Review Article

DOI: 10.7860/JCDR/2024/71005.20298

A Narrative Review on Brain Gym Exercises: An Asset in Alleviating Insomnia and Augmenting Cognitive Functioning

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ABSTRACT

Insomnia is characterised primarily by difficulties with beginning or sustaining sleep, dissatisfaction with sleep duration and quality and significant discomfort and deficits in daytime activities. Females, elderly individuals and individuals experiencing socioeconomic hardships are prone to sleeplessness. Despite its widespread incidence and burden, the pathophysiology and aetiology of insomnia remain unclear. It also impacts cognition, mood, focus, healing and exhaustion. Psychological and medical conditions can cause insomnia. Non pharmacological treatments for this condition include Cognitive Behavioural Therapy for Insomnia (CBTI), acupressure, meditation and yoga. Brain gym exercise is an evolving therapeutic approach to alleviate insomnia. By engaging in brain gym exercises, individuals may experience improvements in their sleep patterns, leading to better overall sleep quality and duration and may experience enhancements in their ability to think, learn and perform cognitive tasks effectively. The review concludes that incorporating brain gym exercises offers notable benefits for both insomnia and cognitive functioning.

Keywords: Attention, Pharmacologic therapy, Physical therapy modalities, Sleep hygiene, Sleeping disturbances

INTRODUCTION

Insomnia is a disorder encompassing persistent dissatisfaction with the quality and quantity of sleep, accompanied by difficulties in falling asleep, frequent awakenings during the night with struggles to resume sleep and early morning awakening [1]. Often, such sleep difficulties are temporary or of minimal significance. Persistent insomnia, on the other hand, is often associated with significant distress, impairment in daily functioning, or both [2]. According to the International Classification of Sleep Disorders-II (ICSD-II), 10 forms of insomnia are classified: insomnia due to substances or drugs, idiopathic insomnia, mental disorders, psychophysiological insomnia, insomnia due to medical disorders, adjustment insomnia, paradoxical insomnia, physiological insomnia, non specific insomnia and inadequate sleep hygiene [3,4]. In most cases, insomnia coincides with physical or psychiatric disorders. Although insomnia was previously considered a symptom of such diseases, available information suggests a complex association between these conditions and insomnia, possibly bidirectional [5].

Pathophysiology of Insomnia

Regardless of its extensive prevalence and consequences, the pathophysiology and aetiology of insomnia remain unclear. Neurobiological and psychological models have been established that indicate alterations in the functioning of the brain, as well as variables such as cognition, genetics, emotion and behaviour, play roles in the occurrence and maintenance of insomnia [6]. These are theoretically divided into predisposing, perpetuating and precipitating factors. Predisposing events, like hyperarousal, lead to insomnia in already vulnerable populations and perpetuating variables, such as excessive concern about sleep deprivation and its repercussions, result in persistent sleep disruptions even after the original cause has been eliminated. In contrast, precipitating variables, such as adverse life circumstances, are the primary causes of an acute episode of the condition [7].

Two essential physiologic operations regulate the function of the sleep and arousal centers: circadian rhythmicity and wake-dependent (homeostatic) sleep drive. Insomnia is triggered by inadequate sleep behaviour amid the ideal sleep phase as a consequence of an S- or C-process discord [8].

Insomnia is frequently seen as a hyperarousal illness characterised by heightened cognitive, somatic and cerebral stimulation. Insomniacs can exhibit physiological hyperarousal within the cortical and autonomic nervous systems. It can also refer to emotional and cognitive processes and various hypotheses propose that both acute and chronic insomnia can be triggered by affective hyperarousal at night-time [9].

Strong research outcomes regarding the genetic predisposition to insomnia were found when carried out in adults, adolescents and infant families, along with twin populations. Around half of the affected individuals have first-degree relatives suffering from insomnia [10].

Clinical Features Associated with Insomnia

Chronic insomnia can lead to decreased quality of life and perceived health, absenteeism and higher rates of occupational injuries, including fatal injuries [11-13]. It can be considered an independent risk factor for suicide attempts and consequent death, a risk not associated with depression [14,15]. Symptoms such as loud snoring, nightmares, non restorative sleep and difficulty initiating sleep can contribute to an increased mortality rate [16]. Women tend to experience more severe symptoms compared to men [17].

Epidemiology of Insomnia

Estimates of insomnia prevalence vary significantly in research due to changes in evaluation strategies, case definitions, assessment interval length and sample characteristics. Prevalence rates have been reported to range from 5% to 50%. Broadly speaking, based on demographic data, approximately 30-36% of individuals report atleast one symptom of nocturnal insomnia (such as non restorative sleep or trouble initiating or maintaining sleep), but this percentage decreases to 10-15% when considering daytime implications like fatigue [18,19]. Insomnia is more prevalent among the elderly, the female population, middle-aged individuals with psychiatric and medical illnesses and shift workers. Studies have shown that females

are more likely to experience sleep disturbances than males, with a risk ratio of 1.41 for females compared to males [20]. While elderly and middle-aged individuals have a higher overall frequency of insomnia, the nature of insomnia varies with age-sleep maintenance issues are more common in the elderly and middle-aged, while sleep initiation problems are more frequent in young individuals [21].

Causes of Insomnia

Primary insomnia is often caused by inconsistent sleep schedules, shift work, jet lag, high caffeine consumption, poor sleep hygiene, alcohol abuse, acute crises, stress and certain drugs. It is typically unrelated to psychiatric or medical disorders [22]. On the other hand, secondary insomnia, which can be acute or chronic, is primarily caused by medical conditions such as asthma, angina, pregnancy, stroke, chronic pain syndromes, degenerative diseases, or medications like diuretics, steroids, antiepileptics, anticholinergics, antidepressants and antihistamines [23,24].

Diagnostic Procedures

The diagnostic process for insomnia should include a comprehensive psychiatric and medical history, screening of sleep-related behaviours and other investigations. A clinical interview should encompass a sleep history (including sleep environment, habits, circadian factors and work schedules) [25], the use of sleep diaries and questionnaires such as the Pittsburgh Sleep Quality Index (PSQI) with an overall reliability coefficient (Cronbach's alpha) of 0.736 [26] and the Insomnia Severity Index (ISI) with 86.1% sensitivity and 87.7% specificity [27]. Additionally, a physical examination and inquiries about mental and somatic wellbeing should be conducted. Further assessments like electroencephalograms, blood investigations and electrocardiograms may be necessary [28].

Polysomnography (PSG) is often used to assess additional sleep disorders if suspected. For individuals at risk and those with treatment-resistant insomnia, PSG can clearly distinguish between good sleepers and insomniacs [29,30].

Various Treatment Modalities

Insomnia therapeutic intervention may be challenging and time-consuming for medical professionals as well as patients. Drug treatment and non medication therapies are the two major categories. The most appropriate therapeutic regimen is determined by the co-morbid conditions, distinct insomnia complaints, their intensity and predicted duration, the individual's desire to participate in behavioural therapy and the patient's susceptibility to the harmful impacts of medicines.

Pharmacologic Therapy

A variety of drugs from multiple classes with different mechanisms of action and dosages are incorporated into the treatment regimen. The Food and Drug Administration (FDA) has permitted an array of drug prescriptions for the management of insomnia, ranging from the melatonin agonist ramelteon, the sedating antidepressant doxepin, benzodiazepines and non benzodiazepine therapies, to the orexin receptor antagonist suvorexant [31]. Additionally, certain drugs permitted for other reasons, particularly the antidepressants mirtazapine and trazodone, are utilised in this scenario. Melatonin, antihistamines and herbal medicines such as kava and valerian are other over-the-counter drugs [32].

Cognitive Behavioural Therapy for Insomnia (CBTI)

The goal of CBTI is to alleviate the variables that contribute to insomnia. It is a short-term regimen that typically consists of four to eight sessions and various components incorporated, which involve stimulus control, sleep restriction, cognitive therapy, relaxation training and sleep hygiene [33]. Sleep restriction and stimulus control are generally regarded as first-line therapies, whereas relaxation techniques, cognitive therapy and sleep hygiene are adjuvant strategies [34].

Several novel non pharmacological therapeutic strategies have been developed, such as mindfulness, which concentrates awareness in a given moment and necessitates entire attention; hypnosis, progressive relaxation and acupressure [35]. Brain gym exercises are an emerging and effective treatment modality used to alleviate insomnia [Table/Fig-1] [36].

S. No.	Brain gym exercises	Effects
1	Spot marching	Primarily serves as a warm-up exercise
2	Hook-ups	Promotes relaxation of body and mind
3	Positive points	Reduces stress levels and enhances memory
4	The active arms	Activates the brain for tool-controlling skills, relaxation of diaphragm and improves hand-eye coordination
5	Earth buttons	Enhances whole-body orientation and improves mental alertness
6	The energy yawn	Facilitates oxygenation
7	Lazy eights	Boosts concentration, balance and eye muscle control
8	Gravity glider	Enhances oxygen and blood flow; boosts stability and confidence
9	Foot flex	Promotes socialisation and optimise posture; aids in relaxation
10	The energiser	Improves posture; tones back muscles and keeps the spine flexible, supple and relaxed

[Table/Fig-1]: Brain gym exercises and its effects [36].

Correlation of Insomnia and Cognition

Insomnia corresponds to deterioration in subjective and objective cognitive function, emphasising the value of controlling insomnia to enhance cognitive output potentially [37,38].

REVIEW OF LITERATURE

PubMed and Google Scholar were used to search literature published in the English language. Approximately 250 publications were searched within 10 years using the following Medical Subject Headings (MeSH) terms: attention, physical therapy modalities, pharmacologic therapy, sleep hygiene, sleeping disturbances. Out of the 250 articles, 10 significant studies on brain gym exercise as a treatment modality to reduce insomnia and enhance cognition were reviewed [Table/Fig-2] [39-48].

Name of author and year	Type of study	Aim of the study	Age groups	Number of participants and group formed	Outcomes	Results
Cancela JM et al., (2015) [39]	A preliminary study	Efficacy of brain gym training on the cognitive performance and fitness level of active older adults: a preliminary study	Elderly between 65-80 years	85 volunteers divided into four training groups	Symbol Digit Modality Test, two-min step and the eight-foot up-and-go tests were used	These data imply that the benefits of BG on cognitive function and physical fitness level of active elderly individuals is comparable to those achieved following a typical exercise programme. Although BG is practised alone or in conjunction with additional exercise programmes, it appears to have little effect on such outcomes

Khose R and Bhore V (2018) [40]	A randomised clinical trial	The purpose of the study was to study the effect of brain gym exercises on attention span and quality of sleep in menopausal women.	Menopausal women	30 participants	Stroop test, Trail Making Test, Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale	The study concluded that brain gym exercises improve attention span and sleep quality in menopausal women
Nursalam N et al., (2018) [41]	Quasi-experimental	The effect of sleep hygiene and brain gym on increasing elderly comfort and sleep quality	Older adults above 60 years	50 participants	PSQI	The research found substantial improvements in the individuals receiving therapy, indicating that brain gym and sleep hygiene have an influence on boosting sleep quality and comfort in older people
Effendy E et al., (2020) [42]	Experimental	To find out the effect of brain gym in the quality of sleep and anxiety in the elderly at nursing home Karya Kasih Medan.	Older adults above 60 years	68 participants	Hamilton Rating Scale For Anxiety (HARS), PSQI	It has shown a significant difference in sleep quality post- exercise, with the PSQI score preceding therapy being 0.68 and after commencement of therapy being 0.89 with ($p<0.001$)
Irvana I et al., (2020) [43]	Quasi-experimental	Therapy of brain exercise on the quality of sleeping in elderly	Elderly between 50-80 years	30 participants	PSQI	According to statistical analysis, brain exercises have considerable effects on the degree to which the elderly sleep effectively, as indicated by a p-value<0.001 (0.05)
Mendrofa FAM et al., (2020) [44]	Quasi-experimental	To determine differences in cognitive function in elderly dementia before and after brain exercise.	Elderly dementia patients above 60 years	63 participants	Short Portable Mental Status Questionnaire	Brain exercise has been depicted to enhance cognitive performance in dementia patients
Lina R and Kurniawan G (2020) [45]	Systematic literature review	To determine whether brain gym exercise is beneficial for cognitive improvement among elderly in Indonesia	Elderly above 60 years	211 participants across multiple studies	Not applicable	In general, the findings reveal that participants (n=211) substantially improved cognitive performance (p=0.05). Indeed, other results were discovered, including reduced stress and improved physical activity function
Seth NH et al., (2022) [46]	Experimental	Ascertain the efficacy of brain gym exercises as a non pharmacological approach for insomnia	Age group of 18 to 24	65 individuals	PSQI score, Insomnia Severity Index	Brain gym exercises may be utilised as a non pharmacological regimen for students suffering from mild to moderate form of insomnia
Winei AAD (2023) [47]	Meta-analysis	To review the role of brain gym critical exercises in enhancing learning and academic performance	Learners	Not specified	Not applicable	Brain gym activities, according to a critical evaluation of the evidence, can still be beneficial for those trying to enhance their cognitive function and academic performance
Kulkarni DC and Khandale DSR (2023) [48]	An interventional study	To study the effect of brain gym exercises on the attention span in young adults	Young adults (18-24)	60 participants	Mindful attention awareness scale	According to the findings of this research, brain gym activities help improve attention span in young people

[Table/Fig-2]: Review of literature [39-48].

CONCLUSION(S)

Insomnia is a prevalent condition in the overall population, leading to a substantial decrease in cognitive functioning. There are numerous treatment modalities to reduce insomnia symptoms with varied effects. Many studies have revealed the positive effects of brain gym exercises in treating insomnia. After reviewing various articles targeting different age groups across different countries, we conclude that brain gym exercises, whether given in isolation or as an adjunct to other therapies, have beneficial effects in alleviating insomnia and thus augmenting cognitive functioning.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 01, 2024
- Manual Googling: Jul 10, 2024
- iThenticate Software: Jul 12, 2024 (07%)

ETYMOLOGY: Author Origin

EMENDATIONS: 5

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 31, 2024**
Date of Peer Review: **May 01, 2024**
Date of Acceptance: **Jul 14, 2024**
Date of Publishing: **Nov 01, 2024**