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Effect of Brain Gym Exercises on Attention Span and Quality of Sleep in Menopausal Women-A Randomized Clinical Trial

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Abstract

Background: During menopause, several common psychological disorders occur, that negatively impact cognition including sleep disorders and attention deficits. These sleep problems can be major sources of impaired quality of life and can lead to physical and psychological conditions such as cardiovascular diseases, diabetes, depression, anxiety, and overuse/abuse of hypnotic medications. Sleep disorders are reported to occur frequently in 40% to 60% of peri and postmenopausal women, and often persist during the rest of their life. Disruption in sleep affects attention, vigilance, working memory and executive function; sleep loss particularly affects attention-rich task.

Aim: The purpose of the study was to study the effect of brain gym exercises on attention span and quality of sleep in menopausal women.

Methodology: 30 subjects were selected according to inclusion criteria out of all the subjects has completed the study. Approval and written consent was taken from all the subjects. Pre-interventional attention span was calculated by Stroop test and trail making test and quality of sleep will be calculated using Pittsburgh sleep quality index. Subjects were treated for 4 weeks using brain gym exercises. Post – intervention, subjects were again assessed using Stroop test and Pittsburgh Sleep Quality Index.

Outcome Measures: Pittsburgh Sleep quality Index, Stroop Test, Trail making Test.

Result: Effective increase attention span and quality of sleep in menopausal women after performing Brain gym exercises. (p=0.001)

Conclusion: Here we conclude that brain gym exercise increase attention span and quality of sleep in menopausal women.

Keywords: Trail making test (TMT), Pittsburgh sleep quality index (PSQI), Brain Gym, Stroop test, Attention span.

Introduction

The World Health Organization has defined the menopause as the permanent cessation of menstruation resulting from loss of ovarian follicular activity (World Health Organization, 1996). The perimenopause commences when the first features of approaching menopause begin until at least 1 year after final menstrual period (FMP). The human ovary establishes several million non growing follicles (NGF) at around five months of gestational age which is followed by a decline to the menopause when approximately 1,000 remain at an average age of 50-51 years. With approximately 450 ovulatory monthly

cycles in the normal human reproductive lifespan, this progressive decline in NGF numbers is attributed to follicle death by apoptosis. Some studies have suggested that the instantaneous rate of temporal change increases around the age of 37 years, when approximately 25,000 follicles remain, followed by exhaustion of the NGF pool and menopause 12-14 years later. Menopause is a physiological event in the women's life. It is caused by aging of ovaries which leads to decline in the production of ovarian Gonadotrophins, Estrogen and Progesterone. The deficiency of these hormones elicits various somatic, vasomotor, sexual and psychological symptoms that impair the overall quality of life of women (Dennerstein et al., 2000 and Deeks & McCabe, 2004). Some of the menopausal symptoms included: hot flushes, urinary incontinence and reduced sexual function (Greendale et al., 1999).

Menopause has an adverse impact on overall musculoskeletal health. It is associated with osteoporosis, osteoarthritis and Sarcopenia. Osteoporosis is a well recognized, most prevalent bone disorder in postmenopausal women, characterized by low bone mineral density and deterioration of micro-architecture of bone. This risk is further potentiated by weak muscles, weak joints and frailty which together increase the risk of fall. Osteoarthritis is also a well-established, easy to diagnose condition which involves loss of cartilage. Sarcopenia is, however, a newly recognized condition which indicates age-related loss of skeletal muscle mass as well as function. Sarcopenia may further progress to frailty and sarcopenic obesity, which put these women under risk of compromised life as well as increased mortality.

Menopause is a risk factor for CVD because estrogen withdrawal has a detrimental effect on cardiovascular functions and metabolism. Menopause negatively impacts upon many traditional risk factors for CVD, including changes in body fat distribution from a gynoid to an android pattern, reduced glucose tolerance, abnormal plasma lipids, increased blood pressure, increased sympathetic tone, endothelial dysfunction and vascular inflammation. The total CVD risk in women may best be defined by high concentrations of triglycerides, a high level of lipoprotein (a) and low level of high density lipoprotein (HDL) cholesterol, with high levels of total cholesterol and low density lipoprotein (LDL) cholesterol having less impact.

Cognition consists of many areas of intellectual functioning, including perception, learning, memory, language, visuospatial skills, abstract reasoning and judgment. During menopausal transition many women complain of memory problems such as difficulty with words, forgetfulness and "brain fog", thus suggesting that hormonal changes related to menopause may be responsible for changes in cognition. Executive functions 'coordinate information, and are involved in strategy generation and planning'. This area of cognition is important in everyday living and is affected by various psychiatric and neurological conditions. Executive function is dependent on attention, perception, categorization and memory. Examples include sustaining and flexibly redirecting attention, inhibiting inappropriate behavioural or emotional responses, planning strategies for future behaviour, then initiating and executing those strategies and being able to flexibly switch among problem-solving approaches to achieve behavioural or motor goals. Executive function is significantly poorer in the late postmenopausal stage women, suggesting that this aspect of cognition deteriorates more rapidly than other functions. During menopausal transition, women are at higher risk of developing depression, stress, anxiety and emotional distress.

Anxiety can affect physiological reactions, behaviour, feelings and thoughts. Symptoms may include a racing heart, rapid breathing, sweating, hot flushes, shaking, dizziness and nausea. Anxiety in the meno-pausal woman is also likely to be influenced by prior history of anxiety disorder, and psychosocial factors such as relationship status, family problems, socioeconomic status and life style factors. Patients with anxiety have been observed to suffer from deficits in attention and to also have difficulties in the ability

to inhibit distracting stimuli. Common psychiatric disorders that may negatively impact cognition include sleep disorders, mood and anxiety disorders, attention-deficit/hyperactivity disorder (ADHD), stress, endocrine disorders and neurological conditions, such as dementia and head trauma. Attention is central to executive function and memory and allows an individual to focus the consciousness on single or divided stimuli. If attention shifts to unrelated stimuli in the external environment it has been referred to as 'mind wandering', a term described by Smallwood et al. (2006) in their article on the restless mind. Mind wandering may occur when tasks that do not need high vigilance are required of the individual. The interplay of ease of distraction, mind wandering, vigilance and attention have been found to be critical for many motor and intellectual functions.

Anxiety and mood disorders- Disrupt attention and increase distractibility, thereby reducing working memory. Sleep complaints are common during the menopause transition. Sleep disorders are reported to occur frequently in 40% to 60% of peri and postmenopausal women, and often persist during the rest of their life. These sleep problems can be major sources of impaired quality of life and can lead to physical and psychological conditions such as cardiovascular diseases, diabetes, depression, anxiety, and overuse/abuse of hypnotic medications. As average life span increases, women are expected to live nearly half of their lives in the postmenopausal state, implying that menopause related problems represent an increasingly high priority. Disruption in sleep affects attention, vigilance, working memory and executive function; sleep loss particularly affects attention-rich task.

Methodology

A randomized, non-blinded, experimental clinical study was conducted on 30 subjects. Institutional Ethics committee approved the research. A written informed consent was obtained from the participants. Pre-interventional attention span was calculated by Stroop test and trail making test and quality of sleep will be calculated using Pittsburgh sleep quality index. Subjects were treated for 4 weeks using brain gym exercises. Post–intervention, subjects were again assessed using Stroop test and Pittsburgh Sleep Quality Index.

Outcome Measures

- Stroop Test
- Trail Making Test
- Pittsburgh Sleep Quality Index(PSQI)
- Epworth Sleepiness Scale

Intervention

Step	Activities	Procedure	Frequency	Duration
1	Drinking Water	-	Before the exercises start	-
2	Cross Crawl	Sit or stand and with your right-hand elbow touch your left knee and vice versa.	2 Times in a day	3 To 5 Minutes
3	Think Of X	Close your eyes think of letter x and visualize it on the body as a left shoulder to the right hip and right shoulder to the left hip.	2 Times in a day	3 To 5 Minutes
4	Lazy eight	Extend arm straight out in front it should be equal to shoulder level with thumb posing towards celling slowly pace the shape of 8	2 Times in a day	3 To 5 Minutes
5	Neck rolls	Drop down head in front simply try to make small rolls while breathing with clockwise and anti-clockwise.	2 Times in a day	3 To 5 Minutes
6	Belly breathing	Put your hands on abdomen inhale deeply and exhale with a short puff of air thinking feather to float in the air.	2 Times in a day	3 To 5 Minutes
7	Brain buttons	Put your right hand on your sternum and place left hand on the abdomen and slowly breathe in and out.	2 Times in a day	3 To 5 Minutes
8	The thinking cap	Using one hand at the top of your every ear try to unroll the curved part of both ears till you reach the bottom ear.	2 Times in a day	3 To 5 Minutes
9	Calf pumps	Place your 1 leg in front and another back of it try to lunge down and contract the calf of backside leg.	2 Times in a day	3 To 5 Minutes
10	The Energizer	Place your head on the desk in front exhale and inhale while coming up and try to hyperextend the neck carefully.	2 Times in a day	3 To 5 Minutes

Statistical Analysis

Data will be statistically analysed by –
Pittsburgh Sleep Quality Index Pre and Post intervention – done by paired t test
Stroop Test Pre and Post intervention – done by paired t test
Trail Making Test (A) Pre and Post intervention – done by paired t test
Trail Making Test (B) Pre and Post intervention – done by paired t test

Results

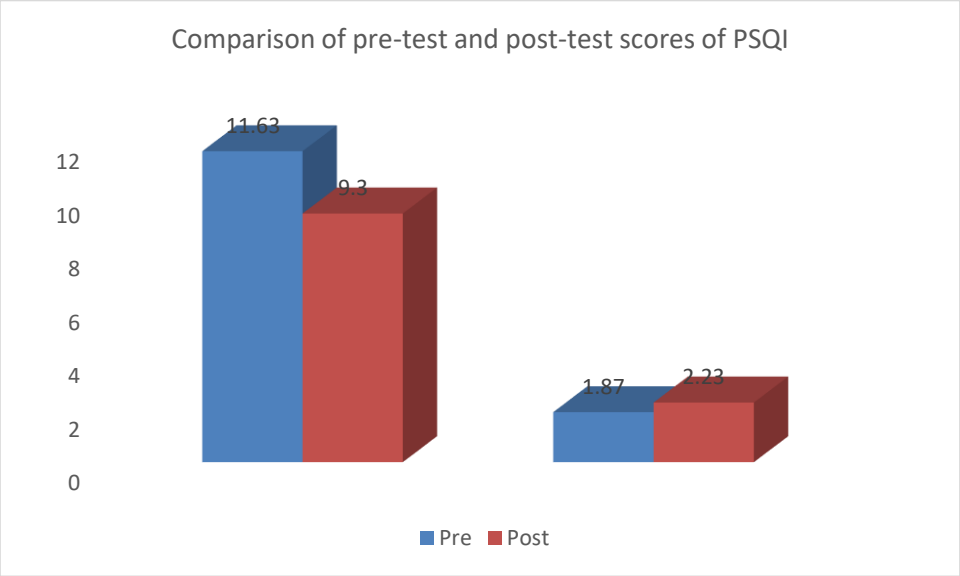
Statistical analysis was done using Paired t-test.
Pittsburgh Sleep Quality Index Analysis:

Table 1: Comparison of pre-test and post-test scores of PSQI

Time	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
Pre	11.63	1.87	2.33	0.88	2.64	14.456	0.001*
Post	9.30	2.23					

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 2.64 value which is assumed to be very high effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Graph 1: Comparison of pre-test and post-test scores of PSQI



Stroop Test Analysis:

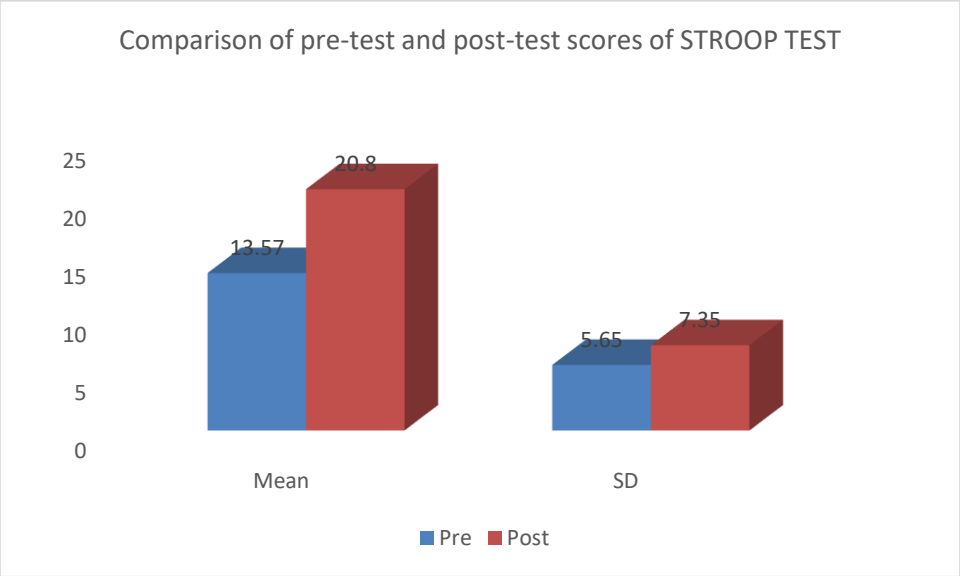
Table 2: Comparison of pre-test and post-test scores of STROOP TEST

Time	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
Pre	13.57	5.65	7.23	2.37	3.05	16.692	0.001*
Post	20.80	7.35					

The mean value indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 3.05 value which is assumed to be very high effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment

values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Graph 2: Comparison of pre-test and post-test scores of Stroop Test



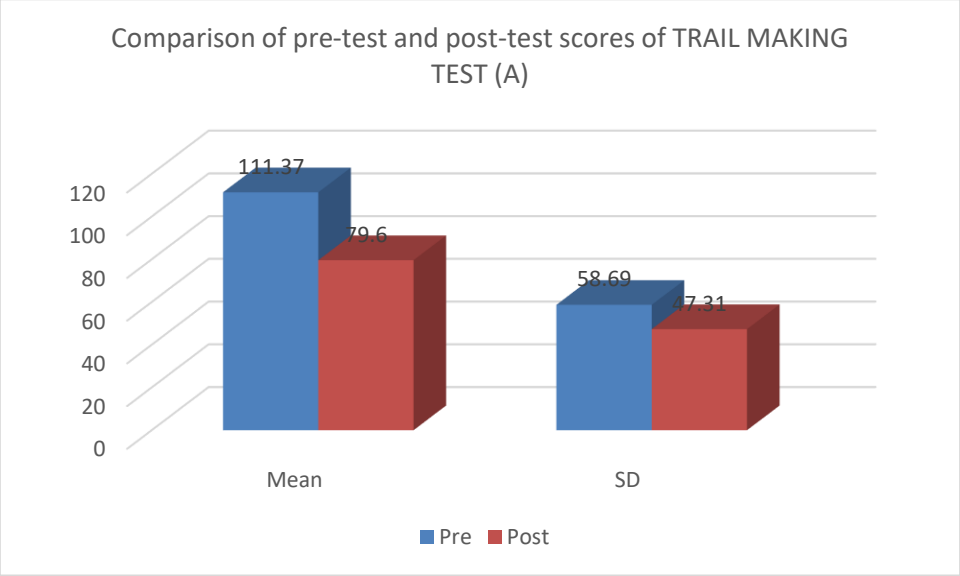
Trail Making Test (A) Analysis:

Table 3: Comparison of pre-test and post-test scores of Trail Making Test (A)

Time	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
Pre	111.37	58.69	31.77	16.72	1.90	10.406	0.001*
Post	79.60	47.31					

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 1.90 value which is assumed to be very high effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Graph 3: Comparison of pre-test and post-test scores of T (A)



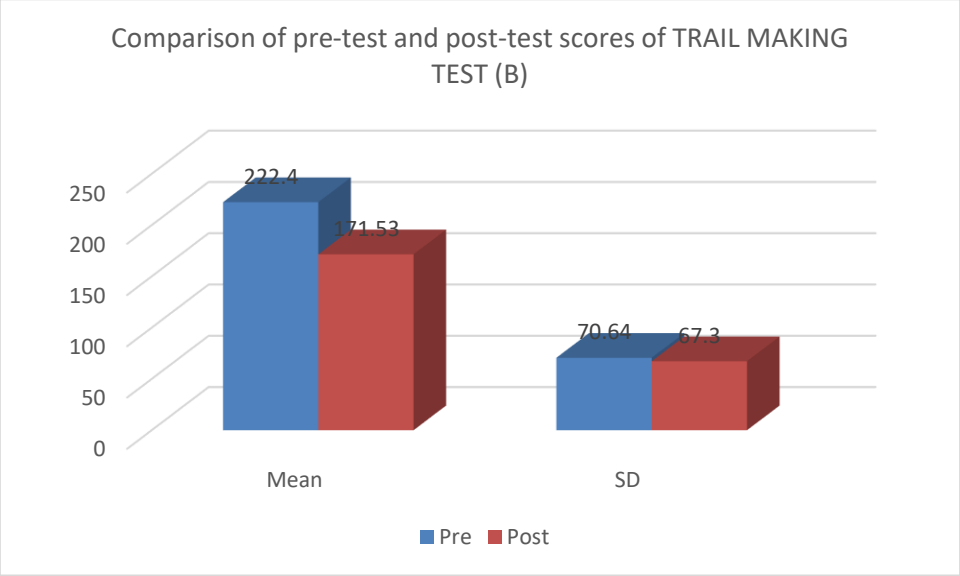
Trail Making Test (B) Analysis:

Table 4: Comparison of pre-test and post-test scores of Trail Making Test (B)

Time	Mean	SD	Mean Diff.	SD Diff.	Effect size	t-value	p-value
Pre	222.40	70.64	50.87	30.55	1.67	9.120	0.001*
Post	171.53	67.30					

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 1.67 value which is assumed to be very high effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Graph 4: Comparison of pre-test and post-test scores of Trail Making Test(B)



Results from analysis:

The final analysis proves that both attention span and quality of sleep were clinically improved.

Paired t-test was used to analyse the Pittsburgh Sleep Quality Index, the mean value indicated changes post treatment and lower values are recorded for post treatment outcome. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Paired t-test was used to analyse the Stroop test, the mean value indicated changes post treatment and higher values are recorded for post treatment outcome. . Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Paired t-test was used to analyse the Trail Making Test (A), the mean value indicated changes post treatment and lower values are recorded for post treatment outcome. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Paired t-test was used to analyse the Trail Making Test (B), the mean value indicated changes post treatment and lower values are recorded for post treatment outcome. . Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

Discussion

The study's key conclusions are addressed below. Executive function and memory depend on attention, which enables a person to concentrate their attention on a single or a variety of stimuli. "Mind wandering" is the term used to describe when attention wanders to unrelated stimuli in the surroundings. During the menopause transition, sleep problems are frequent. According to reports, 40% to 60% of peri and post-menopausal women experience regular sleep difficulties, which frequently last the remainder of their lives.

There are two types of sleep: REM (rapid eye movement), which is characterised by rapid eye movement and a loss of muscular tone, and NREM (non-REM). During REM and NREM sleep, the average sleep cycle lasts 90 to 120 minutes and happens five times per night. 20% to 25% of all sleep is spent in REM sleep, while 75% to 80% of it is spent in NREM sleep. Yoga and aerobic exercise have shown a considerable improvement in sleep quality, which is problematic for menopausal women. Exercises at the brain gym also improved sleep quality (p 0.001). After administering brain gym activities, significant before and after evaluation changes were seen.

One of the common psychological issues menopausal women have is ADHD. Exercises that were carefully planned, mirror treatment, and massage therapy all significantly increased attention span. Comparable improvements in attention span are seen in the pre- and post-assessment adjustments. Exercises that involve the figure 8 improve hand-eye coordination. Also, it helps with attention and can be quite helpful for students who struggle with ADHD.

Brain gym uses movement to establish neural connections in the brain in a similar way that nature does. Alongside improving learning and performance abilities across the board, it supports students with particular behavioural and learning issues. Participants have informed us that the brain gym activities have enhanced their self-confidence, self-esteem, coordination, and communication. Almost 50% of the body's nerves are located in the head and face, and since the jaw muscle is frequently tense, doing so is very helpful for soothing the nervous system, reducing stress, and increasing sensory intake.

The term "brain gym" often refers to a certain collection of actions, procedures, plans, resources, and educational philosophies. There are many sets of exercises in it. When we performed the brain-gym workouts on volunteers, the findings supported the theory. Exercises for the brain gym like drinking water demonstrate effective communication between the neurological system and the brain, as well as effective knowledge storage and retrieval. Recover from your anxiousness and stop dehydration, too. These sets of brain-gym exercises are beneficial for reducing stress, achieving objectives, and improving performance and organising abilities. Cross crawling is one of the brain gym activities that enhances spelling, writing, listening, reading, and understanding.

The regular practise of brain gym activities also has a positive impact on clear listening and speaking, exam taking and other comparable obstacles, and keyboarding. The slow 8 tasks will aid with reading comprehension, writing mechanics, deciphering written language, and reading mechanics. These exercises have also been demonstrated to improve eye-hand coordination, relieve neck and shoulder pain, strengthen the muscles within the eyes, and make it easier to focus on one object at a time when reading. Moreover, it will improve cognitive abilities, silent speaking, and short-term working memory.

Brain gym assists with recalling the study material before/during a test and reawakening a hearing mechanism so that we may hear with both ears at once. Exercises at the brain gym demonstrate how the complete body and mind may be activated. Balance and equilibrium are improved by practising brain gym activities. The participants also demonstrated how the brain gym activities facilitate freer communication and can be especially beneficial for students who are speech-impaired or autistic. Exercises like these revitalise the body after spending a lot of time seated at a desk or in front of a computer, boost oxygen flow, relax the neck and shoulder muscles, and revive attention. Exercises like the energy Yawn target communication skills that call for verbal interaction and boost vitality and alertness.

Subjects were asked to perform Brain Gym Exercises to study its effect on attention span and quality of sleep on menopausal women. The subjects were first screened based on the inclusion and exclusion criteria. They performed 10 different brain gym exercises twice a day for a month. On day 1 pre assessment

data was collected using Pittsburgh sleep quality index for assessing sleep quality and Stroop test, Trail Making Test (A&B) for assessing attention span. After completion of the protocol post assessment data was collected.

When statistically analysed, clinical presentation showed significant improvement in attention span and sleep quality. The p value of all the test (PSQI, Stroop test, Trail making test) are 0.001 which concludes them to be significant.

So to conclude we say that Brain gym exercises help in improving attention span and quality of sleep in menopausal women.

Conclusion

According to the findings the result of the study concludes that there is significant improvement in attention span and quality of sleep in menopausal women.

Appendix

Informed Consent Form

Participant's Name :

Age :

Gender :

Address :

Title of the project: Effect of brain gym exercises on attention span and quality of sleep in menopausal women.

The details of the study have been provided to me in writing and explained to me in my own language. I confirmed that I have understood the above study and have the opportunity to ask question. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving any reasons. By doing so I am aware that my medical care or legal rights will not be affected. I agree that the data or results obtained from this study can be used only for scientific purpose(s). I fully agree to participate in the above study.

Signature of the Participant

_____

Signature of the investigator

_____

Date :

Place:

Data Collection Sheet

Name of participants :
Age:
Gender:
Occupation:
Address:

	PRE TEST SCORE	POST TEST SCORE
Trail Making Test A & B (TMT A & B)		
STROOP TEST		
Pittsburgh Sleep Qualiy In-dex(PSQI)		

Signature of investigator _____

Signature of guide _____

-

Date :

Place:

Conflict of Interest

Authors suggest no conflict of interest

Acknowlegement

I take this grateful opportunity to thank all the “HANDS” which have joined together to make this project a SUCCESS.

It’s my great pleasure and privilege to express my deep-felt gratitude to our respected Principal ma’am **Dr. AAKANKSHA JOSHI** and Guide **Dr. VRUSHALI BHORE** who immensely helped me and rendered their advice, precious time, constant encouragement, knowledge and relevant information regarding my study, and whose suggestion and guidance has enlightened me on this subject. I express my sincere thanks to **all the teaching & nonteaching staff** of the Miraj Medical Centre, College of Physiotherapy. Above all, I would like to thank my parents for their blessings, love, constant support, affection and encouragement.

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