

# Effect of Brain Gym Exercises on the Sleep Quality & Duration in Young Adults: A Quasi Experimental Study

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## ABSTRACT

**Background:** Sleep disturbances are an emerging, latent cause of many illnesses, particularly in young adults. Growing westernization, the use of electronics, and social media use all contribute to shorter sleep durations and poorer sleep quality, which worsen these young adults' general health and ability to function. Brain Gym exercises are frequently utilized by people of all ages and have been shown to be successful in enhancing memory and attention span. The aim of the study was to ascertain the effectiveness of Brain gym exercises on young adult's quality of sleep by utilizing the Pittsburg Sleep Quality Index (PSQI).

**Methods:** The study was a quasi-experimental design, where 360 individuals were screened using the PSQI scale to assess the sleep quality of individuals, 60 participants were selected with mild and moderate sleep disturbances. The intervention was given for 4 weeks with total of 12 sessions which was given on alternate days (3 sessions per week). After the end of the 4<sup>th</sup> week, the participants were again assessed using the same outcome measure to find out if there was any improvement in sleep quality pre and post-intervention.

**Results:** The Brain Gym Exercises showed significant improvement in the PSQI score ( $p < 0.0001$ ) and also improvement in the average number of hours slept ( $p < 0.0001$ ) pre and post the intervention.

**Conclusions:** Brain Gym Exercise can be used as an effective method to improve the sleep quality.

**Keywords:** Brain Gym Exercise, Brain derived neurotrophic factors, Insomnia, Sleep Disorder, Sleep Quality.

## INTRODUCTION

An individual's level of content with every component of their sleep experience is regarded as their level of sleep quality. This sleep quality is deteriorating in young adults due to physiological factors, psychological factors like stress, anxiety, depression and environmental factors like room

temperature, electronic devices, familial or social obligations. Fatigue, irritation, daytime dysfunction, slower responses, and increase in the use of caffeine and alcohol all contributes to poor sleep quality <sup>[1]</sup>.

The International Classification of Sleep Disorders (ICSD-3) defines insufficient sleep as a sleep pattern that has been

reduced and has persisted for atleast three months on the majority of days of the week, together with symptoms of daytime sleepiness [2]. Lack of sleep depletes a person's brain capacity and seriously jeopardizes their physical capabilities leading to variety of health issues. Long-term illnesses now begin at an age when a person should be in the best of health. Short-term and long-term memory along with capacities for creativity, problem-solving, and focus are impacted significantly by sleep deprivation. Additionally being sleep deprived, causes mood fluctuations. A person's ability to drive might also be impacted by sufficient sleep leading to serious mishaps due to skills and reaction time. Balance is yet another issue along with coordination raising the possibility of falling. Also, inadequate sleep lowers immunity and when exposed to the bacteria, a person would be more prone to become ill. Heightened risk of high blood sugar, hypertension, heart disease, obesity and reduced sex drive are also observed. Long-term maintenance of such behaviors might result in anxiety and potentially worsen depression [3].

In the Study, "Effect of sleep on academic performance and job performance in college students" it was observed that, in university students lack of sleep can produce daytime tiredness which interferes with their ability to focus and their intellectual abilities. A person's job performance and capacity were also affected in terms of professional advancements and promotion [4].

Brain Gym Exercise known as "Educational Kinesiology", new ways to move the body that were more functional and co-ordinated was developed by Dr.Paul E Dennison, a specialist educator in 1975. It is easy, enjoyable and intended to improve mental performance [5]. Exercises focusing on *lateralization* aid in the interplay between

both the brain hemispheres, whereas exercises focusing on *focalization* assist a person in strengthening and developing the neural pathways connecting what they are already aware of (which is stored in the recesses of their brain) with their capacity to process and articulate the information (frontal lobes). The *centralization* exercises are calming activities that aid in re-establishing the neurological connection between the brain and body and actually make it easier for electromagnetic energy to move within the body. These activities facilitate the chemical and electrical processes that occur during mental and physical exertion [6].

According to literature effect of brain gym exercises on attention span in young adults has been studied, and was found to be significantly effective in reducing hyperactivity and excessive daydreaming, improving focus and memory, which eventually improved the attention span in young adults [7]. Also Brain Gym exercises have been reported to be effective in improving the sleep quality of elderly individuals within the age group of 60 to 74 years and also reduced anxiety in the same population [8].

Brain gym exercises as a form of physical exercise, include a combination of aerobic activities, co-ordination, slow breathing and relaxation exercise. The body attempts to recover homeostasis by lowering body temperature as a result of expansion of blood vessels and increase in blood flow to the body's peripheral areas. As a result, this mechanism can also serve as a stimulant for sleep initiation [9].

Therefore, considering the rising problem of sleep deprivation and problems associated with sleep impairments in young adults, this study aims to assess the effectiveness of brain gym exercises on the sleep quality of young adults.

The Brain Gym Exercise protocol includes the following exercises:

Brain Gym Exercises	Benefits	Duration
Spot Marching	Warm-up exercise	1 minute
Hook ups	Mind and Body relaxation	2 minutes
Positive Points	Helps to reduce stress levels and relaxes the frontalis muscle.	1 minute
Active Arms	Helps in diaphragm relaxation by lengthening muscles in upper part of chest and shoulders. It also helps in hand-eye co-ordination.	3 minutes
Earth Buttons	Helps in deep breathing and improving mental alertness. It also lengthens muscles of neck thus providing relaxation.	2 minutes
The energy yawn	Helps in improving oxygenation.	1 minute
Lazy Eights	Helps in boosting eye muscle control and co-ordination.	1 minute
Gravity Glider	Improves the blood and oxygen flow, improves co-ordination and stability.	2 minutes
Foot Flex	Helps in relaxation of lower limb by stretching the calf muscles and tibialis anterior.	2 minutes
The energizer	Helps in improving posture, keeps the back muscle toned and the spine supple, flexible and relaxed.	5 minutes

## MATERIALS & METHODS

After obtaining the ethical approval from the institutional ethics committee, a quasi-experimental study was conducted at tertiary health care centre in Pune, Maharashtra in between August 2022 to January 2023. A total 100 individuals were screened using PSQI scale with strong internal consistency and high test-retest reliability for sleep quality and 60 individuals who had mild and moderate sleep disturbances were included in the study, those who had sever and no sleep disturbances were excluded from the

study<sup>[10]</sup>. After taking informed consent from the participants, a 12 session consisting of 3 sessions per week intervention program of Brain Gym Exercise was intervened. Post intervention PSQI Scale was taken, along with the change in total number of hours of sleep.

The data was analyzed using the Statistical Package for the Social Sciences (SPSS) software version 23. Wilcoxon ranked sign test was used to compare the scores of PSQI scale prior to and following the intervention while T test was applied to determine any changes in the number of hours slept.

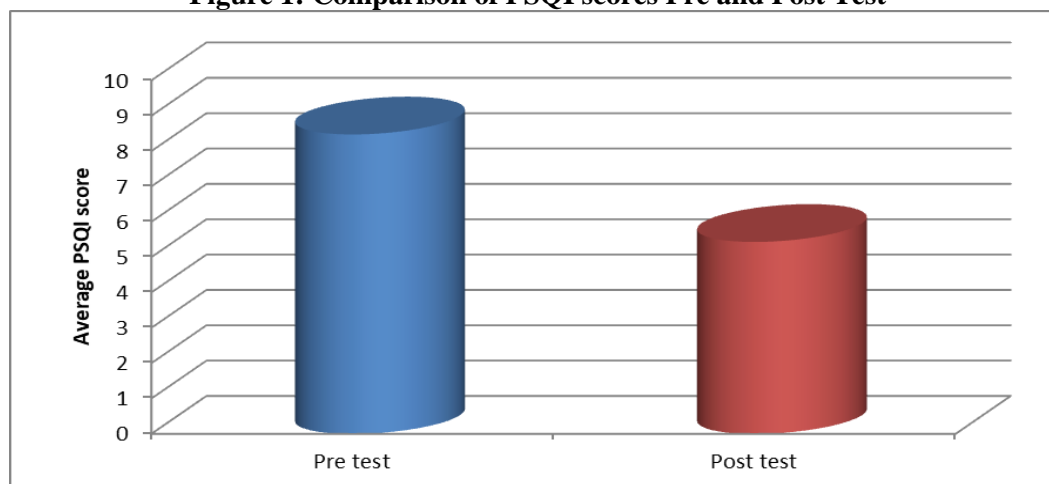
## RESULT

**Table 1: Comparison of PSQI score between pre and posttest in study group**

Parameter	Pre test		Post test		Wilcoxon Z Value	P Value
	Mean	SD	Mean	SD		
PSQI score	8.47	2.646	5.43	2.403	6.63	<0.0001

Table 1 shows the pre and post comparison of PSQI score. Pre-intervention PSQI score was  $8.47 \pm 2.646$  and post intervention it was reduced to  $5.43 \pm 2.403$  with change of 35.89% ( $p < 0.0001$ ).

**Figure 1: Comparison of PSQI scores Pre and Post Test**



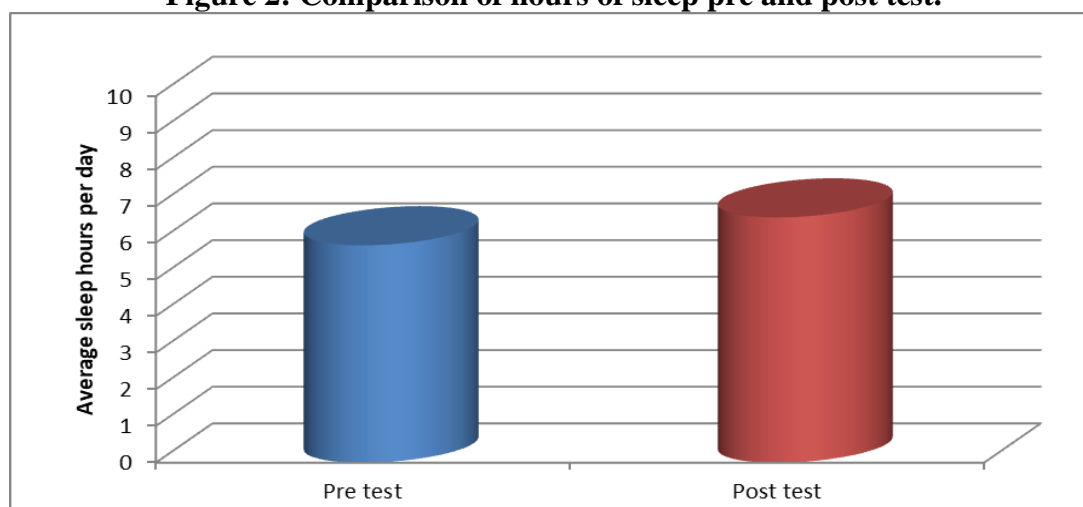
Graph 1 shows the comparison of average PSQI score among the 60 individuals pre- and post-intervention.

**Table 2: Comparison of hours of sleep per night between pre and post test in study group**

Parameter	Pre test		Post test		t Value	P Value
	Mean	SD	Mean	SD		
Sleep hours	5.93	0.683	6.69	0.720	10.91	<0.0001

Table 2 shows the comparison of hours of sleep per night pre and post-intervention. Pre-and post mean and sd of numbers of hours of sleep are  $5.93 \pm 0.683$  and  $6.69 \pm 0.720$  respectively. The percentage change was 12.82% (P < 0.0001)

**Figure 2: Comparison of hours of sleep pre and post test.**



Graph 2 shows the comparison between number of hours of sleep per day on average of the total 60 individuals included in the study pre-intervention and post-intervention. Pre-intervention the typical number of hours of sleep per day was between 5-6 hours and after 4 weeks of intervention the usual duration of hours slept per day has increased to be between 6-7 hours.

## DISCUSSION

The objective of the study was to find the effectiveness of Brain Gym Exercises on the sleep quality in young adults. The study was conducted on 60 individuals including both the genders between the age of 18-25 years whose PSQI score indicated that they had either mild or moderate sleep disturbance. Sleep quality and number of hours of sleep were measured pre and post the Intervention of Brain Gym Exercises.

In our study, the sleep quality of young adults according to PSQI score was 8-9 and

the average number of hours slept per night was  $5.93 \pm 0.683$  pre intervention.

Adolescents' sleep habits are changing rapidly as they start pursuing their higher education studies. The sleep patterns and sleep length of students are highly impacted as the demand on their time for studying, socializing as well as academics, financial stress or interpersonal relationships increases too [11].

Every night, the body needs at least 7 hours of sleep to maintain mood, memory, and cognitive function as well as to grow muscle, heal tissue and synthesize hormones. A study conducted by Yukun Li, Simeng Gu, Zhutao Wang, Hongfan Li, et al. in 2019, it was discovered that stressful life events are directly related to poor sleep quality. The direct and indirect links between stressful life events and poor sleep quality was mediated by resilience [12]. Factors such as college assignments, exams, social gatherings, consumption of tea and coffee late in the evening, alcohol and drug

use, feeling of hunger late at night are considered as contributing factors in sleep deprivation<sup>[13]</sup>.

Overall, Stress is a major factor contributing to poorer sleep quality in young adults. The sympathetic-adreno-medullar (SAM) axis, the hypothalamus-pituitary-adrenal (HPA) axis and the immune system are all activated during a stress response, which is regulated by a complex interaction of neurological, endocrine, and immunological systems. The rapid response brought on by SAM activation leads in increased norepinephrine (NE) and epinephrine (E) secretion into the circulation from the adrenal medulla and increased NE secretion from the sympathetic nerves, which raises NE levels in the brain. These E and NE the binds with  $\alpha$ -adrenergic and  $\beta$ -adrenergic receptors in CNS and smooth muscle along with other organs throughout the body. When these receptors are activated it causes smooth and cardiac muscles to contract, increases blood pressure, heart rate, cardiac output, increased salt retention and elevated blood sugar levels (Fig 1)<sup>[14]</sup>.

A study conducted in 2018 reported a strong correlation between cell phone use, online texting, late night texting with sleep disturbances or poor sleep quality<sup>[15]</sup>. Numerous research among college studies have reported poor sleep quality more in females (65.78%) than in males (55.21%), indicating high frequency of insufficient sleep<sup>[12]</sup>.

In our study, Graph 1 shows the comparison of PSQI scores pre and post brain gym exercises. The score of PSQI pre intervention was 8-9, whereas after giving the intervention for 4 weeks which included 3 sessions per week and 12 sessions in total it was seen that post 4 weeks of Brain Gym Exercises was 5-6, which indicates improvement in the sleep quality of young individuals. Our present study also reports that the average number of hours slept per night also increased from  $5.93 \pm 0.683$  to  $6.69 \pm 0.720$  showing a rise in duration of hours slept.

This result can be justified with the help of study conducted by Nikita seth et al , where they conducted a study to determine the efficacy of brain gym exercises on moderate insomnia. They stated that brain gym exercises helps in releasing of neurotransmitters like dopamine and serotonin which directly stimulates the arousal centres , cerebral cortex, sleep area of brain which is hypothalamus and have a restorative effect. They also highlighted that brain gym exercises improves attention, cognition, and induce relaxation by clearing the brain from accumulated neuro toxic waste products<sup>[16]</sup>.

A Study by Miranda M et al “Brain-derived neurotrophic factor: a key molecule for memory in the healthy and the pathological brain” highlighted that BDNF is found both centrally and peripherally expressed in endothelial cells, adipose tissue, and skeletal muscle cells. High quantities of this molecule have been observed in the hippocampus, amygdala, cerebellum, and cerebral cortex with hippocampal neurons. BDNF is an important component involved in synaptic plasticity and memory process. Exercise, long-term fluoxetine medication and cognitive training have all been demonstrated to increase BDNF concentration which improves performance on memory tasks<sup>[17]</sup>. Prolonged episodes or during chronic sleep deprivation, is linked to decreased hippocampal BDNF production which is linked to reduced memory and impaired cognition<sup>[18]</sup>. In a study conducted in Mampang area of South Jakarta in 2018 it was found that Brain Gym exercise was competent of increasing serum BDNF levels in the elderly population. This explanation supports our observation.

Various Studies including the above mentioned study, have shown that exercise have antidepressant benefits that are mediated by night time increases in non-rapid eye movement (NREM) and decreases in rapid eye movement (REM), alteration to slow-wave sleep (SWS) as well as sleep by raising the temperature and decreasing fatigue. Physical activity serves as a catalyst

for initiation of sleep. Additionally, exercise also has an effect on the cardiac system by acceleration of re-entrainment to a shifted light-dark cycle [19] The cerebral cortex and brainstem are activated by mild sleep deprivation to produce the physiological drives for non-rapid eye movement (NREM) and rapid eye movement (REM) sleep which is accompanied by BDNF over expression in these areas.

In addition, Brain gym exercise helps in physical and mental relaxation and this helps in decreasing the activity of sympathetic nervous system so that adverse effects of stress and anxiety can be avoided. After the session, the participants learned how to recognize signs of tension and routinely relax their muscles to attain calm (Fig 2).

Thus, in the present study, authors have explored the significant effect of brain gym exercises on sleep disorders in young adults which were much neglected. Several studies have recommended yoga, Relaxation and Music Therapy in the treatment of sleep disturbances and brain gym exercises can also be recommended for the same. This study can be conducted later on a larger population for a longer duration and each component of the sleep quality can be assessed to get a better idea of the section in which the improvement is seen.

## CONCLUSION

Authors of the study concludes significant effect of Brain Gym Exercises in improving the sleep quality statistically and clinically by increasing the hours of sleep in young adults therefore, Brain gym exercises can be used as an alternative form of physical exercise which is slow paced and involves deep breathing along with whole body relaxation.

### Declaration by Authors

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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