



**EFFECT OF NEUROBIC EXERCISES ON MEMORY ENHANCEMENT AMONG
YOUNG ADULTHOOD: A RANDOMIZED CONTROL TRIAL**

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ABSTRACT

Objectives: Scientists reported that there is a second growth spurt of gray matter in the brain in the young adults. The present study was planned with the objectives to find out the effect of activity based neurobic exercises program to improve memory among young adulthood and to compare the effectiveness of two different types of neurobic exercise among them. **Methods:** For this purpose randomly selected 84 subjects aged 20-24 years, whose neurobic score was below 21 were considered for this study from Swami Rama Himalayan University. The subjects were further divided into two groups, i.e. experimental and control. In experimental group, the subjects were given 3 sessions of activity based neurobic exercises per week for 2 weeks. Whereas, in control group, conventional neurobic exercises were given to the subjects for home for 2 weeks. Pre assessment was done by using MMSE and PGIMS scale and post assessment was taken after 2 weeks. **Results:** The findings of the present study showed that for memory enhancement in young adulthood, the control group in which conventional neurobic exercises were given, was more effective, statistically significant differences ($p < 0.000$) were found in the control group. When comparisons were made between the control and experimental group, then too, the control group was having higher percentage of increment. **Conclusion:** It might be concluded from the findings that both groups were significantly effective in improving the memory in young adulthood, Conventional neurobic exercises was found to be statistically more effective in improving the memory in young adulthood, In both the outcome measures PGIMS and the MMSE, statistically significant changes were found in the control group as compared with experimental group.

KEYWORDS: Neurobic exercises. MMSE score. PGIMS score. Young adulthood. Neurotrophins.

INTRODUCTION

Young adulthood is a time of life when there is scarcity of information regarding changes of life. It is a period of frequent changes and exploration that covers variety of sides to look forward like school, family, work, social.^[1] Process of becoming adult shows drastic changes in adjusting with the sexually maturing, fidelity, capacity to think, to recognize their uniqueness, and develop stable relationship with peers and self-reliance. They experience swift physical changes triggered by hormones and greater acceptance of physical appearance, limited ability to hold more than one point, firmer sense of identity, growth of romantic and sexually oriented relationships, meets demands like stable interest, higher level of concern about future and self-reliance. All these things lead to multitasking of individuals which can lead to decrease in remembering each task which can lead to

deterioration of the ability to withstand society, work demand, and time management. Sometimes, the person is not able to give its full attention over the work and task given which could lead to depression of them. The attitude of carelessness is always an early sign that the person is having disturbed memory while doing multitasking. These all situations can have a powerful wound over the mind of young adulthood as it is the situation of embarrassing and can lead to lifetime wound over the mind of youngsters.^[1]

Scientists have reported that there is a second growth spurt of gray matter in the brain at the age of 20s followed by pruning where new connections are formed, and if not used, it vanishes with time. If during this time of period, some new connections are built, it can lead to enhancement of cognitive development. If it is possible

to get synapses activated in some way, it can lead to many new connections and activation of different lobes for enhancing the memory. This can help the young adulthood a better life and can help in encouraging them.^[1]

If second growth spurt of gray matter happens which indirectly leads to memory enhancement than it should be activated while this crucial period of time.^[1] If this can be succeed, than it cabled to activation may lobes or areas of brain which can help them to retention more information at same time and can help in many areas like personal development, professional development, social interaction, etc.^[1,2]

As the name indicates, neurobic means aerobic exercise of brain with goal of keeping mental abilities, memory as well as learning new information exercise, is a quirky brain exercise which is based on latest findings of scientific research.^[3] This sets of exercise is combining of all senses like vision, hearing, taste, smell, touch. It is different from others in way that they involve all physical sense, fun, loving, interacting.

Neurobic exercises help in stimulating neurotrophin, a brain protein, which helps in strengthening of brain synapses. It also increases the size and complexity of dendrites to stay younger and stronger, and improve memory retention. The brain-derived neurotrophic factor (BDNF) is a member of neurotrophin which is a growth factor. It is largely expressed throughout the brain, especially in the areas which are responsible for memory, and other cognitive functions which includes the area like hippocampus, basal forebrain, prefrontal cortex. It also has a role in long term memory and overall brain function. By doing the Neurobic exercise daily can stimulate many other areas of the brain.^[3]

It uses six brain senses and encourage non routine daily activities to stimulate nerve cells to be strong and grow continuously and it also helps in reducing the atrophy i.e., shrinking of brain by giving different kind of the experiences. By giving repeated different kind of experiences by different kind of stimulus to different senses like vision, hear, taste, smell, taste, touch and emotions in and unexpected or non-routine way helps in stimulating different lobes of cerebral cortex like frontal lobe, parietal lobe, occipital lobe and temporal lobe.^[2]

Most types of memories are stored in the cortex because almost 90% of neurons are located in the cerebral cortex which is connected to the cerebellum and spinal cord. In the medial temporal lobe of the cerebral cortex where the hippocampus is located and the amygdala is located adjacent to it. These two play a key role in short term memory. Memory begins with the sense taking in stimulus at the cerebral cortex and transformed into sensory memory. When information is repeated, it transfers to the limbic system in the hippocampus and is stored as a working or short term memory. The short

term memory can change to long term memory by repetition. By repetition temporary memory is converted to long term memory which has more retention. The conversion from the short term to long term memory many times needs little repetition but depending upon the core of information its duration and number can be modified.^[4]

When using the sense of touch by object identifying by touching coins, different texture, etc. Frontal lobe is involved in conscious thought and higher mental functions such as decision making, particularly in that part of the frontal lobe known as the prefrontal cortex. It also plays an important role in processing short term memories and retention of longer term memory. Using the emotional sense combined in five senses like playing cards and listening to music, will motivate the diencephalon, especially hypothalamus, which regulates the emotion and encodes memory attention.^[5,6]

MATERIALS AND METHODS

Design: This study was RCT with a repeated measures design.

Participants: Notably, 28 females and 13 males in experimental group and 26 female students and 12 males were recruited through randomized sampling from Swami Rama Himalayan University. The written consent was given by the subjects after clarifying the aim of this study to them.

OUTCOME MEASURE

Mini Mental State Examination (MMSE scale): MMSE is a scale consisting of 11 questions which test orientation, memory, and attention of subjects. First component consists of orientation which consists of 5 points second component is Registration which consists of 3 points, Third component is Attention and calculation which consists of 5 points, Fourth component is recall which consists of 3 points, fifth component is Language which further consists of five sub components total of 8 points, Sixth component is copying consists of 1 point. This scale consists of 30 points, 24 - 30 is a no cognitive impairment whereas below 23 to 18 is mild cognitive impairment and below 17 is severe cognitive impairment.

PGI Memory scale (PGIMS scale): PGIM scale is another scale used in study. This consists of 10 components in which different components have different type of questions and activity. The first component is Remote memory which have 6 set of question and 6 points for this component, Second component is Recent memory and have 5 types of question and total points of 5, Third component is Mental balance which have 3 set of question and total 7 points, fourth component is Attention and concentration which have 2 sub type and total points.

The fifth component is Delayed recall which has total 10 points, sixth type is immediate recall which consists of 9 points, seventh component is verbal Retention for similar pairs consists of 5 points, eighth component is verbal Retention for dissimilar pairs consists of 15 points. Ninth component is visual Retention which consists of a few cards contacting some diagram subjects allowed to look at them for 15 second and draw on paper. It consists of 10 points, the Tenth component consists of 2 cards. Some similar things are drawn on them but few different things too. Subjects are allowed to see the first card for a few seconds and then another card is given to them and asked to find objects seen on the first card consisting of a total of 10 points. This scale consists of a total 88 score, higher the score higher is memory and lower the score indicates low memory.

PROCEDURE

Subjects were recruited and then were randomly allocated to experimental and control groups. Experimental group received new set of Neurobic exercise for 2 weeks 3 session per week while control group received conventional Neurobic exercise by providing them list of exercise they have to do for 2 weeks. Baseline assessment was taken upon entry to the study. MMSE and PGIMS of subjects.

For the experimental group, the subjects were allowed to sit on chairs and allowed to perform the new set of neurobic exercise. This session usually consists of 20-30 min. On assessment day the MMSE and PGIMS scales were used to assess the pre-score of subjects. This treatment continues every week for 2 weeks in which 3 sessions were performed per week. And the post score was taken after two weeks.

For control group the subjects were allowed to sit on chair and pre-test were taken which took around 15-20 minutes and then they were explained about the exercise which were conventional neurobic exercise. Each participant was given the printed paper in which the set of exercise were written and they have to perform that exercise for 2 weeks. And after 2 weeks their post scores were taken.

Statistical Analysis: Standard descriptive statistics (mean \pm standard deviation) were determined for directly measured variables. Chi-square was used for comparison between the two groups, followed by post hoc Bonferroni. Data were analyzed using SPSS (Statistical Package for Social Science) version 20. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 showed the gender-wise distribution of samples in experimental and control groups. In experimental group, 68.30% subjects were females and 31.70% were males, whereas in control groups, 68.40% subjects were females and 31.6% were males.

The comparison of mean of pre and post MMSE score in experimental and control groups were given in Table 2. The mean MMSE scores were 27.97 and 29.12 in pre and post respectively in experimental group, and 27.55 and 29.23 respectively in control group. However, highly significant differences ($p < 0.001$) were found in both the cases.

Table 3 exhibited the comparison of mean of pre and post PGIMS score in experimental and control groups. The mean PGIMS scores were 68.34 and 73.10 in pre and post respectively in experimental group, and 65.02 and 69.71 respectively in control group. However, highly significant differences ($p < 0.001$) were found in both the cases.

The Comparison of percentage increment of MMSE and PGIMS scores between pre and post in experimental and control groups were shown in Table 4. For MMSE scores, the controls had the higher percentage increment (6.10%) than the experiment group (4.11%). Similarly, for PGIMS score also control group had the higher percentage increment (7.21%) than the experimental group (7.96%).

Table 1: Gender-wise distribution of samples in experimental and control groups.

Gender	Experimental Group		Control Group	
	N	%age	N	%age
Female	28	68.3	26	68.4
Male	13	31.7	12	31.6
Total	41	100.0	38	100.0

Table 2: Comparison of mean of pre and post MMSE score in experimental and control groups.

Groups	Pre	Post	t-value	p-value
	Mean \pm SD	Mean \pm SD		
Experimental	27.97 \pm 0.98	29.12 \pm 1.16	6.91	0.0001
Control	27.55 \pm 1.53	29.23 \pm 0.97	7.88	0.0001

Table 3: Comparison of mean of pre and post PGIMS score in experimental and control groups.

Groups	Pre	Post	t-value	p-value
	Mean± SD	Mean ± SD		
Experimental	68.34 ± 6.17	73.14± 7.08	10.454	0.0001
Control	65.02 ± 7.21	69.71±7.39	12.352	0.0001

Table 4: Comparison of percentage increment of MMSE and PGIMS scores between pre and post in experimental and control groups.

Groups	MMSE	PGIMS
Experimental	4.11%	6.96%
Control	6.10%	7.21%

DISCUSSION

In the present study, we aimed to examine the effect of neurobic exercises on memory enhancement of young adulthood. For this purpose, subjects were taken in experimental and control groups. In the experimental group, the subjects were treated with activity based neurobic exercises and in control group, the subjects were treated with conventional neurobic exercises. Initially 84 samples were chosen which were equally divided into 2 groups of 42 but with start of study total 5 subjects dropped out of which 1 was from experimental and 4 were from control group. As the age group of the subjects was 20 to 24 years, thus mostly the participants were students and rest were employees.

In table 1 gender-wise distribution in both experimental and control group were almost similar for males and females. For experimental group, females were 68.3 % and for males, its was 31.7 %, Similarly in control group, females were 68.4% and for males it ws 31.6%. Both the groups showed significant increase in the MMSE and PGIMS scores, but the subjects of control group was found to have more significant improvement than the subjects of experimental group. In table 4, the comparison of MMSE and PGIMS pre and post had been shown between control and experimental groups, in MMSE the score for experimental is 4.11% and for control was 6.10%. Whereas, for PGIMS score for experimental group, it was 6.96% and for control, it was 7.21%. During the session for both groups the participants received the program to use two or more sense in different ways Thus combining two or senses stimulated the functions of brain, which involved with memory process, including frontal, parietal, temporal, occipital lobes. New experiences accumulate the brain functions and connections and pathways.

In experimental and control groups, use of six sense vision, hearing, smelling, touching, and emotional sense and breaking a routine in unexpected ways to strengthen nerve cells stimulation were used in a different manner with a systemic way. The neurobic exercises help in each sense to activate brain functions and nerve cells stimulation are discussed - using vision - seeing objects and then rearranging the same order of objects helps in stimulating occipital lobe which processes visual information that activates cortex which helps in relaying sensory information to cerebral cortex; using smell -

smelling objects without seeing it helps in stimulating the Temporal lobe. The hippocampus acts as temporary transit points for long term memories; using sense of taste - tasting without seeing it will activate the parietal lobe ,which involves sensory information, cognition and processing memory; using sense of touch - without seeing and touching and guessing names can activate the frontal and parietal lobe. It also plays an important role in long term and short term memory; using sense of hearing - hearing sounds without seeing anything and remaining the same order of sounds helps in activating temporal and limbic systems involving emotional and motivation associated with memory.^[2]

The findings of the study clearly indicated that the control group was much effective than the experimental group. The participants in the experimental group and control group found activity to be very interesting and were happy to be part of this study. They also felt happy and relaxed leading to improved memory retention as brain circuits were altered and activated.

Studies carried out by various authors have shown that neurobic exercise has also a significant effect in memory enhancement. They believed that stimulating different parts of brains leads to increase neurotrophins in brain which strengthen the brain.^[5,6] Small sample size was one of the limitations of the study.

CONCLUSIONS

From this study, it might be concluded that both conventional and activity-based neurobic exercises helped in improving the memory in young adulthood, albeit, conventional neurobic excises were more effective than activity based neurobic exercises.

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Ethical Approval: Approved.

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