

EFFECTIVENESS OF CIRCUIT TRAINING AND BRAIN GYM EXERCISE ON SLEEP AND COGNITION IN COLLEGIATES WITH POOR SLEEP QUALITY – A COMPARATIVE STUDY

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Abstract: Background: Insomnia is the most common sleep disorder; affecting people of all ages, with poor sleep quality being particularly common among college students. Non-pharmacological remedies are becoming increasingly important. For undergraduate physiotherapy students, academic burdens and clinical postings often contribute to poor sleep quality, which can negatively impact cognition and academic performance. Non-pharmacological remedies, such as circuit training and brain gym exercise. This study aims to compare the effectiveness of these two interventions in addressing poor sleep quality and cognition challenges in students.

Objective: To ascertain the effectiveness of circuit training and brain gym exercise on sleep and cognition in collegiate with poor sleep quality.

Method: The study design is comparative study. This study includes 30 participants selected with the age group of 18-27 years and there are selected under selection criteria. The participants were randomly divided into 2 groups which as circuit training Group A and brain gym exercise Group B respectively. The intervention of the study was 8 weeks thus 4 sessions per week of 30 minutes per session and treatment duration of 4 weeks. The participants were assessed with PSQI, ISI (poor sleep quality) RDT, SG, SC-WT (cognition) at the beginning and at the end of the 4th week.

Result: the data analysis of pre-test and post-test showed a significant outcome of reduced sleep scale and increased cognition test. Thereby it improved the overall sleep quality of the participants.

Conclusion: both CT and BG exercises improved sleep quality and cognition performance. CT showed significantly greater improvement, making it the preferred intervention for enhancing cognitive abilities in individuals with poor sleep quality. Therefore, circuit training helped in improving sleep quality as well cognition.

Keywords: Poor sleep quality, Circuit Training, Brain Gym Exercise, PSQI, ISI, RDT, SG, SC-WT.

1. INTRODUCTION

Sleep accounts for approximately 1\3rd of human existence. However, recent research findings suggest that sleep exerts a much greater impact on the brain.^[3]Poor sleep quality affects people of all ages, and non-pharmacological remedies are becoming increasingly important.^[5]

According to the comprehensive worldwide literature review focusing on the sleep experiences of medical students, we observe that inadequate sleep is not only common among this group but also prevalent compared to non-medical students and the general population.^[3]

Sleep quality is a critical determinant of overall health, well-being, and cognitive performance. Collegiate students, due to academic stress, irregular sleep schedules, and lifestyle habits, are particularly vulnerable to poor sleep quality.^[11]

Insufficient or disturbed sleep has been associated with impaired concentration, reduced memory retention, and diminished problem-solving abilities, significantly impacting academic and personal success.^[8]

Physical exercise has long been recognized as an effective intervention for improving sleep quality. Circuit training (a combination of aerobic and resisted training), a high-intensity form of exercise involving a combination of strength, endurance, and cardio exercises has been shown to regulate sleep patterns and enhance cognition function.^[2]

Similarly, Brain Gym exercise (designed to enhance brain function, may help improve sleep and cognition abilities), which involve specific movements aimed at improving brain activity and coordination, have gained attention for their attention for their potential benefits in enhancing cognitive abilities and promoting relaxation, thereby contributing to improve sleep quality.^[4]

However, limited evidence exists on the comparative effectiveness of these two interventions in improving sleep quality and cognition in collegiate students. This study aims to fill this gap by investigating and comparing the effects of Circuit training and Brain Gym exercise on sleep and cognition in this population.

Despite all limitation, this systemic review provided the evidence of the prevalence rates of insomnia among the university student in south Asian countries. As the pooled prevalence of insomnia is considerably higher than general population, this review emphasized that insomnia in university students is a common health issue and more attention should be given to reduce insomnia among university students.

- A high prevalence of stress (99.9%) and which leads to poor sleep quality (76.7%) were found among physiotherapy students who were engaged in clinical posting.^[8]
- Nearly 60% of all UG students are reported to have poor quality of sleep.^[5]
- Poor sleep quality can have a negative impact on a college students ability to study, and their physical and physiological well-being. Lack of sleep can reduce learning ability by up to 40%.

NEED OF THE STUDY: The need of the study is to find out the effectiveness of Circuit training and Brain Gym exercise (on sleep and cognition in collegiates with poor sleep quality) to reduce the sleep disturbance and improve the sleep quality and cognition among college students.

- To improve the overall components that make up good sleep are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, and day-time dysfunction.
- To improve the working memory (is through to be a fundamental cognitive process that enables the brain to concurrently retain and manipulate information) and executive function.^[1]

Poor sleep quality is a prevalent issue among collegiate student, leading to adverse effects on physical health, mental well-being, and academic performance.^[10] Both physical and cognitive interventions, such as CT and BG exercise, have been shown to individually benefit sleep quality and cognitive function, but a direct comparison between these interventions has been explored in this population. This study aims to provide evidence-based recommendations for targeted interventions to enhance sleep and cognition, addressing a critical gap in existing literature.

2. REVIEW OF LITERATURE

1. **Mohit Kumar, et al., (2024)** – The study concluded that the CT shows improvement in sleep and also in (cognition) working memory and attention among college student.
2. **Vaishnavi M. Thakre, et al., (2024)** – The study concluded that improvement in sleep quality among students highlights that BG exercise have the potential to be a non-pharmacological alternative for managing mild to moderate insomnia.

3. MATERIALS AND METHODS

The study is a comparative study conducted in Adhiparasakthi College of Physiotherapy, Melmaruvathur, Tamil Nadu. This study includes 30 participants, who were divided into 2 groups which as Circuit training Group A and Brain Gym exercise Group B respectively, by simple random sampling method under randomized control trial for UG physiotherapy college students were selected under inclusion criteria of poor sleep quality, age group 18-27 years, both male and female, BMI<29Kg/M², ISI (8-19), PSQI (5-14), volunteers. And exclusion criteria of migraines, recent surgical history, smokers, under-psychotic drugs, on-going psychological counselling, presence of physical or mental illness, cognitive damage, overweight.

PROCEDURE

Participants were screened for poor sleep quality. Randomised allocation into CT or BG group. All the procedure and purpose of the study was explained to the participants and printed format informed consent form were taken from everyone. The intervention of the study was 8 weeks thus 1st two weeks and last two weeks for assessing the participants and 4 session/week of 30 minutes/session and treatment duration of 4 weeks.

Outcome measures are 1) ISI- measures area such as difficulty falling asleep, staying asleep, wake-up too early, and the impact of insomnia in daily functioning.^[13] 2) PSQI- the self-rated items are combined to form “7-components” score such as subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medications, day-time dysfunction.^[14] 3) RDT- a simple, non-invasive method to measure a person’s reaction time to a visual stimulus.^[17] 4) SG- done on online mode, electronic game of follow lights and sound, suspense built as sequences get longer.^[22] 5) SC-WT- a psychological assessment tool used to measure cognitive flexibility, processing speed, selective attention, and the ability to inhibit cognitive interference.

3-components: i) WT- word reading condition (neutral task), read the color word printed in black ink. ii) CT- color naming condition (neutral task), name the color of a series of colored block. iii) C-WT- incongruent (interference) condition, name the ink color of word where the color name and ink color do not match.^[25]

Physical exertion was monitored using Borg Rating of Perceived Exertion (RPE) before and after each session. CT group: engaged in structured workout focusing on physical fitness. BG exercise: performed cognitive-motor exercises designed to stimulate brain function. Data were analysed using paired t-tests for within-group comparisons and independent t-test for between-group comparisons to evaluate changes in sleep and cognitive function.

TREATMENT PROTOCOL

Table 1 group A- CIRCUIT TRAINING

CIRCUIT TRAINING	DURATION
Walking	3 Minutes
Seated rows	3 Minutes
Walking	2 Minutes
Leg curls	2 Minutes
Walking	2 Minutes
Bench press	2 Minutes
Walking	2 Minutes
Adductor machine	2 Minutes
Walking	2 Minutes
Abductor machine	2 Minutes
Walking	2 Minutes
Pushdown	2 Minutes
Walking	2 Minutes
Biceps curls	2 Minutes
Walking	2 Minutes

Note: CT exercise order with duration

Table 2 group B- BRAIN GYM EXERCISE

BRAIN GYM EXERCISE	SET/ REP	DURATION
Spot March	3 set/ 10 rep	1 Minutes
Hook Ups	5 set/ 8 rep	2 Minutes
Positive Points	10 rep	1 Minutes
The Active Arm	3 set/ 10 rep	5 Minutes
Earth Button	10 rep	2 Minutes
The Energy Yawn	10 rep	1 Minutes
A Lazy 8’s	10 rep	1 Minutes
Gravity Glider	2 set/ 10 rep	5 Minutes
Foot Flex	2 set/10 rep	2 Minutes
The Energizer	3 set/10 rep	5 Minutes

Note: BG exercise with set, rep, duration

4. DATA ANALYSIS AND RESULT

Table 3 Pre and Post Test values of CIRCUIT TRAINING

GROUP A	MEAN	S.D.	T Value	P Value
ISI pre	12.800	2.484	16.940	<.000
ISI post	6.733	1.579		
PSQI pre	10.933	2.016	17.451	<.000
PSQI post	5.066	0.798		
RDT pre	14.380	0.807	10.077	<.000
RDT post	12.646	0.842		
SG pre	7.120	0.424	12.64	<.000
SG post	7.920	0.380		
WT pre	112.200	5.747	18.60	<.000
WT post	125.866	6.186		
CT pre	72.133	3.961	5.688	<.000
CT post	75.866	3.594		
C-WT pre	46.533	2.474	12.61	<.000
C-WT post	48.466	2.386		

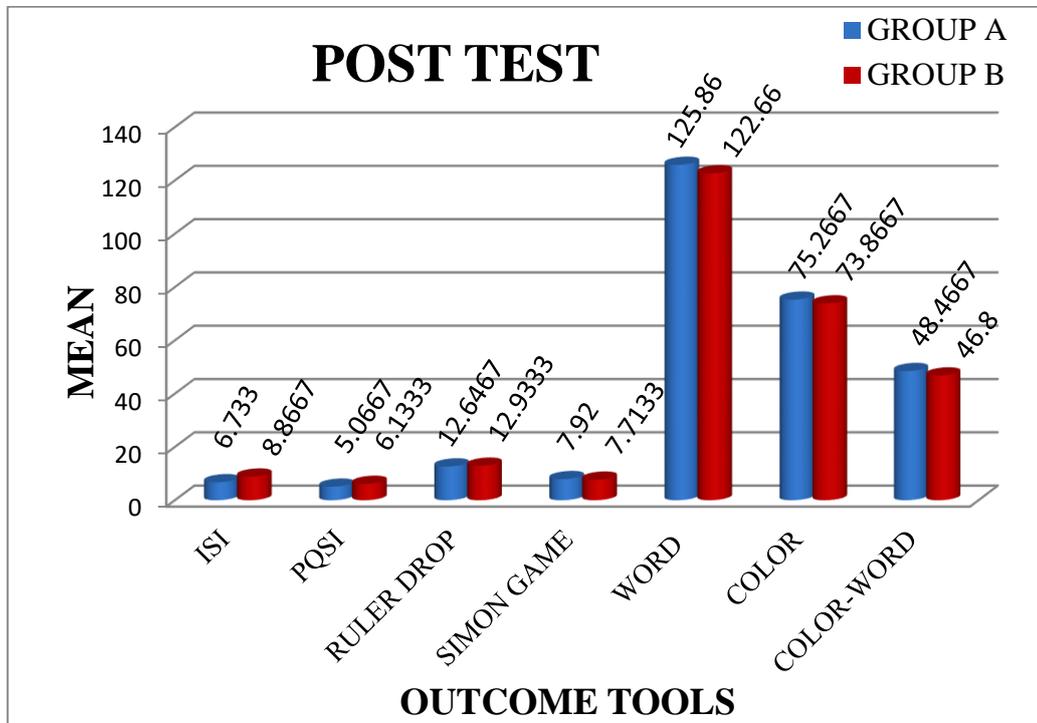
Table 4 Pre and PostTest value of BRAIN GYM EXERCISE

GROUP B	MEAN	S.D.	T Value	P Value
ISI pre	13.133	2.199	16.000	<.000
ISI post	8.866	2.199		
PSQI pre	11.533	1.995	15.466	<.000
PSQI post	6.133	0.743		
RDT pre	14.353	0.855	17.750	<.000
RDT post	12.933	0.658		
SG pre	7.006	0.388	24.88	<.000
SG post	7.713	0.367		
WT pre	110.533	6.490	4.513	<.000
WT post	122.666	10.621		
CT pre	70.933	3.239	14.22	<.000
CT post	73.866	3.622		
C-WT pre	45.466	2.774	10.58	<.000
C-WT post	46.800	2.980		

Note: Group-A; p value significant (<.000)

Note: Group-A; p value significant (<.000)

GRAPH 1 Shows the post-test of both group A (CT) and group B (BG exercise)



5. DISCUSSION

Sleep quality is a critical determinant of overall health, well-being, and cognitive performance. Insomnia is the most common sleep disorder. The prevalence of poor sleep quality elevates notably among UG physiotherapy students, academic burdens and clinical posting often contribute to poor sleep quality, which can negatively impact cognition and academic performance.

Collegiate students, due to academic stress, irregular sleep schedule, and lifestyle habits, are particularly vulnerable to poor sleep quality.^[11] Insufficient or disturbed sleep has been associated with impaired concentration, reduced memory retention, and diminished problem-solving ability, significantly impacting academic and personal success.^[8]

The present study aimed to evaluate the effectiveness of CT and BG exercise on sleep and cognition in collegiate students with poor sleep quality. The study conducted by Mohit Kumar, et al., was concluded that the CT shows improvement in sleep and also in (cognition) working memory and attention among college students.

The present study was primarily designed to see the effects of CT and BG exercise on sleep and cognition in collegiate students with poor sleep quality. There is a dire need of study to examine the effect of 4 weeks of CT and BG exercise on sleep and cognition in collegiate students. The primary findings of the study were: (1) Female was found to have poor sleep quality with slightly higher prevalence than male. (2) Overall sleep quality and its components were improved after 4 weeks of CT. (3) CT results significant difference in working memory and executive function.

Considering the following results of the studies we can say that combined, aerobic and resistance training was effective in improving sleep quality but we should emphasize that our protocol of 16 sessions showed positive benefit comparable to studies using longer intervention times. Thus, our 4 week CT routine may help to improve sleep quality.^[1]

The study conducted by Vaishnavi M. Thakre concluded that improvement in sleep quality among students highlights that BG exercise has the potential to be a non-pharmacological alternative for managing mild to moderate insomnia.

BG is a curriculum rooted in neuroscience and education kinesiology principles. Utilizing the “brain-body link” theory, these exercises help activate the brain to render neurons stronger to deal with an array of external data and respond to a “corporate member” of their duty corresponding to certain brain areas.^[3]

The results suggest that CT is more effective than BG exercise in improving cognitive performance among collegiate students with poor sleep quality. CT may enhance attention, cognitive flexibility, and inhibitory control, leading to superior performance in tasks requiring complex cognitive processing.

The statistical analysis demonstrates a notable improvement in the pre-and post-scores of the ISI, PSQI, RDT, SG, SC-WT following 4 weeks of CT. In comparison, BG exercise showed less effectiveness in addressing insomnia. The observed improvement in sleep quality among students highlights that CT has the potential to be a non-pharmacological alternative for managing poor sleep quality.

These findings highlight the importance of incorporating structured physical and cognitive exercises into daily routine to enhance sleep and cognitive performance, especially in populations vulnerable to poor sleep quality, such as college students, this research underscores the potential for non-pharmacological intervention to address sleep and cognitive challenges in this demographic.

Further research could explore the long-term benefits and underlying mechanisms of these interventions, as well as their applicability to broader population. Promoting accessible and effective lifestyle modifications like CT and BG exercises could significantly enhance the well-being and academic performance of college students.

Since participants that were taken in our study have no cognitive impairments, they only had poor sleep quality. We only assess the cognition at baseline and after the 4 weeks of intervention which significantly improved as their sleep quality improved. Therefore, **CIRCUIT TRAINING** helped in improving cognition as well.

6. CONCLUSION

This study concluded that both interventions are effective in improving sleep quality and cognitive performance in collegiate students with poor sleep quality. However, **CIRCUIT TRAINING (GROUP A)** appears to yield slightly greater benefits compared to **BRAIN GYM EXERCISE (GROUP B)**.

LIMITATION: This study was limited in age group between 18-27 years, small sample size and short duration. The results may not be generalized to other population. Use of 2 variable scales for assessment.

SUGGESTION: use of more sampling for research purpose. It can be done in bigger samples.

The study duration can be extended and monitor the long-term effects. Use of more reliable scale for assessment and increase the follow-up.

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