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Beneficial effect of yoga in middle-aged women with poor sleep quality

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Abstract

Context: Previously, yoga has a relaxing effect on the mind and can potentially improve sleep quality. However, it is still needed to clarify the beneficial effect of yoga in individuals with poor sleep quality. Middle-aged women usually encounter poor sleep quality.

Aims: The present study aimed to investigate the beneficial effect of yoga in middle-aged women with poor sleep quality.

Material and Methods: A total of 68 middle-aged women with an age range of 40 to 59 years were studied to determine the sleep quality by using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Women with global PSQI score more than 5 was categorized as having poor sleep quality. Thirty-one middle-aged women (45.6%) with poor sleep quality [age: 47.58 ± 6.03 years, body mass index (BMI) 25.37 ± 3.46 kg/m^2] underwent online yoga practice one hour per day, three days a week for 12 weeks. After intervention, sleep quality was reassessed by the PSQI questionnaire.

Results: The median and interquartile range (IQR) of the global PSQI score before yoga intervention was 10 (9-14) and that after yoga intervention was 3 (2-6) in the participants. The global PSQI score was significantly decreased after 12 weeks of yoga practice ($p < 0.001$) indicating the improved sleep quality.

Conclusions: The present study indicates that 12 weeks of online yoga practice interventions has beneficial effect in middle-aged women with poor sleep quality. Yoga practice may be useful as a non-pharmacological approach to improve sleep quality.

Keywords: Middle-aged women, PSQI, sleep quality, yoga

Introduction

Yoga is an ancient Indian practice that promotes physical and mental well-being by reducing stress and encouraging relaxation. [1] It offers the benefits for sleep, with one of its primary advantages being the reduction of stress and anxiety. [2] Perceptions of sleep quality can vary individually. Therefore, assessing sleep quality is essential to fully explore yoga's potential impact. This study utilized the Pittsburgh Sleep Quality Index (PSQI), [3] a widely recognized tool for measuring sleep quality in both clinical and research settings. [4]

Sleep quality tends to vary across a woman's lifespan due to hormonal changes associated with menstruation, pregnancy, and menopause. As a result, women are more prone to sleep disorders than men. [5] Poor sleep quality is particularly prevalent among middle-aged women and is recognized as a significant global health concern. It is linked to a heightened risk of various diseases and negative social outcomes. [6] While pharmacological treatments for sleep issues are available, they often carry risks such as physical and psychological dependence. Given these considerations, the present study aimed to investigate the non-pharmacological effects of yoga on improving sleep quality in middle-aged women experiencing poor sleep.

Materials and Methods

Subjects

An announcement about the study was made at a yoga center in Sanchaung Township, Yangon. The announcement stated that middle-aged women who were willing to participate in the study and had not engaged in regular yoga or any other type of exercise in the previous three months were recruited. All participants were explained about the study and written informed consent was obtained. The participants who had a history of taking medications that interfered with their ability to sleep such as melatonin, alprazolam, anticonvulsants, etc were excluded from the study. The study commenced after obtaining approval from the Ethics Review Committee 1 on Medical Research Involving Human Subjects, University of Medicine (2) Yangon [Letter No. 51/ERC-1 (1-2022)]. The study was conducted during the period of July 2022-June 2023.

Assessment of sleep quality

Middle-aged women (n=68) who voluntarily participated in the present study were assessed for sleep quality over a one-month interval by using the Pittsburgh Sleep Quality Index (PSQI) questionnaire. It includes 19 self-rated items grouped into 7 components: sleep duration, sleep disturbance, sleep latency, daytime dysfunction due to sleepiness, sleep efficiency, overall sleep quality, and sleep medication use. Global PSQI scores > 5 were categorized as poor sleep quality. [3] Thus, 32 middle-aged women with poor sleep quality were eligible for yoga intervention. After 12 weeks of yoga intervention, reassessment of the sleep quality index was done.

Yoga intervention

Due to COVID-19-imposed social distancing measures, most of the fitness industry shifted to online delivery of fitness programs during the study period, which ran from December 2022 to February 2023. Thus, in the present study, online yoga practice was given to 32 middle-aged women by a certified yoga trainer for 12 weeks. Each session of yoga training was one hour per day. Each one-hour session included pranayama (breath control: shallow breathing, bhastrika, kapalbhati, bhramari) for 15 minutes, asanas (postural activities: surya namaskar, trikonasana, vajrasana, vakrasana, uttanpadasana) for 30 minutes, followed by relaxation (yoga nidra in the posture of shavasana) for 15 minutes. The yoga asanas used in this study were adapted from previous studies. [7-10] Yoga training was given three days a week for 12 weeks. The online yoga class was in the evening, from 5:00 p.m. to 6:00 p.m. on Monday, Wednesday, and Friday. The investigator observed the performance of the participants throughout the class and recorded their attendance.

Statistical analysis

Thirty-two participants completed the 12-week yoga intervention. One of the 32 participants was excluded for an error in the global PSQI score due to a marital problem. Thus, a total of 31 participants remained to investigate the effect of yoga on sleep quality. The data were analyzed using the Statistical Package for Social Science (SPSS 22.0) software. Data were presented by median and interquartile range (IQR) since the variables had a skewed distribution. A comparison of the data before and after 12 weeks of yoga practice was done by the Wilcoxon Signed Rank test. The 'p' value of less than 0.05 was considered significant.

Results

Background characteristics

A total of 31 women with poor sleep quality were included in the final data analysis of the present quasi-experimental study. The mean ± SD age of the study population was 47.58 ± 6.03 years with the range of 40 to 59 years old. All women were in the menopausal transition phase: 18 (58.1%) of 31 women were perimenopausal women while 13 (41.9%) were post-menopausal. The mean ± SD BMI of all participants was 25.37 ± 3.46 kg/m^2. Fifteen out of 31 women (48.4%) were normal weight (BMI 18.5 to 24.9 kg/m^2) and 16 out of 31 subjects (51.6%) were overweight (BMI 25.0 to 29.9 kg/m^2).

Pittsburgh sleep quality index (PSQI) scores

Baseline global PSQI score (mean ± SD) in the middle-aged women (n = 31) with poor sleep quality (global PSQI score > 5) participating in the present study is 10.84 ± 2.70. Among the six components of the global PSQI score, the sleep latency score had the highest score, whereas the habitual sleep efficiency score had the lowest score. After 12 weeks of yoga intervention, the mean global PSQI score of sleep quality decreased significantly to 3.77 ± 2.50 (n = 31, $p < 0.001$) (Fig 1). When each component was compared before and after 12 weeks of yoga practice, a significant decrease was also observed in six components: subjective sleep quality score, sleep latency score, sleep duration score, habitual sleep efficiency score, sleep disturbances score, and daytime dysfunction score (n = 31, $p < 0.001$) (Table 1). The use of sleep medications component was not considered in this study because participants who had used drugs that affected sleep were not allowed to participate.

Table 1: PSQI scores at baseline and after 12 weeks of yoga practice (n = 31)

PSQI scores	Median (IQR)		p-value
	Baseline	After yoga	
Subjective sleep quality score	2 (2-2)	0 (0-1)	< 0.001*
Sleep latency score	3 (2-3)	0 (0-1)	< 0.001*
Sleep duration score	2 (1-3)	1 (0-1)	< 0.001*
Habitual sleep efficiency score	1 (0-3)	0 (0-0)	< 0.001*
Sleep disturbances score	2 (1-2)	1 (1-1)	< 0.001*
Daytime dysfunction score	2 (1-2)	0 (0-1)	< 0.001*
Global PSQI score	10 (9-14)	3 (2-6)	< 0.001*

* Wilcoxon Signed Rank Test, IQR = interquartile range

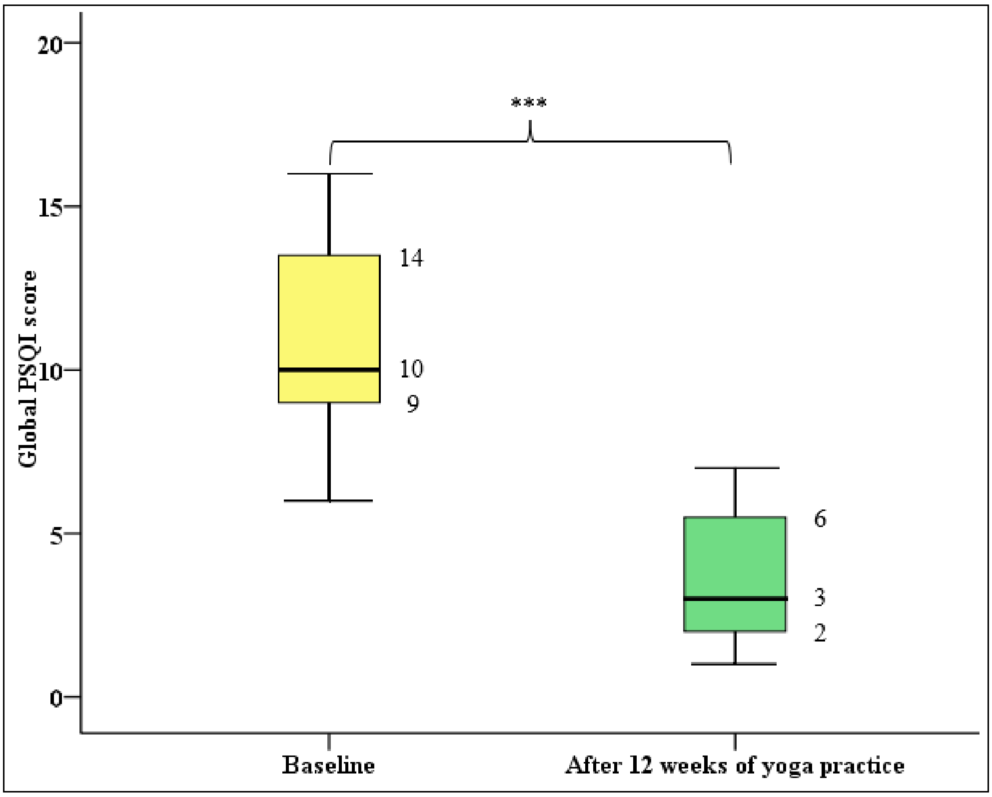

Fig 1: Comparison of global PSQI scores between baseline and after 12 weeks of yoga practice (n = 31)**.** The data were presented as the median and interquartile range (IQR)**.** Statistical test: Wilcoxon Signed Rank Test**.** *** indicates $p < 0.001$.

Discussion

The PSQI has been used to identify sleep quality status in clinical and epidemiological researches, [4] and its validity has been tested through comparison with polysomnography. [3] This study investigated sleep quality in middle-aged women with a global PSQI score > 5 as women with poor sleep quality, with a mean baseline score of 10.84 ± 2.70. The highest component score was found in sleep latency, while the lowest component score was found in habitual sleep efficiency. Therefore, sleep latency is a major concern for poor sleep quality in middle-aged women.

After the yoga intervention, the baseline global PSQI score was significantly decreased to 3.77 ± 2.50 ($p < 0.001$). It indicated that practicing yoga improved sleep quality. This finding of the present study was consistent with previous studies conducted by Ide *et al.* (2008), [11] Innes and Selfe (2012), [12] Newton *et al.* (2014), [13] Fang and Li (2015), [14] Ebrahimi *et al.* (2017) [10] and Rao *et al*. (2017). [15] Despite variations in the study population and study design, a consistent and significant enhancement of the quality of sleep has been observed with yoga practice as shown in Table 2. Moreover, it was also noted that the improvement in sleep quality increased with the number of the hours spent practicing yoga.

In the present study, the mean percent change in the global PSQI score after yoga practice was -65.42 ± 19.03%. The mean percent change across the six PSQI component scores was -73.66 ± 33.27 % for the subjective sleep quality score, -76.34 ± 35.43 % for the sleep latency score, -44.62 ± 56.01 % for the sleep duration score, -47.31 ± 54.96 % for the habitual sleep efficiency score, -27.42 ± 31.19 % for sleep disturbances score, and -60.22 ± 50.68 % for the daytime dysfunction score. According to the findings, yoga had the greatest beneficial effect on sleep latency and the least on the sleep disturbances score. These improvements are probably related to changes in the autonomic nervous system, central nervous system, and neuroendocrine pathways. [7] One important way that yoga may enhance the quality of sleep is by lowering the activation and reactivity of the hypothalamo-pituitary-adrenal (HPA) axis and the sympathetic nervous system, both of which are strongly related to mood and sleep. [16,17] Additionally, one study reported that yoga directly increases parasympathetic nervous system output, potentially through vagus nerve stimulation. [18] Likewise, another studies of yoga on healthy volunteers have shown that after short term yoga exercise, there is significant increase in the vagal tone, decrease of sympathetic discharge in the form of significantly decreased heart rate response on standing as well as decreased catecholamine levels in plasma. [19,20] This shift from sympathetic to parasympathetic dominance enhances cardiovagal function, neuroendocrine balance, and metabolic responses. Consequently, it also promotes better sleep, mood, and muscle relaxation.

Yoga exercises involve stretching and relaxing of muscles resulting in significant physical and mental relaxation leading to less sleep latency, less sleep disturbances, and better sleep efficiency. [21-23] Yogic breathing exercises can improve strength of the respiratory muscles which resulted in better tissue perfusion and improved oxygen saturation. This might explain for less sleep disturbances in yoga group. [24] Regular yogic breathing exercise might have beneficial effect by strengthening upper airway muscles resulting in improvement of sleep quality. [25,26]

Yoga practices also boost levels of the feel-good brain chemicals like dopamine, serotonin, melatonin [27] and gamma-aminobutyric acid (GABA). [28] It has been reported that dopamine and serotonin play a role in sleep-wake cycle. Dopamine can inhibit norepinephrine, causing to feel more alert. Serotonin is involved in wakefulness, sleep onset, and preventing REM sleep. [29] It's also required to produce melatonin, which plays an important role in sleep and is a regulator of biological rhythms. [30-32] GABA is the main inhibitory neurotransmitter of the CNS. It is well established that activation of $GABA_A$ receptors favours sleep. [33] These effects collectively contribute to the sleep-enhancing benefits of yoga.

Table 2: Studies concerning effect of yoga on PSQI in different women

Study	Subjects	Age range (years)	Yoga session length (mins)	Yoga frequency (sessions/ week)	Study duration (weeks/ study)	Total hours	Mean global PSQI score		
							before yoga	after yoga	difference
Ide *et al.* (2008)[11]	Women with fibromyalgia syndrome (n = 18)	20-60	60	4	4	16	13.17	9.95	-3.22
Innes and Selfe (2012)[12]	Non-smoking women, post-menopausal, physical inactive and overweight with restless legs syndrome (n = 8)	45-79	90	2	8	24	8.71	3.57	-5.14
Newton *et al.* (2014)[13]	Previous sedentary women in menopausal transition or post-menopausal or had hysterectomy (n = 95)	40-62	45	2	12	18	7.7	5.6	-2.1
Fang and Li (2015)[14]	Female nurses (n = 54)	25-51	>50-60	>2	24		9.98	7.61	-2.37
Ebrahimi *et al.* (2017)[10]	Women with type 2 diabetes mellitus (n = 15)	38-53	90	3	12	54	14.40	3.73	-10.67
Rao *et al.* (2017)[15]	Female teachers (n = 30)	30-55	30	5	4	10	5.63	3.10	-2.53
Present study	Middle age women with poor sleep quality (n = 31)	40-59	60	3	12	36	10.84	3.77	-7.07

Strengths and limitations of the study

Because only middle-aged women with poor sleep quality were included in the study, results might not apply to other populations. Randomized controlled trials are needed to confirm the benefits of yoga practice on sleep quality. In the present study, the PSQI questionnaire collects subjective data on sleep quality. The incorporation of other objective methods like polysomnography could have been more helpful in substantiating the findings of the present study. Understanding the underlying possible biological mechanisms of the effect of yoga on sleep quality will be recommended. The findings highlight the need for further research examining other biological mechanisms and neuroendocrine factors linking yoga and sleep.

Conclusion

Thirty-two out of 68 middle-aged women (45%) had poor sleep quality, suggesting that sleep latency may be the major concern for poor sleep quality. Yoga has a greater effect on the sleep latency component than its effect on the other components. The findings suggest that yoga could be a safe and helpful intervention for middle-aged women who have poor sleep quality. Thus, regular yoga practice is one of non-pharmacological interventions that can enhance the quality of sleep.

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Key messages: PSQI questionnaire is recommended as a helpful tool for assessing sleep quality in research settings. Poor sleep quality is experienced by 45% of middle-aged women. Twelve-week online yoga practice has a beneficial effect on sleep quality. Yoga practice may be useful as a non-pharmacological approach to improve sleep quality.

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