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ORIGINAL ARTICLE

Improvements in Sleep Quality and Duration Following a Meditation Retreat: an Open-Trial Pilot Study

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Abstract

Purpose Disturbed sleep and other sleep-related problems have a negative impact on the human mind and body. Meditation practices are reported to improve physiological functions and might also have a positive impact on regulating sleep. This research investigates the efficacy of an advanced mind–body medicine intervention, called Hollow and Empty Meditation (HEM), on improving sleep quality.

Methods The study was a single-arm open-trial pilot study which assessed 413 adults who underwent a 4-day meditation retreat offered by the Art of Living, called the Advanced Meditation Program (AMP), and experienced a novel meditation—HEM. Results were measured using a self-report questionnaire, the Pittsburgh Sleep Quality Index (PSQI), which was administered to the participants thrice: on the first day of the program (pre-intervention), immediately after program (post-intervention/Day 4), and on Day 40 (D40) after the program.

Results There was a significant difference in pre–post and pre–D40 scores in the population. Both sleep quality and sleep duration showed an improvement immediately after the AMP (post), and the residual impact was still experienced at D40, especially with the group with age > 36 years.

Conclusions The use of HEM resulted in improvement in sleep quality not just immediately after the program, but had longer-term effects that extended over several weeks, helping remediate sleep problems among younger adults as well as older ones. It resulted in improvement in sleep quality as well as reduction in sleep-related daytime impairment, which have substantial constructive implications for well-being, everyday functioning and quality of life.

Keywords Meditation · Hollow and Empty Meditation (HEM) · Insomnia · Sleep Quality · Sleep Duration

1 Statement of Significance

Being the major concern for current time, our study developed noninvasive interventional application for improvement in sleep quality and related well-being. We owe this novice idea which can be used by many generations coming forth.

2 Introduction

One of the common problems reported today is poor sleep. A 2019 survey across 12 countries (including India) found that about 62% of the participants (n > 11,000) do not sleep very well, and only 10% reported sleeping extremely well [1]. Many studies suggested that sleep problems could be seen among school-going youngsters of age 10–17 years as well as among the population over 50 years of age [2–4]. Sleep is one such autoregulatory mechanism of the body, essential to perform many vital physiological functions such as development, clearing of brain waste, and modulation of the body's immune responses [5], and hence deprivation of this function increases the risk of disorders like stress, anxiety, depression, obesity, hypertension, dyslipidemia, diabetes, cardiovascular diseases, cancer [6] and can potentially lead to substance abuse and even suicidal ideation. At the same time, efficacious behavioral treatments such as mind–body therapies, biofeedback, guided

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imagery, hypnotherapy, mind–body movement, meditation, relaxation techniques, yoga, and even spiritual practices or other contemplative techniques, that help reduce stress and improve sleep exist alongside pharmacological management of insomnia and sleep disturbances [7–15].

Research establishes that such practices significantly improve sleep quality, duration and other aspects of sleep, both in clinical as well as non-clinical populations: meditation in particular impacts various components of the body's sleep generating mechanisms and alters them [11]. Although there are various kinds of meditation, there are commonalities between various techniques, and all of them are beneficial to some degree or other for the reduction of stress, anxiety, depression, and improvement of pain [10–13, 15, 16]. A recent meta-analysis by Rusch et al. [17], which focused on RCTs involving populations with significant sleep disturbance, also compellingly suggests that meditation improves sleep quality even in such populations [17]. The beneficial impact of certain types of meditation on sleep has been extensively studied, particularly mindfulness meditation and mindfulness-based stress reduction (MBSR) exercises, along with Vipassana, other kinds of transcendental meditation (TM) and Sudarshan Kriya Yoga [11, 17–19]. An inverse association for higher frequency of practice of Sudarshan Kriya Yoga and lower odds of poor Sleep Quality (OR = 0.52; 95% CI 0.28–0.94) has also been revealed [20]. However, so far as we know, no study discusses another type of meditation, known as the Hollow and Empty Meditation (HEM) and its effect on sleep.

Taught as part of Advanced Meditation Program (AMP), a meditation retreat offered by the Art of Living Foundation, the practice of HEM leads to a non-cognitive/non-affective state. HEM differs from normal meditation practices as it is only practiced in a retreat setting and not as a home practice. It is practiced only with a trainer guiding one through the process and not by oneself. It also presupposes a familiarity with the well-researched breathing technique of Sudarshan Kriya Yoga (SKY) [16, 21–24]. Ideally experienced once in 6 months, HEM has been practiced for more than 40 years, and its effects are said to last a long time. However, scientific evidence around its benefits is lacking. This study is one of the first research studies on it, and adds to the currently limited research around meditation retreats and their residual benefits, and expands its scope by studying the effect of HEM on sleep quality and duration. It also investigates whether HEM has residual effects post practice by assessing these impacts on day 40 as well.

3 Methods

3.1 Study Design

This study is an open-trial pilot study with a single-arm pre–post design. The data were collected between November 2018 and May 2019 from people attending the Advanced Meditation Program (AMP), a meditation retreat during which HEM is conducted several times daily. These retreats are normally organized from Thursday through Sunday each week. The objective was to assess the immediate and residual impact of the meditation retreat on sleep quality and duration. Participants did not practice HEM between the last day of the retreat and the day 40 assessment. Respondents filled up a standardized questionnaire on sleep at three different time points: pre-intervention, immediately post-intervention (Day 4), and after 40 days of practice (Day 40). Online as well as offline questionnaires were used to collect the data. Each of the participants were contacted for the Day 40 assessments through email and phone calls.

3.2 Participants

The participants of this study were healthy individuals, who visited the Art of Living International center to experience the meditation retreat. The data were collected from Nov 2018 to May 2019. On the first day of the retreat, all the participants were apprised about the research study and informed consent was obtained. A total of 413 participants were enrolled in the study. All the participants were over 18 years of age. Ethics approval for the study was obtained by the ethics committee of Sri Sri Institute for Advanced Research.

3.3 Intervention: the HEM Practice

HEM is a unique meditation technique derived from ancient yogic traditions, and is a combination of focused attention meditation (FAM) and open monitoring meditation (OMM) [23, 24]. It is conducted daily over the four days of the AMP retreat, with participants meditating four times a day for 30–45 min in each iteration.

Using the domain and taxonomic key system of classification, HEM can be categorized on the basis of its method as a Null Domain Meditation (NDM) resulting in a state of emptiness, with no phenomenological content [25]. It is a guided meditation with the specific cognitive strategy of directing the awareness to various body parts in easy succession. It also involves metacognition that enables the meditator to be aware of the stages of the process and stay on task. The requisite posture is sitting with an erect yet relaxed spine,

with eyes closed. The meditation is totally non-verbal, with extrinsic guidance aimed at mellowing the mind and leading it to a quiescent state. It does not require any religious or other belief system, although it may have some philosophical basis. The breathing pattern is normal throughout the meditation.

3.4 The measure: PSQI Questionnaire

The Pittsburgh Sleep Quality Index (PSQI) was administered to the participants of the study. PSQI is a standardized sleep questionnaire that has been used with multiple populations in many languages, and is a well-used, largely reliable and valid tool. Consisting of 19 individual questions, it is a broad subjective measure that attempts to assess and measure 7 components including sleep quality, the time taken to fall asleep (sleep latency), duration of sleep, habitual sleep efficiency, sleep disturbances, the use of sleep medication, and even daytime dysfunction. The component scores, which are aggregated to get a global PSQI score, are based on a 0–3 scale, whereby 3 reflects the negative extreme on the Likert Scale. A global PSQI score of 5 or more indicates poor sleep quality; the lower the score, the better the sleep quality.

3.5 Data Analysis

The analysis was done for each of the seven components of the PSQI with the focus being the global PSQI score. The paired-sample t-test was used to compare the differences between pre-intervention, post-intervention, and Day 40, with p value less than 0.05 being considered as significant (confidence interval-95%). MS-Excel Data analysis tool was used for this purpose. Linear correlation between the two variables for all domains was performed to calculate the Pearson correlation coefficient. Significant difference was calculated for overall population and for different age groups. The effect size was calculated via Cohen's d value, while internal validity of the questionnaire was tested by calculating Cronbach's alpha.

4 Results

A total of 413 respondents completed the questionnaires at the three different time points: pre-intervention (pre), post-intervention (post), and Day 40 (D40). The sample was divided according to gender and age group, enabling observation of differences in sleep in populations between 18 and 35, and 36 + years. Table 1 depicts the demographic distribution of the respondents.

Table 2 depicts the global PSQI scores for the population at three different time points. The scores decrease post retreat, indicating improved sleep quality, and even though they show a slight increase at day 40, they are still significantly lower than the pre retreat scores. A significant difference was observed in pre–post and pre–D40 score ($p < 0.001$ for all).

Table 1 Demographic distribution of the respondents

Age	Overall	Male	Female
18–35	235	141	94
36 +	178	101	77
Total	413	242	171

The sleep duration (Table 3) shows a significant and consistent increase across populations after a few weeks of the retreat, irrespective of age and gender. As observed, the sleep duration does not increase significantly immediately post retreat but shows a marked increase after a few weeks.

The percentage of the population with good sleep quality (population with global PSQI < 5) showed an increase as observed in pre, post and D40 values. Table 4 depicts that the population with better sleep quality across all ages and across gender increased to almost double at the end of the program, and the population with good sleep quality remained significantly large even at D40 for all age groups and gender.

4.1 Internal Validity, Pre–post, and Pre–D40 Values

Internal validity was measured using the Cronbach Alpha test, and was found to be 0.703, 0.645 and 0.64, respectively, for pre, post and D40. The effect size (Cohen's d value) pre–post was 0.68, while pre–D40 was 0.55. According to Coe [28],[26] 75% of the population showed improved sleep quality immediately after the retreat and 71% was still able to maintain a significant change in sleep quality after 40 days. This shows a significant shift in overall sleep quality immediately after the intervention, which continued over a substantial amount of time.

5 Discussion

This is the first study on HEM and sleep, and a unique one as it examined a distinctive technique of meditation quite different from mindfulness meditation as well as transcendental meditation. HEM is directed not at developing a keen present-moment awareness or meta-awareness, but at becoming empty of thoughts as well as emotions and achieving a deep, silent inner state. The study measured immediate and residual long-term effects of HEM meditation on sleep quality and duration in the healthy population. The results show that immediately after the meditation retreat the global PSQI scores reduced significantly ($p < 0.001$), for both genders as well older and younger age groups. The percentage of

Table 2 Mean scores and standard deviation for Global PSQI with *p* values at three different time points of assessment

Population	PRE mean (SD)	POST mean (SD)	D40 mean (SD)	*p* value pre–post	*p* value pre–day 40
Overall	6.80 (3.8)	4.12 (2.8)	4.81 (2.9)	0.001	0.001
Male	6.81 (3.9)	4.25 (2.9)	4.93 (2.9)	0.001	0.001
Female	6.80 (3.7)	3.92 (2.6)	4.63 (2.9)	0.001	0.001
Age:18–35 years	6.92 (3.8)	3.94 (2.9)	5.03 (3)	0.001	0.001
Age: 36 +	6.65 (3.6)	4.35 (2.3)	4.51 (2.9)	0.001	0.001

PSQI is Pittsburgh Sleep Quality Index. A global PSQI score < 5 is the indicator for good sleep quality.

SD Standard Deviation, *Pre* before SKY practice, *Post* immediately after SKY practice, *D40* after 40 days of SKY practice

Table 3 Sleep duration (in mins)—mean (SD) and *p* values at three different time points of assessment

Population	PRE mean (SD)	POST mean (SD)	D40 mean (SD)	*p* value pre–post	*p* value pre–day 40
Overall	366.65 (101.02)	374.41 (98.12)	408.58 (134.08)	0.192	0.001
Male	370.68 (106.17)	376.82 (93.73)	402.70 (136.68)	0.428	0.002
Female	361.6 (96.37)	371.01 (104.18)	416.89 (130.26)	0.257	0.001
Age:18–35 years	376.72 (97.20)	386.35 (94.00)	407.58 (98.54)	0.155	0.001
Age:36 + years	353.98 (104.80)	358.70 (101.44)	409.89 (170.31)	0.643	0.001

SD Standard Deviation, *Pre* before SKY practice, *Post* immediately after SKY practice, *D40* after 40 days of SKY practice

Table 4 Percentage of population with good sleep quality (Global PSQI Score < 5)

GLOBAL PSQI Score < 5	PRE-%	POST-%	D40-%
Overall (*n* = 413)	43.58	76.03	65.62
Overall male (*n* = 242)	45.87	75.62	64.46
Overall female (171)	40.35	76.61	67.25
Overall Age:18–35 years (235)	42.55	77.87	60.85
Overall Age:36 + years (178)	44.94	73.60	71.91

PSQI is Pittsburgh Sleep Quality Index. A PSQI global score < 5 is the benchmark for good sleep quality.

Pre 275 Before SKY practice, *Post* immediately after SKY practice, *D40* after 40 days of SKY practice

the population with good quality of sleep (PSQI < 5) almost doubled immediately after the retreat.

Meditation retreats have been shown to have residual effects that can last from a few weeks to up to a year or more. Rusch et al. indicate that even at a 5–12-month follow-up, the effect of mindfulness meditation is not different from evidence-based sleep treatments, and sleep quality improves appreciably compared with nonspecific active controls. The current study also measures the long-term impact (40 days) of the meditation retreat. The global PSQI scores increased slightly compared to post retreat scores but remained significantly less than pre scores ($p < 0.001$) at day 40. The number of people with good sleep quality peaked at the end of Day 4, and showed substantial impact even at D40. In comparison to males, the overall female population showed a greater impact at D40, while the population over 36 showed consistently better sleep quality at D40 in comparison to the 18–35 age group. This is significant considering how various studies show that sleep duration and quality both deteriorate with age [2, 6, 29, 30]. The sleep duration for all groups increased significantly.

This study, while focusing on the specific technique HEM, corroborates existing literature on the positive impact of meditation on sleep [11–18]. While Black et al. [18] found mindfulness meditation to be efficacious enough to be introduced as a short-term solution to moderate sleep disturbances, Innes et al. [14] found that sleep quality improved significantly at 12 weeks, and continued even up to week 26.

In this study, the significant improvement in global PSQI at post (D4) assessment can be attributed to the immediate impact of the practice of HEM: Like several other OMM and FAM, HEM appears to enhance the relaxation of the mind greatly, which leads to a further relaxation of the body, which itself generates a relaxation response in the mind. The long-term residual impact of HEM which was measured by administering the PSQI at D40 showed that the quality of sleep is better than the pre-intervention state even after 40 days [26]. That this restorative sleep pattern also persists over an extended period of time across populations, particularly the older population, is significant given that older populations that generally report a greater number of

sleep-related problems. It points to the efficacy of HEM as a restorative meditation practice.

Comparative analyses of the neurobiology of various kinds of meditation reveal that the techniques are marked by unique characteristics that affect practitioners in different ways [25, 31, 32]. FAM "show activations in brain areas for cognitive control that require monitoring performance, voluntary regulation of attention and behavior, consistent with largely effortful, sustained attention with a range of regulation demands and deactivations in mind-wandering, episodic memory retrieval, simulation of future events, and conceptual semantic processing," while OMM "has activations in brain areas for voluntary regulation of thought and action, interoceptive processing (insula), cognitive control (coordinating, monitoring attention to both internal and external channels of information) and deactivations in sensory gating (right thalamus) and no blocking of sensory information" [25]. Since these two types of meditation coalesce in the practice of HEM, and particularly because the global PSQI decreases with practice of HEM, a more intensive study of the HEM technique of meditation is merited. Further studies that examine the mechanism by which HEM exerts residual effects and its exact neurobiology are required.

The study had several limitations. Convenience sampling was adopted and there was no randomization. The study also lacked a control group. However, the sample size of 413 respondents lends a measure of accuracy of the results. Although most subjects self-reported at day 40 to not having experienced any additional yoga or meditation practices during the 36-day period post retreat, that possibility cannot be ruled out. The findings also need to be replicated for both socio-economic and ethnic diversity.

6 Conclusion

The study shows HEM as an advantageous technique that could be useful to improve the quality of sleep. HEM is also seen to have long-term beneficial residual effects by its positive impact on sleep quality and duration even after several weeks. Further studies are needed to understand its detailed mechanism and neurobiology.

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Availability of Data and Materials All data relevant to this survey can be generated as and when required through email by any one of the authors.

Code Availability Not Applicable.

Declarations

Conflict of Interest There is no competing interest to disclose that could be reasonably perceived to influence the work.

Ethics Approval Ethics approval for the study was obtained by the ethics committee of Sri Sri Institute for Advanced Research.

Informed Consent Informed consent was obtained from all the participants.

Consent for Publication Not Applicable.

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