Universal Journal of Public Health 11(1): 78-88, 2023
DOI: 10.13189/ujph.2023.110109 http://www.hrpub.org

Effects of Yogic Intervention on Sleep Quality of Healthy Elderly: A Systematic Review

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Received December 5, 2022; Revised January 6, 2023; Accepted February 6, 2023

Cite This Paper in the Following Citation Styles

(a): *[1] Nita Bandyopadhyay, Tuhin Das, Ankur Biswas, Abhijit Koley, "Effects of Yogic Intervention on Sleep Quality of Healthy Elderly: A Systematic Review," Universal Journal of Public Health, Vol. 11, No. 1, pp. 78 - 88, 2023. DOI: 10.13189/ujph.2023.110109.*

(b): *Nita Bandyopadhyay, Tuhin Das, Ankur Biswas, Abhijit Koley (2023). Effects of Yogic Intervention on Sleep Quality of Healthy Elderly: A Systematic Review. Universal Journal of Public Health, 11(1), 78 - 88. DOI: 10.13189/ujph.2023.110109.*

Abstract Sleep disturbances and poor sleep quality are more common in the elderly, and they are frequently ignored and untreated. As pharmacological treatments are not free from health hazards, nowadays, community-based non-pharmacological treatments are gaining huge acceptance for managing health issues. Yoga is one of the most feasible and cost-effective non-pharmacological means to manage sleep quality. The current systematic review aims at investigating the effects of yoga on the sleep quality of the elderly. So, the review was conducted on the basis of experimental investigations by using key words such as "effect of yoga", "sleep quality", "sleep disorder", "insomnia", and "older adults" published in English across four databases such as Scopus, ScienceDirect, PubMed, and PubMed Central. The risk of bias in selecting the studies was assessed by CASP. Four randomized controlled trials (RCTs), one pre-post study, one cross-sectional study (CS), and one longitudinal study (LS) met the inclusion criteria, with a total of 524 participants aged between 40 and 95 years from three different countries. Six out of seven studies used subjective tools to assess sleep quality, of which five used the Pittsburgh Sleep Quality Index (PSQI) and one used a sleep rating questionnaire, while the remaining one used an objective method to assess sleep quality through polysomnography. All seven studies reported significant improvements in sleep quality in the intervention group. Cohen's d effect size could be calculated for four studies, ranging from 0.55 to 1.88, whereas for the remaining three studies it could not be calculated because of insufficient data. So, the current review concludes that yoga can improve the sleep quality of the elderly population. Further, it is recommended that yoga can be adopted as a cost effective, community-based, non-pharmacological means to promote sleep quality among the elderly.

Keywords Sleep, Sleep quality, Yoga, Elderly aged, Insomnia

1. Introduction

Sleep plays a vital role in maintaining the physical and mental well-being of human beings. It is a state in which the organism slows down and repairs itself, characterized by reduced consciousness and decreased physical activity. Humans sleep for roughly one-third of their lives. Physiologically, sleep is regulated by the homeostatic mechanism and the circadian rhythm process over the course of 24 hours in a day. Several hormones are responsible for sleep and circadian rhythmicity, such as melatonin, cortisol, progesterone, hunger hormones, insulin, leptin and ghrelin, thyroid hormone, growth hormone, etc. [1,2]. After getting signals from the environment (sun rays or light) through the eye, it sends the information to the brain, and the suprachiasmatic nucleus (SCN), located in the anterior hypothalamus above the optic chiasm, helps to activate a feeling of wakefulness and alertness. Melatonin has a strong impact on circadian rhythmicity and is crucial in the regulation of human sleep [1]. Sleep quality is determined by the soundness of sleeping of an individual at night. Generally, sleep quality is measured subjectively by standard questionnaires like the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), etc. on the basis of self-reported awakening during sleep, sleep

duration, sleep latency, and a feeling of tiredness or freshness after the completion of sleep [3]. There are two distinct phases of sleep: REM (rapid eye movement) and NREM (non-rapid eye movement). The REM phase lasts about the first 90 minutes after falling asleep, during which dreams come. Each phase has distinct characteristics such as differences in brain wave patterns, eye movements, and muscle tone [4,5]. During the non-rapid eye movement, the functions of the heart and lungs slow down, the muscles relax, and the eye movement slows down [6].

Poor sleep is very common in elderly people, which has been linked to a number of negative health outcomes, including morbidity, impaired cognitive function, and decreased quality of life. With advancing age, there is a decrease in sleep quality at night among older people; 30% of them experience difficulty in sleeping [7,8]. A common feature of the geriatric population is that, as they grow older, their bone mineral density and muscle mass decrease, resulting in reduced muscular strength, and physical activity. Because of their inability to perform necessary physical activity, elderly people are forced to enjoy excessive leisure time when they mostly maintain a lying or sitting posture. The common factors that cause sleep disturbances are physical inactivity, decreased energy expenditure, health issues, boredom, stress, poor sleep preparation, daytime napping, mental issues, and the types and timing of food intake, which decrease the regulation of the melatonin hormone and are linked to sleep latency [6,9]. As humans grow older, the primary components of sleep, i.e., the sleep duration and the sleep stages, and the other components, like the quality and quantity of sleep oscillations change. Humans experience well-defined changes in sleep architecture beginning in their fifth decade of life, such as earlier sleep onset, longer sleep-onset latency, shorter overall sleep duration, waking during sleep, fragile sleep, and less deep sleep [10].

Various medicines like doxepin, estazolam, zaleplon, butabarbital, chloral hydrate, etc. are available in pharmacy stores for the pharmacological treatment of sleep disorders, but these are not free from side effects, and those who use them regularly may be the cause of various serious diseases. Currently, the American National Sleep Foundation (2019) opines that unmedicated options of treatment are much preferable to manage sleep problems [11]. Yoga is a wonderful non-pharmacological treatment that is safe, inexpensive, easily accessible, and beneficial to the elderly. There is evidence that regular practice of yoga has beneficial effects on sleep quality in elderly adults. Moreover, it promotes healthy sleeping, reduces timing to fall asleep, decreases sleep disturbance during the night, ensures better sleep quality, and decreases the use of medications for sleep [12,13].

Several research studies have shown that participating in a yoga program can improve an individual's perception of the quality of sleep that they get. This effect is particularly noticeable in adults, with regard to the length of time spent in sleeping as well as the sensation of being more refreshed upon waking up. In another research, it was revealed that relaxing techniques brought on by meditation helped to improve problematic pre-sleep interpretation processes and disrupt rumination and worry, both of which may contribute to the reduction of sleep complaints [14].

Another study on healthy volunteers found that yoga practice raises vagal tone, lowers sympathetic discharge with a reduced postural heart rate response, and lowers plasma catecholamine levels. Yoga practice may result in relaxation and reduced responsiveness to external stimuli that cause improvements in sleep quality [6].

Oken et al. [15] discovered that six months of yoga practice may result in better quality sleep, shorter sleep latency, fewer night disturbances, and less use of sleep medication in older people. Another study revealed that yoga practice on a regular basis can help the elderly to have better quality of sleep, less lethargy during the day, a feeling of freshness in the morning, and reduce the intake of sleep medication [16].

A study suggests that yoga, through frequent meditation practices, activates the parasympathetic nervous system, which results in a calmer, less stressful state, as demonstrated by reduced blood pressure, heart rate, and cortisol levels. The parasympathetic system cancels the sympathetic system and calms the body, preparing the body for sleep [17–19]. Furthermore, meditation techniques have been shown to increase dehydroepiandrosterone [20], anterior pituitary hormones such as growth hormone, thyroid stimulating hormone (TSH), prolactin [21,22], and melatonin levels, resulting in improved sleep quality [23]. Besides this, sleep apnea is linked to low oxygen saturation. Pranayama makes the breathing muscles stronger, which leads to better oxygenation and perfusion of the tissues [6,24].

Although numerous studies have been conducted to examine how yoga impacts sleep quality among healthy elderly persons, the findings have not yet been thoroughly gathered and summarized. This is an unmet research need because "healthy aging" is strongly related to a person's level of physical activity and sleep, both of which tend to decline as they age. The goal of this study was to offer a systematic overview of the effects of yoga on sleep quality among a healthy elderly population.

2. Methods

2.1. Search Strategy

The extensive searching was done through four electronic databases viz. Scopus, PubMed, ScienceDirect, and PubMed Central for three months since May 2022 to July 2022. Besides that, a thorough bibliographic searching was done from relevant studies. Literature search was performed in each database by using the keywords- “effects of yoga”, “sleep quality”, “sleep disorder” (insomnia, sleep complaints, sleep disturbance), and “older adults”. The search was restricted to English-language articles. Each of the retrieved articles was screened and verified by two researchers and the entire text was assessed by one reviewer. All relevant studies reported in this study were discussed among researchers to avoid any conflict of interest and to reach a consensus.

2.2. Eligibility Criteria

The only studies that investigated the impact of yoga intervention on sleep quality in elderly people between the ages of 40 and 95 years were included in this systematic review. The studies were finally considered which satisfied the following inclusion criteria.

(i). Articles: The relevant articles published in English from 2005 to 2021 in the selected databases (Scopus, ScienceDirect, PubMed, and PubMed Central).

(ii). Population: Older adults aged ≥40 years who were healthy and living without support may have self-reported complaints of poor sleep quality, such as frequent awakenings during sleep, daytime dysfunction, taking long time to fall asleep, using medicine for sleep, etc.

(iii). Intervention: At least 6 weeks of any form of yogic intervention with minor stretching exercises, breathing exercises, and relaxation exercises of any frequency.

(iv). Outcome: The studies measured the different components of sleep, such as sleep latency, sleep duration, awakening, daytime dysfunction, use of sleep medication, sleep disturbances, slow wave sleep (SWS), rapid eye movement (REM), etc., either subjectively or objectively.

(v). Outcome measures: The studies that used only standardized tools, either subjective or objective, to measure sleep quality were included in the current review.

(vi). Types of studies: The randomized controlled trials, pre-post test studies, cross-sectional studies, and longitudinal studies were included.

Exclusion: The studies were excluded which were conducted on chronic patients and the intervention was applied less than 6 weeks. The review article, meta-analysis, and protocol guidelines were also excluded.

2.3. Study Selection

The process of searching for and selecting studies was individually performed by three researchers. After identifying all records from four databases, duplicate articles were removed. Initially, the articles were excluded on the basis of screening, which was found irrelevant. After abstract screening, the full text of the articles was considered for critical analysis and examination. The entire searching process for articles is depicted in a PRISMA flow chart (Figure 1). This review followed the preferred reporting items for systematic review protocols (PRISMA) without meta-analysis [25].

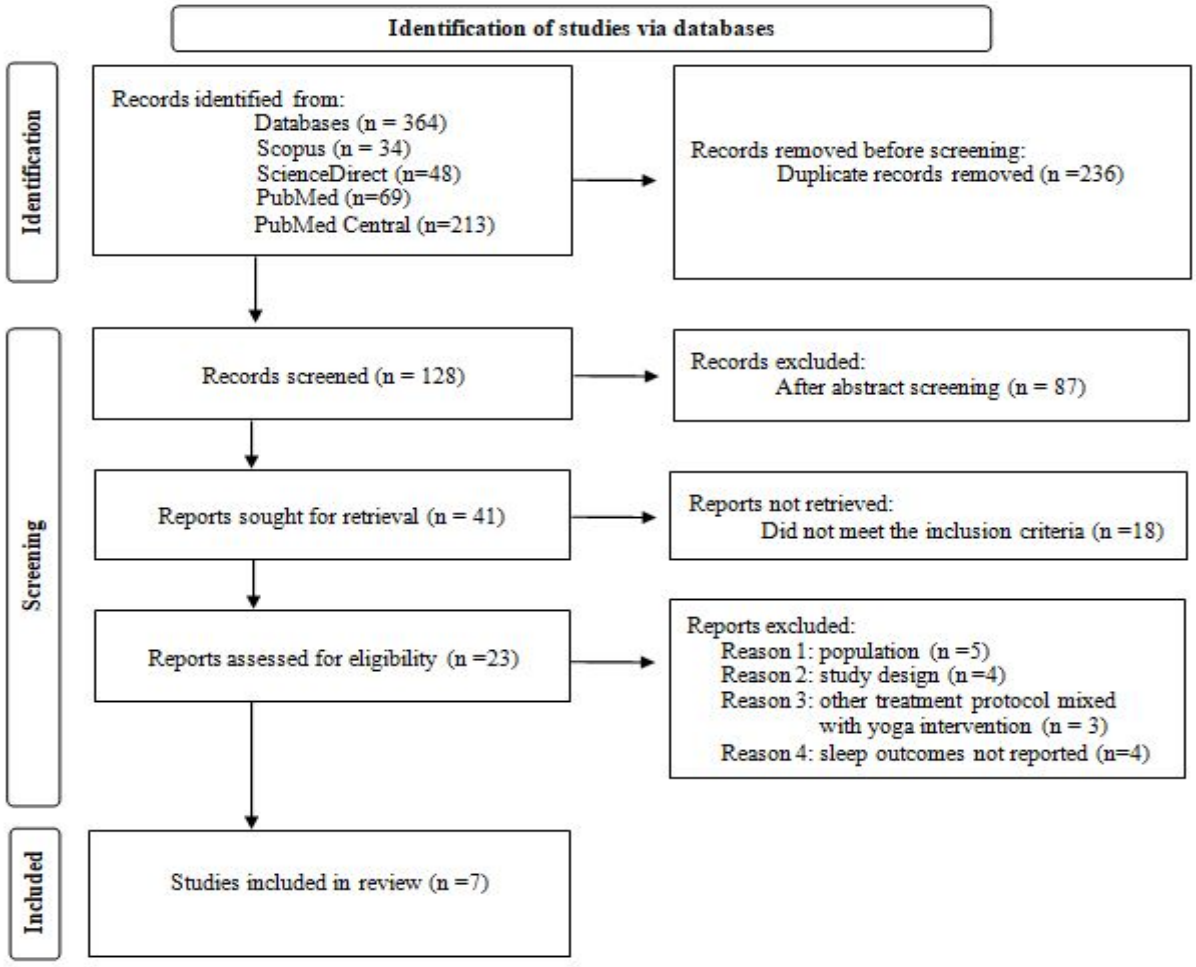

Figure 1. Search and selection process (PRISMA 2020 flow diagram)

2.4. Critical Assessment and Risk of Bias

The articles were critically evaluated by using the Critical Appraisal Skills Program standardized approach (CASP) [26]. It consists of 10–12 questions with answer options of "yes", "no," and "can't tell," depending on the types of study (RCT, pre–post, CS, etc.). Three reviewers evaluated the articles, and those that satisfied more than 7-8 items were selected for the current review.

3. Results

3.1. Study Selection

Initially, 364 studies were searched through four databases: Scopus (34), ScienceDirect (48), PubMed (69), and PubMed Central (213), as well as through a bibliographic search. Before screening, 236 duplicate items were eliminated. After screening the abstracts, 87 out of the remaining 128 articles were eliminated, and 41 were retrieved for full text screening. Following that, 18 papers were removed for not satisfying the inclusion criteria, and 23 articles were evaluated for eligibility. Following that, 16 publications were discarded for the following reasons: target population mismatch (n = 5), research design mismatch (n = 4), other treatment protocols mixed with yoga intervention (n = 3), and sleep result not given (n = 4). Finally, the current review study included seven studies (n=7).

3.2. Study characteristics

The present review included randomized controlled trials (RCTs, n = 4), pre-post tests (n = 1), cross-sectional study (CS, n = 1), and longitudinal study (LS, n = 1) from different countries, such as India (n = 5), China (n = 1), and the United States (n = 1), published from 2005 to 2021.

3.3. Participants

Sample sizes in the included studies ranged from 49 to 120 subjects, with a total of 524. The subjects' age ranged from 40 to 95 years, with a mean age of 50 years and above. In the current review study, participants were of community-dwelling elderly people in one RCT [27] and one CS study [24], as well as postmenopausal women in one pre-post study [28]. Two RCTs included male and female subjects from elderly homes [29,30]. One LS involved a healthy male volunteer from meditation practice centres and the private public sector [16], while in one RCT it was not reported [31]. Out of seven studies one study included only female subjects [28], one included only male volunteers [16], three included both males and females [24,30,31], and the remaining two studies [27,29] did not report participants' gender (Table 1).

Table 1. Study and Sample characteristics

Authors, Year, Country	Sample size of groups and sex	Age in Years (range and mean)	Study Design	Setting	Outcome Measures	Outcomes
Bankar et al. (2013) [24] India	n=65, (EG=35, CG=30); Men and Women	>60 y, (EG - 63.7,CG - 62.8)	CS	Community dwellers	PSQI	Participants of Yoga group showed significantly sound (P<0.0001) sleep quality in comparison to Non-Yoga group. Yoga = 3.77 (2.14), Non-Yoga = 8.00 (2.36)
Hariprasad et al. (2013) [29] India	n=120, (EG=62, CG=58); Elderly adults	>60 y, (EG=75.74, CG=74.78)	RCT	Old Age Residential Home	PSQI	Significant improvement (P = 0.001) was observed in sleep quality among the subjects of Yoga group. Yoga: Pre test = 7.65 (3.36), Yoga: Post test = 6.87 (3.10)
Black et al. (2015) [27] USA	n=49, (EG: MAPs=24, CG: SHE=25); Elderly adults	>55 y , (EG = 66.5, CG = 66.1)	RCT	Community dwellers	PSQI	Mindful Awareness Practice group showed significant improvement in sleep quality (P<0.05) on the PSQI. MAPs: Pre test = 10.2 (1.7), MAPs: Post test = 7.4 (1.9).
Shree Ganesh et al. (2021) [31] India	n=81, (EG=48, CG=33); Men and Women	60 -75 y, (EG= 62.6, CG = 65.5)	RCT	Not reported	PSQI	Yoga group had statistically better quality of sleep in comparison to control group (P ≤ 0.001).
Lu et al. (2020) [28] China.	n=106, (EG=52, CG=54); Menopausal Women	45-55 y, (EG= 50.56, CG= 50.74)	Pre-post test	Community dwellers	PSQI	Experimental group showed significant (P= 0.001) improvement in sleep quality. EG (Pre test) = 7.63 (1.52), EG (3months Post test) = 6.57 (1.23), EG (6months Post test) = 6.01 (1.44);
Manjunath &Telles, (2005) [30] India	n=46, (EG=23, CG=23); Men and Women	60 -95 y, (EG = 70.10, CG= 72.3)	RCT	Old Age Residential Home	Closed and open-ended Questionnaire	Yoga group showed a significant decrease in time taken to fall asleep (average 10 min =p< .05) and an increase in the duration of sleep i.e. hours slept in each night (average 60 min =p< .05).
Pattanashetty et al. (2010) [16] India	n=57, 40-49y CG=12, EG=11; 50-60y CG=17, EG=17; Men	Middle-aged=40-49 y, Older -aged=50-60 y.	LS	Vipassana Research Institute	Polysomnography	Vipassana meditators were significantly benefited with all aspects of good sleep organization (high sleep efficiency index, enhanced slow wave sleep and rapid eye movement, a higher number of sleep cycles and onset latency) at p < 0.05 level.

Note. MAPs=Mindful Awareness Practice, SHE= Sleep hygiene education CS=Cross-Sectional, RCT =Randomized Controlled Trial, LS =Longitudinal Study, PSQI=Pittsburgh Sleep Quality Index, CG=Control Group, EG=Experimental Group, y = Years

Table 2. Yoga Intervention program

Authors, Year, Country	Types of Yoga Intervention	Yoga Frequency (Sessions/Weeks)	Session length	Study duration
Bankar et al. (2012) [24] India	Various Asanas, Bandhas, Hatha Yoga	Daily	≥60 min	2 years or more
Hariprasad et al. (2013) [29] India	Suksmavyayama (Loosening exercises), Yogasana (Physical Postures), Pranayama (Breathing Exercises) and Nadanusandhana (OM Meditation).	Daily	60 min	6 months
Black et al. (2015) [27] USA	Mindfulness meditation that included mindful sitting meditation, mindful eating, appreciation meditation, friendly or loving-kindness meditation, mindful walking and mindful movement.	Daily	5-20 min	6 weeks
Shree Ganesh et al. (2021) [31] India	Breathing exercise (combination of posture synchronized with breathing), Suksmavyayama (loosening exercise with chair support), Yogasana (physical Posture), Pranayama (breathing techniques) and meditation (Nadanusandhana-OM Meditation). Lecture session (yoga philosophy & integrated yoga therapy) in fortnight.	3	Not reported	3 months
Lu et al. (2020) [28] China.	Yoga exercise along with conventional treatment and positive information support counselling.	3	60 minutes	24 weeks
Manjunath & Telles, (2005) [30] India	Yoga including breathing exercise - 10min, Shithilikaranavyayama (Loosening exercise) - 5 min, Asanas (Physical postures) - 20min, Pranayama (Voluntarily regulated breathing) - 10 min, Yoga-based guided relaxation - 15 min, Bhajanas (Devotional songs) - 15 min.	6	60 min	6 months
Pattanashetty et al. (2010) [16] India	Vipassana meditation (Mindful meditation, specially designed by Vipassana Research Institute that involves the strategy of mindfulness, where mediators learn to ignore reacting to the senses and thoughts arising in the mind on the basis of a particular situation. Instead, they focus their attention on their bodily activities).	Daily	>2-4 hours	More than 3 years

Table 3. Sleep Measurement types (Subjective & Objective), Cohen's d effect size and assessment of Study Quality

	Bankar et al. (2012) [24]	Hariprasad et al. (2013) [29]	Black et al. (2015) [27]	Shree Ganesh et al. (2021) [31]	Lu et al. (2020) [28]	Manjunath &Telles, (2005) [30]	Pattanashetty et al. (2010) [16]
Subjective (s) or objective (o)	s	s	s	s	s	s	o
effect size (d)	1.88	0.55	0.87	na	1.12	na	na
study quality	good	good	good	moderate	good	moderate	moderate

*Note.*na = not available, s=subjective, o=objective

Table 3 reveals that six [24,27–31] out of seven studies used a subjective tool and one study [16] used an objective tool to measure sleep quality. Among the seven studies, Cohen's d effect size for four studies [24,27–29] was calculated and ranged from 0.55 to 1.88, while in the remaining three studies [16,30,31] the data were not available to calculate the effect size [32]. There were only four studies [24,27–29] with good quality and the remaining three studies [16,30,31] were of moderate quality.

3.4. Intervention

3.4.1. Intervention period

The outcomes of yoga intervention programs were reported in all seven studies in this review. The duration of the yoga intervention programs ranged from 6 weeks to 6 months in the four RCTs [27,29–31] and in one pre-post test study [28]. Only one cross-sectional study [24] and one longitudinal study [16] demonstrated a duration of yoga's impact of more than 2 years. The duration of the yoga sessions ranged from 5 to 20 minutes to even 2 hours, and the frequency of the sessions ranged from 3 times a week to once daily (Table 2). Six of the seven yoga intervention studies [16,24,27–29,31] were carried out under the supervision of certified experts. However, of these six studies, one study [29] provided participants with supervised sessions for the first month, and then weekly one supervised session for the second and third months. All seven studies included control groups that continued with their regular activities. Three of the seven studies had a control group on the waiting list; two had a control group, and the remaining two had non-yoga and Sleep Hygiene Education (SHE) group as control groups.

3.4.2. Types of Yoga included in intervention Program

Out of seven studies of the current review, two studies i.e., one RCT [27] and one LS [16] used exclusively meditation in their treatment protocol such as Black et al. used meditation in all spheres i.e., in sitting, eating, walking, and mindful movement even in appreciation friendly or loving kindness. On the other hand, Pattanashetty et al. used Vipassana meditation, which was particularly designed by the Vipassana Research Institute. Two more RCTs [29,31] used meditation (Nadamsandhana - OM meditation) along with asanas (physical postures), pranayama (breathing technique), and Suksmavyayama (loosening exercise), among which one RCT [31] used lecture sessions on yoga philosophy and integrated yoga therapy in a fortnight. Apart from these, one CS [24], one RCT [31], and one pre-post study [28] did not use meditation in their treatment protocol, among which one study used asanas along with bandhas and Hatha yoga [24] and in one RCT by Manjunath and Telles [30] used asanas along with breathing exercise, Shithilikaranavyayama, pranayama, guided relaxation, and bhajanas (devotional songs), and one pre-post study [28] used yoga exercise along with conventional treatment and positive information support counseling which are presented in Table 2.

3.5. Outcome assessment

3.5.1. Subjective assessment of sleep outcomes

Six of the seven articles included in the present review study used a subjective measuring tool to assess the sleep quality, with five [24,27–29,31] using the PSQI while remaining one study [30] that used a self-rating questionnaire which included seven questions (open and closed-ended) about the time it took to fall asleep, the number of hours slept each night, the feeling of being rested in the morning, the number of awakenings at night, and the number of minutes slept each afternoon [30]. The PSQI score is a robust, accurate, and standardized assessment technique that is widely used to assess sleep quality [33]. The self-rated PSQI assessment includes information on sleep quality, sleep disruption, and sleep duration, sleep latency, sleep habit efficiency, sleeping drug use, and daytime dysfunction which are all factors to consider for sleep quality [33]. The PSQI score, which has seven components, evaluates sleep problems and can vary from 0 to 21 points. A PSQI score of 5 or higher indicates a sensitive and specific assessment of poor sleep quality [33]. The PSQI global score was reported in five investigations. Some of these studies provided seven PSQI subscales, including daytime dysfunctions (n = 4), duration of sleep (n = 5), sleep quality (n = 3), sleep disturbances (n = 4), sleep latency (n = 4), habitual sleep efficiency (n = 4), and sleep medication use (n = 4).

The PSQI global score revealed significant improvement in all four RCTs [24,27,29,31], while the mean score improved significantly in one pre-post study [28].

Sleep daytime dysfunction was reported in four trials, i.e., in two RCTs [29,31], in one pre-post study [28], and in one cross-sectional (CS) study [24], all of which indicated significant improvement. Five studies measured sleep duration, of which one RCT [30] revealed a substantial improvement. Three studies measured sleep quality, and significant improvement was found in two RCTs [29,31] and in one CS study [24]. Investigations on sleep disruptions were found in four studies, and substantial reductions were seen in three of them, i.e., in one RCT [31], one CS study [24], and one pre-post study [28] while Hariprasad et al. [29] found no significant changes in sleep disruption in their study. All four investigations that examined sleep latency showed significant improvement, including two RCTs [29,31], one pre-post [28] trial, and one CS study [24]. Four studies reported on habitual sleep efficiency, out of which two studies showed significant improvement, i.e., one RCT [31] and one CS study [24], and two studies showed no significant improvement, i.e., in one RCT [29] and in a pre-post study [28]. The use of sleep medication was considerably reduced in all four studies

that included yoga, i.e., in two RCTs [29,31], in one pre-post study [28], and in one CS study [24]. One pre-post study [28] showed a significant improvement in the time taken to fall asleep.

The only RCT out of four that employed a self-rating open-and-closed ended questionnaire consisted of seven questions and indicated a significant reduction in the time taken to fall asleep and a significant improvement in sleep duration [30].

3.5.2. Objective assessment of sleep outcomes

Out of the seven studies, only one longitudinal study used polysomnography as an objective sleep measure [16]. Sleep onset latency, rapid eye movement (REM) onset latency, total sleep time, number of sleep cycles, sleep efficiency index, non-rapid eye movement (NREM), stage-1, 2, 3, 4, slow wave sleep (SWS), and rapid eye movement (REM) were measured, among which REM onset latency, number of sleep cycles, SWS, and REM were significantly improved by polysomnographic records following more than 3 years of yoga practice.

4. Discussion

The purpose of this study was to conduct a systematic evaluation of the literature on the effects of a yogic intervention program on the sleep quality of elderly, healthy individuals over the age of 40 years. Seven studies were included in the current systematic review study after searching four databases, including four RCTs [27,29–31], one pre-post test study [28], one longitudinal [16], and one cross-sectional [24] study. Four of the seven studies [24,27–29] were of good quality, while the other three [16,30,31] were of moderate quality and all illustrated the effects of a yoga intervention program. Despite the scarcity of evidence, this systematic analysis included the research published between 2005 and 2021 provides evidence that various types of yoga intervention programs may be considered as non-pharmacological means, valuable alternatives to medicine, and good for maintaining and improving sleep quality. Effect sizes could be estimated in four [24,27–29] out of seven studies and were declared significant in three [24,27,28], while in the remaining three studies [16,30,31] could not be computed because of the non-availability of sufficient data. There were sixteen different sleep outcomes recorded [16,24,27–31] such as sleep latency, sleep disturbances, total sleep time, sleep medication, SWS, NREM, sleep efficiency, and so on.

The majority of the yoga intervention programs, i.e., four out of seven studies, implemented daily yoga practice for a week, and all four studies reported significant improvements in sleep quality, including two RCTs [27,29], one CS study [24], and one longitudinal study [16]. Apart from those four studies, one RCT included a yoga practice of six days per week [30] and the remaining two studies, i.e., one RCT [31] and one pre-post study [28], implemented yoga three times per week, and all three studies reported significantly better (100%) sleep quality (PSQI-Global score). The duration of yoga interventions ranged from six weeks to three years and above. Yoga intervention included a variety of forms of yoga, with 29% of the study using only meditation and 57% using physical postures in addition to other forms of yoga such as Hatha yoga, bandhas, Suksmavyayama, and Shithilikaranavyayama (loosening exercises), relaxation techniques, Pranayama (breathing exercises), bhajana, and meditation. Only one study used lecture sessions along with yoga practice. Consistent with our findings in the current review, an experimental investigation reported that practicing yoga with various postures and stretching exercises improves joint flexibility, muscular strength, and blood circulation [34] and prevents the dystrophy of the cartilage, thereby maintaining joint function [35] and increasing the capacity to remain physically active, which contributes to good sleep. Further, yoga exercises can reduce nervous tension, balance the excitement suppression process of the sympathetic nervous system, alleviate fatigue, enhance sleep and deep sleep [36] and also promote endorphin secretion [37] and oxygen saturation [38] which help to contribute to better sleep quality. Through participation in a routine yoga program, the level of norepinephrine and cortisol decreases in the human body and mind, which provides relaxation for the body [39], and thereby reduces daytime dysfunction and improves sleep quality. Studies found that yoga poses are linked to higher levels of the neurotransmitter gamma-amino butyric acid (GABA), as detected by nuclear magnetic resonance spectroscopy (NMRs) [40, 41], which would support cortical inhibition and, consequently, aid in sleep. Sleep may be aided by guided relaxation since it is linked to more relaxation than passively lying in bed [42]. Pranayama and meditation help to raise melatonin levels in healthy populations, which promote better sleep quality [17,43].

So, it is well evident that participation in a yoga program of at least three sessions per week can significantly benefit all aspects of good sleep organization, including decrease in sleep disturbances, sleep latency, time taken to fall asleep, and an increase in sleep duration and sleep efficiency that can improve sleep quality [16,24,28,30].

5. Conclusions

Based on the findings of the present review and within its limitations, it may be concluded that yoga, specifically the yogic posture, pranayama, and meditation, can be considered as an effective non-pharmacological means for improving sleep quality among elderly people. However, there are many elderly people who do not have adequate awareness about the benefits of various yogic

interventions; instead, they use medicines for regulating their sleep. In this context, the policy could be framed to implement yogic intervention programs in the community, as well as in hospitals and medical sectors, in order to raise awareness among stakeholders.

5. Limitation and Strength

We have primarily focused on the sleep quality of healthy elderly individuals who were not suffering from any chronic illness and were living without support. The current review does have some limitations. The only articles published in English were included. The review focused only on yoga interventions, whereas other non-pharmacological means can also provide a significant impact on sleep quality but have not been included in this study. 86% of the studies used a self-reported subjective assessment tool (PSQI) for measuring sleep quality, which might have lowered the accuracy of the results even though it is globally accepted. Further, the included experimental studies were evaluated subjectively by three reviewers using the CASP rating scale, which determines the appropriateness of methods employed for assessing the quality of research articles. Moreover, the effect size of three studies could not be calculated by the researchers because of the non-availability of sufficient data. Among the included studies, there were wide variations in the total duration, frequency, and length of each session of the yoga intervention program. This systematic review also has some other shortcomings, such as it included only 57% of RCTs on the elderly population on targeted dependent variables. Six of the seven studies employed subjective assessment tools to assess sleep outcomes.

Despite these limitations, this systematic review does an excellent job of summarizing what has already been investigated about how yoga improves sleep quality and what its implications are for practice and research. Participants in the current study were recruited from a variety of contexts and countries, including healthy general elderly people of community dwellers, research institutes, and old age residential homes. The findings from the present review may be applied to a wide section of the elderly population to improve their sleep quality and manage their sleep problems using non-pharmacological means.

6. Recommendation

The population over the age of 50 is fast rising, less active, and has more sleep issues. Future research should be conducted using stronger RCTs and other successful experimental study designs, as well as having sufficient implementation integrity to investigate the genuine effectiveness of yoga. Such reviews may be conducted on different age groups of the population, and especially on those who use medicine for insomnia. Further, it is recommended for greater benefits that such a program may be combined with some lecture sessions based on sleep hygiene, managing sleep quality, quality of life, and awareness of following non-pharmacological means to manage health issues.

Acknowledgement

Not applicable.

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