Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2020, 9(11): 39-45

Physical Activity Affects the Sleep Quality of Women in Saudi Arabia: A Prospective Follow-up Study

Huda S AL-Raddadi[1*] and Sami Abdo Radman Al-Dubai[2]

[1]Department of family and Community Medicine, Taibah University, Al Madinah, Saudi Arabia

[2]Joint Program of Preventive Medicine Post Graduate Studies, Ministry of health, Al Madinah, Saudi Arabia

**Corresponding e-mail: Huda.s.alradaay@hotmail.com*

ABSTRACT

Objectives: *The prevalence rates of sleep insufficiency and physical inactivity are increasing worldwide. Accumulating evidence indicates a relationship between physical inactivity and sleep disturbance. This study aimed to determine the impact of physical activity on sleep quality and body mass index in women in Saudi Arabia.* ***Methods:*** *This prospective study included 63 women at sport clubs in Medina, Kingdom of Saudi Arabia. The study was conducted between June 2019 and August 2019. All participants were followed up for 3 months. Sleep quality was measured using the validated Pittsburgh sleep quality index, and physical activity was measured using the validated international physical activity questionnaire. Sleep quality and body mass index were compared at baseline and after 3 months using paired t-tests.* ***Results:*** *Physical activity improved sleep quality (p=0.034) and reduced BMI (p=0.002) significantly.* ***Conclusion:*** *Physical activity improves sleep quality and decreases body mass index.*

Keywords: Adult, Exercise, Physical activity, Saudi Arabia, Sleep quality, Women

Abbreviations: BMI: Body Mass Index; KSA: Kingdom of Saudi Arabia; PA: Physical Activity; SQ: Sleep Quality

INTRODUCTION

Current evidence suggests that regularly sleeping at least 7 hours per night is essential for good physical health of adults aged 18 to 60 years [1]. Sleep deprivation (failure to obtain adequate amount of sleep) has become a serious problem because of its negative impact on well-being [1,2]. The prevalence of sleep deprivation is approaching 33% in the Kingdom of Saudi Arabia (KSA) and is higher among Saudi women than Saudi men (37.3% versus 31.4%) [3].

In addition, nearly 23% of adults globally are physically inactive [4]. In KSA, the prevalence of physical inactivity ranges from 50% to 85% in men and from 73% to 91% in women [4-7]. According to the World Health Organization, adults aged 18-64 years should do at least 150 minutes of moderate-intensity physical activity throughout the week [8]. Recent studies have found a positive relationship between Physical Activity (PA) and sleep [9]. Notably, three studies in KSA showed that PA correlated significantly with sleep duration [10-12]. However, the associations of PA and physical fitness with Sleep Quality (SQ) remain unclear. Some studies have shown no association [13], but others concluded the opposite [14-16].

This study aimed to investigate the impact of PA on SQ and Body Mass Index (BMI) in women aged >18 years in Medina, KSA. To the best of our knowledge, this is the first prospective study to investigate the effect of PA on SQ and BMI in Saudi women.

MATERIALS AND METHODS

Study Setting and Participants

This prospective follow up study was performed at four women sport clubs in Medina and included 63 women. The study was carried out between June 2019 and August 2019. Women who applied for new registration in the sport clubs were recruited until the target number of participants was reached. Each woman filled a self-administered questionnaire on the first day when she joined the sport club and then the same self-administered questionnaire 3 months later. The questionnaire was prepared in the Arabic language.

Women aged ≥18 years who spoke Arabic were included in the study. Pregnant women were excluded. The study sample size was calculated to be 53 with a power of 80%, 95% CI, and a level of significance of 5% (two-sided). To compensate for the non-response and loss to follow up, an additional 20% was added to the sample size [17]. Therefore, a total of 63 women were included in this study.

Ethical approval for this study was obtained from the Ethics Committee of the Directorate of Health in Al-Madinah. The benefits and objectives of the study were explained to the participants. Confidentiality and anonymity of the participants was assured. All participants signed an informed consent form. Contact information was provided by the participants, and data were collected from each participant at baseline and after 3 months.

Study Instruments

Sociodemographic variables and health status: Sociodemographic variables included age, marital status, number of children, family income, education level, employment status, chronic diseases (such as asthma and diabetes mellitus), shisha smoking, and cigarette smoking. Smoking was measured according to the Global Tobacco Surveillance System [18]. The participants rated their health by answering one question: How would you grade your health status? Answers were ranked based on a Likert-type scale as follows: (1) very bad, (2) bad, (3) fair, (4) good, and (5) excellent. Participants self-reported their height in centimeters (cm) and weight in kilograms (kg).

International physical activity questionnaire: To assess PA, we used the validated Arabic short version of the international physical activity questionnaire [19]. The questionnaire collects information about the time and number of days spent in PA. Participants were categorized as high active, moderately active, or low active.

SQ assessment: The validated Arabic version of the Pittsburgh sleep quality index was used to measure the quality and pattern of sleep in adults. Cronbach's alphas are 0.80 for the original English version and 0.65 for the Arabic version [20,21]. The scale examined SQ retrospectively over a 1-month period and assessed different SQ components, including subjective SQ, sleep latency, sleep duration, sleep efficiency, sleep troubles, use of sleeping pills, and daytime dysfunction. Each component was ranked from 0 to 3, with 3 indication the worst condition of that particular component. The sum of the scores of these seven components provides a single total SQ score. The highest possible Pittsburgh sleep quality index score is 21. High scores were suggestive of poor SQ. Scores less than or equal to 5 (0 to 5) indicate normal SQ, and scores above 5 indicate poor SQ.

Statistical Analysis

Each questionnaire received a unique code, and every response was coded with numerical indicators. Descriptive & inferential data analysis were performed using SPSS Version 25. The normality test was conducted and showed that the data were normally distributed.

Continuous variables were presented as mean ± standard deviation (SD), and categorical variables are presented as frequency and percentage. T-test and ANOVA tests were used to compare mean SQ score across the study variables. A paired t-test was used to assess SQ and BMI before and after practicing exercise. Statistical significance was established at $p<0.05$.

RESULTS

A total of 63 women participated in this study. Mean (SD) age was 25 (6.6) years, and mean (SD) BMI was 28.2 (8) (Table 1). Most of the participants were singles (71.4%), non-smokers (82.5%), and students (65.1%); did not have kids (90.5%); and had a university level of education (68.2%). Most of the participants worked during the daytime only (73.7%) and had a family income of less than 10000 Saudi riyals (65.2%). Approximately 22.2% of the participants had a chronic disease, and 3.2% were not satisfied with their health. More than 87% of the study participants claimed that they used smartphones during bedtime. The average smartphone use was above 7 hours per day. At the

start of the study, 23.8% of the participants were physically inactive.

Table 2 describes sleep characteristics at baseline. More than half of the study participants (52%) had poor SQ. Mean (SD) sleep duration was 7 (2.6) hours per night, and the mean (SD) sleep onset latency was 25 (20.26) minutes. The mean sleep onset latency decreased from 25.2 minutes at baseline to 21.2 minutes at the end of the study. At the start of the study, 28.6% of the study participants claimed that they took sleep pills at least one time per month; this number was decreased to 20.6% at the end of the study.

Table 3 shows the association between the SQ score and participants' characteristics at baseline. No significant association was found. Table 4 represents the results of the paired t-test. There were a significant improvement in SQ (p=0.034) and a significant decrease in BMI (p=0.002) after PA.

Table 1 Baseline sociodemographic and other health characteristics of participants

Variables	N (%)	Variables	N (%)
Age (years)		**Shift work**	
≤ 25	42 (66.7%)	Day shift	28 (73.7%)
≥ 26	21 (33.3%)	Night shift	3 (7.9%)
BMI (kg/m^2)		**Family income**	
<18	5 (7.9%)	<3000	10 (15.9%)
18-25	20 (31.7%)	3000-5999	11 (17.5%)
25.1-30	16 (25.4%)	6000-9999	20 (31.8%)
30.1-40	15 (23.8%)	10000-18000	17 (27%)
> 40	7 (11.1%)	>18000	5 (7.9%)
Mean (SD)	28.2 (8%)		
Marital status		**Smoking cigarette**	
Single	45 (71.4%)	Yes	8 (12.7%)
Married	13 (20.6%)		
Engaged	3 (4.8%)	No	55 (87.3%)
Divorced or widowed	2 (3.2%)		
Children		**Smoking water pipe**	
Yes	6 (9.5%)	Yes	6 (9.5%)
No	57 (90.5%)	No	57 (91.5%)
Education level		**Chronic disease**	
Less than university	20 (31.8%)	Yes	14 (22.2%)
University	43 (68.2%)	No	49 (77.8%)
Employment		**Health satisfaction**	
Student	41 (65.1%)	Excellent	16 (25.4%)
Not employed	8 (12.7%)	Very good	20 (31.7%)
Private sector	8 (12.7%)	Good	16 (25.4%)
Government sector	6 (9.5%)	Acceptable	9 (14.3%)
		Bad	2 (3.2%)
Using smartphone at bedtime		**Physical activity level**	
Yes	55 (87.3%)	Low	15 (23.8%)
No	8 (12.7%)	Moderate	23 (36.5%)
		High	25 (39.7%)

		Smart phone use (hours per day)	
		<6	19 (32.2%)
		6 h-10 h	31 (52.5%)
		≥ 10	13 (15.3%)
BMI: Body Mass Index			

Table 2 Sleep characteristics at baseline

Variables	**Frequency (%)**
Pittsburgh sleep scores	
Good	30 (47.6%)
Bad	23 (52.4%)
Mean (SD)	7.9 (4.5%)
Sleep duration (hours)	
≥ 7	32 (55.2%)
<7	31 (44.8%)
Mean (SD)	7 (2.6%)
Sleep efficiency	
>85%	26 (45.6%)
75%-84%	13 (22.8%)
65%-74%	10 (14%)
<65%	14 (17.5%)
Sleep onset latency (minutes)	
<15	27 (47.4%)
16-30	13 (22.8%)
31-60	17 (29.8%)
Mean (SD)	25.67 (20.26%)
Sleep pills	
Yes	18 (28.6%)
No	45 (71.4%)

Table 3 Relation between sleep quality and participants' characteristics at baseline

Variables	**Mean**	**SD**	**p-value**	**Variables**	**Mean**	**SD**	**p-value**
BMI (kg/m^2)				**Family income**			
<18	8.8	4.7	0.34	<3000	5.6	2.5	0.45
18-25	8.7	4.3		3000-5999	9.1	4	
25.1-30	6.7	5.1		6000-9999	8.2	4.5	
30.1-40	9.1	4.8		10000-18000	8.5	5.5	
>40	5.7	1.8		>18000	7	4.7	
Marital status				**Shift work**			
Single	8.2	4.8	0.48	Day shift	8.5	5.4	0.5
Married	7.2	3.8		Night shift	11.6	2.5	
Engaged	5.3	1.5		Both	7.7	2.6	
Kids				**Educational Level**			

Yes	6.7	3.8	0.35	Less than university	7.4	3.8	0.14
No	8	4.6		University	8.1	4.9	
Health satisfaction				**Employment**			
Excellent	6	4.8	0.07	Student	7.1	4.6	0.43
Very good	8.6	4.2		Not employed	9.2	2.8	
Good	7.2	3.1		Private sector	8.4	3.8	
Acceptable	11.1	5.5		Government sector	9.8	5.7	
Bad	6.5	3.5					
Chronic diseases				**Cigarette smoking**			
Yes	10.3	4.6	0.89	Yes	4.5	3.3	0.30
No	7.6	4.5		No	8.3	4.5	
Using smartphone at bedtime				**Water pipe smoking**			
Yes	8	4.3	0.28	Yes	8.8	5.3	0.62
No	6.8	5.7		No	7.8	4.5	
Smartphone use (hours per day)							
<36	7	3.6	0.20				
6-10	7.9	5.2					
>10	10.2	4.1					
BMI: Body Mass Index							

Table 4 Difference in SQ and BMI at baseline and after 3 months

Variables	At baseline		After 3 months		Mean differences	SD	CI 95%	p-value
	Mean	SD	Mean	SD				
SQ	7.9	2.5	6.5	1.3	1.4	4.9	0.1-2.6	0.034*
BMI (kg/m2)	28.2	8	27.1	7.6	1.1	2.6	0.4-7.7	0.002*
SQ: Sleep Quality; BMI: Body Mass Index; * Significant p-values								

DISCUSSION

This study found that 52.4% of women had insufficient sleep, and the total sleeping time was much less than the recommended 7 hours per night [1]. This is not unexpected as the prevalence of poor SQ among the Saudi population is 33.8% [3], and it is higher among women than men (37.3% versus 31.4%) [3]. Women have a higher prevalence of poor SQ and physical inactivity. For instance, one study in Saudi Arabia showed that a great proportion of the females had insufficient sleep, and PA significantly correlated with sleep duration [10]; poor SQ was frequently observed among undergraduate female students (54%) in eastern Saudi Arabia, with a mean total sleep duration of 5 h/day, and was associated with low PA [11]. Similarly, the current study indicates that practicing PA improves SQ among women (p=0.034). However, the association of PA and physical fitness with SQ remain controversial. Some studies have shown no association [13], but a meta-analytical review found that regular PA had little effect on sleep efficiency, and moderate positive effect on sleep onset latency and SQ [22].

Indeed, exercise would promote cardiorespiratory fitness and thus solve sleep problems, including sleep apnea and insomnia [23]. The improvement of these disorders with exercise could then lead to a good metabolic control and physiological benefits, such as body temperature, heart rate, metabolic rate, blood pressure, and blood glucose control [23]. However, a recent randomized controlled trial found that a 1-week sedentary behavior-inducing intervention had a statistically significant negative effect on overall SQ, indicating sedentary behavior worsened SQ [24]. In older adults, exercising for a long period leads to better SQ [25-29]. In addition, Harp evaluated the effects of a 15-week aerobic exercise intervention on sleep in young adults [30]. The study showed improved SQ and BMI after the intervention

[30]. Consistent with the findings of earlier research, the findings of our present research have demonstrated that PA improves SQ and BMI. Taken together, these findings indicate that regular exercise improves SQ.

There are some limitations to this study. First, a control group was not included in this study. This study only compared changes between pre- and post-exercises in one study group. Second, the sample size was relatively small. Third, we used the subjective measurement of PA and SQ in this study.

CONCLUSION

The present findings indicate that PA has an independent effect on the improvement of subjective SQ and BMI. Our findings on SQ and PA were mainly based on subjective estimates; thus, further studies are needed to determine objective measures of PA and sleep by polysomnography or ambulant sleep recording devices.

DECLARATIONS

Source of Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Consensus Conference Panel, et al. "Joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society on the recommended amount of sleep for a healthy adult: Methodology and discussion." *Sleep,* Vol. 38, No. 8, 2015, pp. 1161-83.

[2] Shankar, Anoop, et al. "Insufficient rest or sleep and its relation to cardiovascular disease, diabetes and obesity in a national, multiethnic sample." *PloS One,* Vol. 5, No. 11, 2010, p. e14189.

[3] Ahmed, Anwar E., et al. "Prevalence of sleep duration among Saudi adults." *Saudi Medical Journal,* Vol. 28, No. 3, 2017, pp. 276-83.

[4] Al-Hazzaa, Hazzaa M. "Physical inactivity in Saudi Arabia revisited: A systematic review of inactivity prevalence and perceived barriers to active living." *International Journal of Health Sciences,* Vol. 12, No. 6, 2018, pp. 50-64.

[5] Al-Zalabani, Abdulmohsen H., et al. "The prevalence of physical activity and its socioeconomic correlates in Kingdom of Saudi Arabia: A cross-sectional population-based national survey." *Journal of Taibah University Medical Sciences,* Vol. 10, No. 2, 2015, pp. 208-15.

[6] El Bcheraoui, Charbel, et al. "Low uptake of periodic health examinations in the Kingdom of Saudi Arabia, 2013." *Journal of Family Medicine and Primary Care,* Vol. 4, No. 3, 2015, pp. 342-6.

[7] Al-Hazzaa, Hazzaa M., et al. "Patterns and determinants of physical activity among Saudi adolescents." *Journal of Physical Activity and Health,* Vol. 11, No. 6, pp. 1202-11.

[8] World Health Organization. Prevalence of insufficient physical activity, 2020. https://www.who.int/gho/ncd/risk_factors/physical_activity_text/en/.

[9] Hartescu, Iuliana, et al. "Increased physical activity improves sleep and mood outcomes in inactive people with insomnia: A randomized controlled trial." *Journal of Sleep Research,* Vol. 24, No. 5, 2015, pp. 526-34.

[10] Alzamil, Hana A., et al. "A profile of physical activity, sedentary behaviors, sleep, and dietary habits of Saudi college female students." *Journal of Family and Community Medicine,* 2019, Vol. 26, No. 1, pp. 1-8.

[11] Al-Otaibi, Hala. "Associations between sleep quality and different measures of obesity in Saudi adults." *Global Journal of Health Science,* Vol. 9, No. 1, 2017, pp. 1-9.

[12] Al-Hazzaa, H.M., et al. "Lifestyle correlates of self-reported sleep duration among Saudi adolescents: A multicentre school-based cross-sectional study." *Child: Care, Health and Development,* Vol. 40, No. 4, 2014, pp. 533-42.

[13] Kakinami, Lisa, et al. "Associations between physical activity and sedentary behavior with sleep quality and quantity in young adults." *Sleep Health,* Vol. 3, No. 1, 2017, pp. 56-61.

[14] Durcan, Laura, et al. "The effect of exercise on sleep and fatigue in rheumatoid arthritis: A randomized controlled study." *The Journal of Rheumatology,* Vol. 41, No. 10, 2014, pp. 1966-73.

[15] Loppenthin, Katrine, et al. "Effect of intermittent aerobic exercise on sleep quality and sleep disturbances in patients with rheumatoid arthritis-design of a randomized controlled trial." *BMC Musculoskeletal Disorders,* Vol. 15, 2014, p. 49.

[16] Can, Sema, et al. "The effects of exercise preferences on body fat and body mass index by self-report." *Universal Journal of Educational Research,* Vol. 7, No. 1, 2019, 293-7.

[17] Dhand, Navneet, et al. Statulator: An online statistical calculator. Sample size calculator for comparing two paired means, 2019. http://statulator.com/SampleSize/ss2PM.html.

[18] Centers for Disease Control and Prevention. Global Tobacco Surveillance System Data (GTSSData): Datasets, 2020. https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?CAID=2.

[19] Helou, Khalil, et al. "Validity and reliability of an adapted Arabic version of the long international physical activity questionnaire." *BMC Public Health,* Vol. 18, 2018, p. 49.

[20] Suleiman, Khaled H., et al. "Translating the Pittsburgh sleep quality index into Arabic." *Western Journal of Nursing Research,* Vol. 32, No. 2, 2010, pp. 250-68.

[21] Carpenter, J.S., et al. "Psychometric evaluation of the Pittsburgh sleep quality index." *Journal of Psychosomatic Research,* Vol. 45, No. 1, 1998, pp. 5-13.

[22] Kredlow, Alexandra M., et al. "The effects of physical activity on sleep: A meta-analytic review." *Journal of Behavioral Medicine,* Vol. 38, No. 3, 2015, pp. 427-49.

[23] Strand, Linn B., et al. "Insomnia symptoms and cardiorespiratory fitness in healthy individuals: The Nord-Trondelag Health Study (HUNT)." *Sleep,* Vol. 36, No. 1, 2013, pp. 99-108.

[24] Edwards, Meghan K., et al. "Experimentally increasing sedentary behavior results in decreased sleep quality among young adults." *Mental Health and Physical Activity,* Vol. 12, 2017, pp. 132-40.

[25] Siddarth, Divya, et al. "An observational study of the health benefits of yoga or tai chi compared to aerobic exercise in community-dwelling middle-aged and older adults." *The American Journal of Geriatric Psychiatry,* Vol. 22, No. 3, 2014, pp. 272-3.

[26] Wang, Xuewen, et al. "Sleep quality improved following a single session of moderate-intensity aerobic exercise in older women: results from a pilot study." *Journal of Sport and Health Science,* Vol. 3, No. 4, 2014, pp. 338-42.

[27] Du, Shizheng, et al. "Taichi exercise for self-rated sleep quality in older people: A systematic review and meta-analysis." *International Journal of Nursing Studies,* Vol. 52, No. 1, 2015, pp. 368-79.

[28] Dzierzewski, Joseph M., et al. "Exercise and sleep in community-dwelling older adults: evidence for a reciprocal relationship." *Journal of Sleep Research,* Vol. 23, No. 1, 2014, pp. 61-8.

[29] Melancon, Michel O., et al. "Sleep depth and continuity before and after chronic exercise in older men: Electrophysiological evidence." *Physiology and Behavior,* Vol. 140, 2015, pp. 203-8.

[30] Harp, Celina Jeanne. *Exercise training and sleep quality in young adults from the training interventions and genetics of exercise response (TIGER) study.* Diss, 2014.