0.4679	-0. 2591 100 0.0092	1.0000 100									
Gender	-0.1075 100 0.2872	-0.0426 100 0.6736	-0.0202 100 0 . 8419	1.0000 100								
WC	0.1639 100 0.1033	-0.1685 100 0.0938	0.6661 100 0.0000	-0.2378 100 0.0172	1.0000 100							
BFP	-0.0769 100 0.4468	-0.0717 100 0.4785	0.3692 100 0.0002	0.6366 100 0.0000	0.2759 100 0.0055	1.0800 100						
BWP	0.1561 100 0.1209	0.0976 100 0.3340	- 0. 2316 100 0.0204	-0.7066 100 0.0000	-0.1031 100 0.3073	-0.7731 100 0.0000	1.0000 100					
VF	0.1459 100 0.1476	-0.2043 100 0.0415	0.6828 100 0.0000	-0.0675 100 0.5046	0.7733 100 0.0000	0.4600 100 0.0000	-0.2498 100 0.0122	1.0000 100				
MM	0.0779 100 0.4412	-0.1051 100 0.2980	0. 3692 100 0.0002	-0.7374 100 0.0000	0.6018 100 0.0000	-0.3122 1.00 0.0016	0.4178 100 0.0000	0-5102 100 0.0000	1.0000 100			
WTH	0. 2538 100 0.0109	-0.1832 100 0.0680	0.6589 100 0.0000	0.0333 100 0.7425	0.8944 100 0.0000	0.3989 1.00 0.0800	-0. 2160 100 0.0309	0.7226 100 0.0000	0.3180 100 0.0013	1.0000 100		
BMI	0.1898 100 0.0586	-0.2117 100 0.0345	0.8111 100 0.0000	-0.0748 100 0.4593	0.8518 100 0.0000	0.4173 100 0.0800	-0.2368 100 0.0177	0.8619 100 0.0000	0.5419 100 0.0000	0.8283 100 0.0000	1.0000 100	
SS	0.1040 100 0.3031	-0.1417 100 0.1597	0.0916 100 0.36411	0.1480 100 0.1417	0.0528 100 0.6015	0.3458 1.00 0.0004	-0.1881 100 0.0609	0.1532 100 0.1281	-0.1339 100 0.1841	0.1145 100 0.2565	0.1313 100 0.1927	1.0000 100

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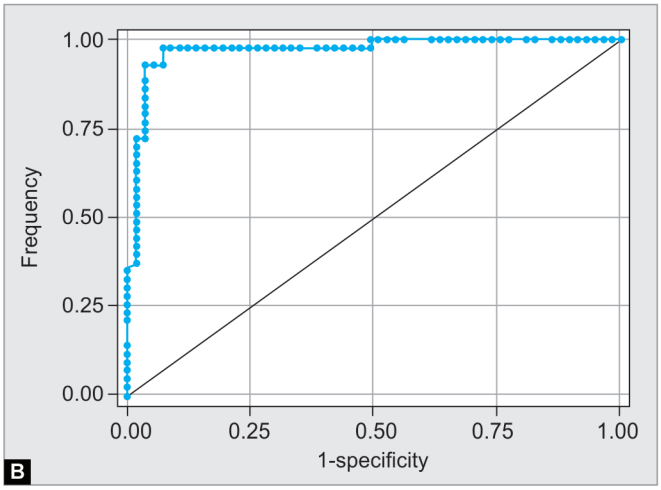

Figs 1A and B: (A) Correlation matrix for study variables. WC, waist circumference; BFP, body fat percentage; BWP, body water percentage; VF, visceral fat; MM, muscle mass; WTH, waist to height ratio; BMI, body mass index; SS, stress score; (B) Area under the curve for the prediction of sleep quality

Discussion

Our analyses revealed that subjects with an increased likelihood of being overweight/obese were associated with disturbed sleep quality. Similarly, another study conducted in 2019 by Hawes et al., revealed a positive association of BMI with sleep apnea (p <0.0001).[7] A study by Hung et al.,[8] which was conducted on a large Chinese population sample (N = 2803), showed that those participants who were overweight/obese had a 40.0 and 60.0% higher risk of being disturbed sleepers. As for the association between long sleep and BMI, the mechanism underlying the association between sleep quality and BMI is still unclear.[8] It has been documented that disturbed sleep quality changes appetite regulation mechanisms, possibly leading to poor food choices and an increased caloric intake.[9,10] A cross-sectional study conducted by Kristicevic et al., in 2018, among 2,100 university students showed an association of poor sleep quality of overweight/obesity with poor sleep quality.[11] Another study conducted by Bonanno et al. on 199 subjects including seven adults concluded quality of sleep as a risk factor of overweight and obesity.[12]

To the best of our knowledge, this is the first study that shows BMI as a predictor for disturbed sleep quality. The analysis showed that BMI is a strong predictor for disturbed sleep quality in male subjects with a very high OR of 9.1. In univariate analyses, an association was found between disturbed sleep quality and predictors like sleep duration, BMI, BF%, VF, and MM having a p <0.001. After adjusting the confounding effects of variables that could distort the study results, it was observed that BMI is an independent predictor for disturbed sleep quality (OR 4.31).

Conclusion

The current study helps to understand that a high BMI is an independent predictor for disturbed sleep quality (OR 4.31, 95% CI 1.98–9.38).

Limitations

This study has a few limitations. First, this study was cross-sectional; we cannot exclude the possibility of reversing the disturbed sleep pattern to sound sleep pattern provided the BMI of the subjects is brought to normal. Second, we used self-reported data to assess sleep patterns and sleep quality. Although subjective, a very good correlation has been presented between self-reported and measured BMI.

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Orcid

Dimple Rawat https://orcid.org/0000-0002-1238-5900
Amit Kumar https://orcid.org/0000-0003-0970-5333
Ram Sagar https://orcid.org/0000-0002-4297-2639

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