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Comparison of Brain Gym and Dynamic Movement Skill on Verbal Memory in Middle - Aged Women

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ABSTRACT

Exercise is recognized as a promising approach to counteract aging – associated declines in cognitive functions. Emerging literature suggests that exercise which involves with attention, concentration, memory, thinking have a positive effect on cognition.

Objective:

The aim of the current study is to compare Brain Gym and Dynamic Movement Skill on Verbal Memory in Middle – Aged Women.

Outcome Tool:

Rey Auditory Verbal Learning Test (RAVLT) is used. In this Immediate Recall (IR), Delayed Recall (DR), and Recognition Memory (RM)scores are evaluated. Using t-test, Pre and post test scores are taken to compare within the group and between the group.

Method:

It is an experimental study. Participants randomly assigned into two groups. Group A (n=50) Brain Gym and Group B(n=50) Dynamic Movement Skill. Both groups received their sessions 5 days/week for 12 weeks.

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Result:

From the collected data, it shows that significant difference exists in IR, DR, RM in pre and posttest values P<0.01. For IR Mean % increase in Group B – 34.05 for Group A - 13.21, followed by DR Mean % increase in Group B – 52.12for Group A – 19.48 and RM Mean % increase in Group B - 22.62 and for Group A – 9.66. Posttest IR, DR & RM % increase Mean in Group B is greater than Group A. ANOVA shows that there is significant difference between Mean % increase in Group B. % increase maximum in DR – Mean (52.12) followed by IR – Mean (34.05) and RM – Mean (22.62).

Conclusion:

Hence, it was concluded that each group shows improvement. But Group B shows highest improvement. % increase mean in Group B is greater than Group A.

BACKGROUND OF THE STUDY:

Cognitive decline is a normal part of the aging process. However, cognitive decline can become more severe in older adults, which is the manifestation of clinical conditions such as Mild cognitive impairment, Dementia and Alzheimer's disease[1]. Many studies argue that physical activity is the most important of these factors for maintaining cognitive function (Bhernet al., 2013; King and kitchen 2014). A growing body of evidence suggests physical activity is integral to keeping cognitive process sharp and brain can be changed by certain kinds of stimuli, including movements[1]. In previous studies aerobics, strengthening, resistance and coordination exercise are given to enhance cognitive function in elderly population[1,2,3,8].

NEED FOR THE STUDY:

An Important healthcare need in our aging society is the development of easily applicable noninvasive strategies to aid the functional independence of elderly with cognitive complaints[4].

Hence, strengthening of neural network integrity is considered a prime target for intervention strategies. Strengthening exercise, aerobic exercise may not be sufficient by themselves, since these methods do not necessarily target large networks[4]. In the current study, aims effect of newly developed intervention to improve whole brain neural network integrity through exercises that require direct integration of cognitive functions.

INTRODUCTION:

According to World Health Organization recorded a decline in cognitive function of elderly an estimated 121 million people of which 5.8% of men and 9.5% of women[5]. Increasing age also decreased the work function of the brain will affect the process of information with the loss of orientation, registration, attention, memory, language making elderly daily activities become interrupted[5].

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Various forms of dementia are increasingly considered neural network disorders, emphasizing the importance of white matter dysfunction as a prime aspect of early-stagedisease pathology. Especially in Alzheimer's disease, the most common dementia etiology, it is emerging that diminished neural integrity in large. Whole brain functional network mayprecede the manifestation of traditional clinical symptoms such as hippocampal atrophy and memory loss[4]. Exercise is recognized as a promising approach to counteract aging – associated decline in cognitive function. An important healthcare need in our aging society is development of easily applicable, non-invasive strategies to aid the functional independence of elderly with cognitive complaints[4]. Brain plasticity is a lifetime developmental process and continues to play a significant role in older adulthood. Cognitive and motor activities have to be intellectually stimulating and physically appropriate to bring about maximal benefits to the aging brain[6]. Dynamic Movement Skill is a training and rehabilitation methodology that stimulates the CNS & PNS. The newly obtained experience will alter the neural maps, networks, pathways or circuits made up of countless neurons and synapses[6]. Brain gym is a program of exercises that focus on the performing of specific physical activities that activate the brain, thereby enhancing cognitive performance and making it more receptive to learning[7].

REVIEW OF LITERATURE

1. *Arthur F. Kramer, Krish I. Erickson etal.,2006[8] :Exercise cognition and the aging brain, Journal of Applied Physiology. The research reviewed in thispaperhighlights the positive effects that exercise has on the aging brain in clinical populations.*

2. *MuchsinDoewesetal.,.,june 2009[9] : Exercise and brain health in elderly . Research concluded that regular exercise on elderly is a very effective modality to reduce and prevent cognitive decline in function associated with aging problems.*

3. *Casper de Boer, Holly V.Echlinetal.,., 2018[4] :Thinking while - moving exercise may improve cognition in elderly with mild cognitive deficits. It concluded that cognitive motor exercise induce improved test scores, which is most prominent in elderly with only mild cognitive deficits; It improves altered visuomotor behaviour and improvements in measures of general cognition.*

4. *Liuyangcaietal., March 2014[6] :Brain plasticity and motor practice in cognitive aging. It concluded that Dynamic movement activities of older adults may enhance their cognitive motor functionality due to brain plasticity and eventually, increase their quality of life over a long period of time.*

5. *BungawaliAbduhetal., 2018 [10] :The effectiveness of brain gym and brain training intervention on working memory performance of student with learning disability . The findings shows a significant increment for Digit span memory and spatial memory skillsamong participants in the Brain Gym intervention group.*

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6. *Yakindo, Brain gym journal., March 2008[11] :To measure the impact of Brain gym at the junior high school level for the learning achievement. The data suggest that Brain gym is even more effective for students with low average grades.*

7. *DiniMeiwetal.,July 2017[12] :The effect of brain gym on cognitive function of the elderly in surabaya. The data suggested that the intervention group with Brain gym effect to repair the cognitive function than the control group with out brain gym.*

8. *Kunartietal., March 2018[5] : Effects of brain gym on adult memory . It concluded that brain gym activities are carried out regularly by a group of middle aged adult and elderly are expected to prevent and slow down memory loss as a result of the aging process.*

9. *Ah.Ysufetal., April 2010[13] : Brain gym improves cognitive function in elderly. The research concluded that brain gym improves cognitive function in elderly.*

10. *Catherine Alexandra Gregoire etal.,Apri2019[14] :Gross motor skills training leads to increased Brain derived Neurotrophic factor levels in healthy older adults. The result shows that Gross Motor Skills induced a large increase in plasma BDNF concentration.*

11. *Elaheh Moradi etal.,2017[15] : Rey Auditory verbal Learning Test Scores can be predicted from whole brain MRI in Alzheimer's disease. It concluded that RAVLT were found to be reliable for Alzhiemer's disease diagnosis and reflect well the underlying AD pathology.*

12. *Sabrina de souse Magalhaesetal.,2012[16] :validity Convergent and reliability Test – Retest of the Rey Auditory verbal Learning test. It concluded that It had adequate convergent and divergent validity and good reliability in terms of internal consistency.*

13. *MehrnazRezanfard etal.,2017[17]: The Rey Auditory verbal Learning test: Alternate Forms Equivalency and Reliability for the Italian Adult Population. It concluded that RAVLT is a reliable instrument for repeated neuropsychological testing.*

14. *Ziad S. Nasreddine MD Natalie A etal.,2005 [18] :The Montreal cognitive Assessment, MOCA: A brief screening tool for mild cognitive impairment. It concluded that MOCA is a brief cognitive screening tool with high sensitivity and specificity for detecting MCI*

15. *Paula T. Trzepaczetal., 2015[19]: Relationship between the Montreal Cognitive Assessment and Mini-mental State Examination for assessment of mild Cognitive impairment in older adults. It concluded that MOCA and MMSE were more similar for dementia cases, but MOCA distributes MCI cases across a broader score range with less ceiling effect.*

METHODOLOGY

Study Setting: School of Physiotherapy VISTAS, Thalambur, Chennai

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Study Design: Experimental Study

Sample Size:100 Group A =50, Group B = 50

Exercise Session:5 days/week for 6 months

Inclusion Criteria:

- Age: 40 – 50 years
- BMI: 18.5 – 24.9 kg/m2
- Gender: Female
- MOCA Score: 19 – 25/30 [18,19]
- VO2 MAX: Range 31 – 41 ml/kg.min[20]
  VO2 MAX calculated by using Personalised step test [21,22,23]

Exclusion Criteria:

- History of DM, HT, Psychiatric or systemic disease, Substance abuse, Movement disorder.
- Restricted Mobility (Disabled Person, Major visual or hearing impairment)
- Diagnosis of Orthopedic, Neurological & Cardiovascular disease.
- History of any Surgery in last six months
- Bone density problem
- In Physical Activity readiness questionnaire if they answered yes to one of the questions they are excluded.[24]

Materials:

- Dynamic Movement skill Mat
- HR Monitor
- Weighing Machine
- Height Adjustable wooden Stepper.

Intervention:

A total of 110 participants were recruited for the study through Vels mission hospital, VISTAS, Thalambur. Out of which five were not shown interest to participate in the study; three withdraw during the study and two not met the inclusion criteria. Participants were completely voluntary and all subjects gave the written informed consent form. 60 – 80% as target heart rate should maintain during exercise [25,26]. Max HR is calculated by using the formula HR max = 208 – (0.7 x age)

Randomization:

Those who met the inclusion criteria were randomly assigned into two groups.

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Group A (n=50) – Brain Gym

Group B (n=50) – Dynamic Movement Skill

Group A (n=50) – Brain gym

Warm up – 5 min (Low speed stepping, Active stretching, Breathing Exercise)

Exercise duration: 30 min

Lateralization:

- Cross crawl (2 min)
- Hook ups (2 min)
- Lazy 8's (2min)
- Double doddle (2min)
- The Elephant (2min)

Focalization:

- The Owl (2min)
- The active arm (2min)
- The gravitational glider (2min)
- The Rocker (2 min)

Centralization:

- Brain Button (2 min)
- Earth Button (2min)
- Balance Button (2min)
- Space Button (2min)
- Thinking Cap (2min)
- Energetic Yawn (2 min)

Cool down: 5 min (Diaphragmatic breathing, slow shoulder movements)

Group B (n=50) – Dynamic Movement Skill

Warm up – 5 min (Low speed stepping, Active stretching, Breathing Exercise)

Exercise duration: 30 min

- Quick feet forward to A Left Lead (1 min)
- Quick feet forward to A Right Lead (1 min)
- Quick feet backward to C LeftLead (1 min)

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- Quick feet backward to C RightLead (1 min)
- Open step 3 with right-handed catch (1 min)
- Open step 4 with left-handedcatch(1 min)
- Closed step 4 with left-handedcatch (1 min)
- Closed step 3 with Right-handedcatch (1 min)
- Reverse closed step to 3 with right-handedcatch (2 min)
- Reverse closed step to 3 with left-handedcatch (2 min)
- Reverse closed step to 4 with left-handedcatch (2 min)
- Reverse closed step to 4 with right-handedcatch (2 min)
- Quick feet to A with two handed catch left lead (2 min)
- Quick feet to A with two handed catch right lead (2 min)
- Quick feet to D with two handed catch Left lead (2 min)
- Quick feet to B with two handed catch right lead (2 min)
- Quick feet to A with two handed Juggle left Lead (2 min)
- Quick feet to A with two handed Juggle right lead(2 min)
- Double leg jumps to C with two handed Juggle(2 min)

Cool down: 5 min (Diaphragmatic breathing, slow shoulder movements)

OUTCOME MEASUREMENTS:

Rey Auditory Verbal Learning Test (RAVLT):

To evaluate the verbal episodic memory. It consists of orally presenting a list of 15 concrete nouns (List A) to the participants. The list was read aloud in the same order five consecutive times. After each reading, a free recall test of the words presented was given. Participants were free to say the words as they remembered them. After the fifth reading, participants were presented with the distractor list (list B), with 15 different concrete nouns followed by free recall test from list B. Immediately afterward Immediate Recall (IR) of List A was tested without repeating the list to the participants. After 20 min interval participants were asked again to recall the words from the List A Delayed Recall (DR). Finally, the final task was orally presenting to the participants a list of 50 nouns, including those from List A & B, and 20 phonologically (or) semantically similar words to List A & B. The participants needed to identify and recognize the words that were part of List A & B. For all trials total up each word recalled correctly and place the totals at the bottom of each column [16,17].

STATISTICAL ANALYSIS:

The aforementioned statistical analysis was performed using SPSS software. A t-test were performed to determine mean difference of pre and post-test comparison for IR, DR& RM for Group A & B. $P<0.01$ which is highly significant. There is significant difference in the pre and post - test values in Group A & B. 1- tailed t - test is used to determine how much difference between pre-test and post-test

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scores in Group A & B. Between group % increase comparison were performed using t-test and 1-tailed t-test. ANOVA were used to determine % increase values in Group B. P<0.01 there is significant difference between mean % increase in Group B.

Table 1-Mean and SD of RAVLT in Group A

RAVLT	Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		ListB		Trial 6 (IR)		Trial 7 (DR)		Trial 8 (RM)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	9.04	9.24	9.12	9.44	9.84	10.42	10.14	10.86	10.72	11.36	9.14	9.80	7.78	8.76	6.42	7.50	19.58	21.40
SD	1.66	1.54	1.72	1.60	1.70	1.55	1.74	1.61	1.80	1.58	1.60	1.52	1.58	1.61	1.75	1.60	3.90	4.05

Table 2-Mean and SD of RAVLT in Group B

RAVLT	Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		ListB		Trial 6 (IR)		Trial 7 (DR)		Trial 8 (RM)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean	7.92	9.56	8.04	9.78	8.68	10.46	8.98	10.88	9.64	11.88	8.04	9.78	7.16	9.32	5.98	8.64	18.48	22.4
SD	2.00	1.81	2.06	1.78	2.15	1.86	2.09	1.81	2.19	1.83	1.91	1.96	2.00	1.93	1.99	2.07	3.66	3.57

Table 3-Comparison of Immediate Recall Pre & Post Test Score in Group A

GROUP A -Immediate Recall (IR)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
IR pre	7.780	1.582	0.224	7.330	8.230	50
IR post	8.760	1.611	0.228	8.302	9.218	50

1-tailed t-Test

Ho. Diff	Mean	SE	t' value	DF	'p'

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	Diff.	Diff.			value
	-				
0.000	0.980	0.067	-14.639	49.000	0.000
					'p' <
			Significant		0.01

Variable	Mean	SD
IR pre	7.780	1.582
IR post	8.760	1.611

INFERENCE:

There is a significant difference in the IR score between Pre and Post tests
Post-test IR mean is greater than the Pre-test mean in Group A

Table 4-Comparison of Immediate Recall Pre & Post Test Score in Group B

GROUP B -Immediate Recall (IR)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
IR pre	7.160	2.004	0.283	6.591	7.729	50
IR post	9.320	1.932	0.273	8.771	9.869	50

1-tailed t-Test

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	-2.160	0.144	-15.012	49.000	0.000
					'p' <
			Significant		0.01

Variable	Mean	SD.
IR pre	7.160	2.004
IR post	9.320	1.932

INFERENCE:

There is a significant difference in the IR score between Pre and Post tests
Post-test IR mean is greater than the Pre-test mean in Group B

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Table5-Comparison of Immediate Recall % increase in Group A&B

Descriptive Statistics

Variable	Mean % increase	SD.	Std Err	Lower 95% CL	Upper 95% CL	N
IR% increase B	34.055	19.588	2.770	28.488	39.622	50
IR% increase A	13.214	7.292	1.031	11.142	15.287	50

1-tailed t-Test (% increase B > % increase A)

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	20.841	2.956	7.051	62.326	0.000
			Significant		'p' < 0.01

Variable	Mean % increase	SD
IR% increase B	34.055	19.588
IR % increase A	13.214	7.292

INFERENCE:

There is a significant difference in the IR % increase in post test score between group A and Group B Post- test IR % increase mean in Group B is greater than the % increase in Group A

Table 6-Comparison of Delayed Recall Pre & Post Test Score in Group A

GROUP A -Delayed Recall (DR)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
DR post	7.500	1.607	0.227	7.043	7.957	50
DR pre	6.420	1.751	0.248	5.922	6.918	50

1-tailed t-Test

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	1.080	0.075	14.453	49.000	1.000
			Significant		'p' < 0.01

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Variable	Mean	SD
DR post	7.500	1.607
DR pre	6.420	1.751

INFERENCE:

There is a significant difference in the DR score between Pre and Post tests

Post-test DR mean is greater than the Pre-test mean in Group A

Table 7-Comparison of Delayed Recall Pre & Post Test Score in Group B

GROUP B -Delayed Recall (DR)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
DR post	8.640	2.078	0.294	8.050	9.230	50
DR pre	5.980	1.995	0.282	5.413	6.547	50

1-tailed t-Test

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	2.660	0.191	13.939	49.000	0.000
			Significant		'p' < 0.01

Variable	Mean	SD
DR post	8.640	2.078
DR pre	5.980	1.995

INFERENCE:

There is a significant difference in the DR score between Pre and Post tests

Post-test DR mean is greater than the Pre-test mean in Group B

Table 8-Comparison of Delayed Recall % increase in Group A & B

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
% increase B	52.122	34.428	4.869	42.338	61.907	50
% increase A	19.487	13.954	1.973	15.521	23.452	50

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1-tailed t-Test (% increase B > % increase A)

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	32.636	5.254	6.212	64.676	0.000
			Significant		'p' < 0.01

Variable	Mean	SD
% increase B	52.122	34.428
% increase A	19.487	13.954

INFERENCE:

There is a significant difference in the DR % increase in post test score between group A and Group B

Post-test DR % increase mean in Group B is greater than the % increase in Group A

Table 9-Comparison of Recognition Memory Pre & Post Test Score in Group A

GROUP A -Recognition Memory (RM)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
RM post	21.400	4.051	0.573	20.249	22.551	50
RM pre	19.580	3.908	0.553	18.469	20.691	50

1-tailed t-Test

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	1.820	0.127	14.355	49.000	0.000

Variable	Mean	SD
RM post	21.400	4.051
RM pre	19.580	3.908

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INFERENCE:

There is a significant difference in the RM score between Pre and Post tests

Post-test RM mean is greater than the Pre-test mean in Group A

Table 10-Comparison of Recognition Memory Pre & Post Test Score in Group B

GROUP B -Recognition Memory (RM)

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
RM post	22.400	3.574	0.505	21.384	23.416	50
RM pre	18.480	3.666	0.518	17.438	19.522	50

1-tailed t-Test (P8B post > P8B pre)

Ho. Diff	Mean Diff.	SE Diff.	t' value	DF	'p' value
0.000	3.920	0.176	22.304	49.000	0.000
			Significant		'p' < 0.01

Variable	Mean	SD
RM post	22.400	3.574
RM pre	18.480	3.666

INFERENCE:

There is a significant difference in the RM score between Pre and Post tests

Post-test RM mean is greater than the Pre-test mean in Group B

Table 11-Comparison of Recognition Memory % increase in Group A & B

Descriptive Statistics

Variable	Mean	SD	Std Err	Lower 95% CL	Upper 95% CL	N
% increase B	22.623	10.530	1.489	19.631	25.616	50
% increase A	9.660	5.307	0.751	8.152	11.169	50

1-tailed t-Test (% increase B > % increase A)

Ho. Diff	Mean Diff.	SE Diff.	T	DF	P
0.000	12.963	1.668	7.773	72.388	0.000

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Variable	Mean	SD.
% increase B	22.623	10.530
% increase A	9.660	5.307

INFERENCE:

There is a significant difference in the RM % increase in post test score between group A and Group B
Post testRM % increase mean in Group B is greater than the % increase in Group A

Table12-Comparing IR, DR and RM % increase values in Group B

Descriptive Statistics

Y Variable	Group	Mean	SD.	Std Err	N
% increase in group B	IR	34.055	19.588	2.770	50
	DR	52.122	34.428	4.869	50
	RM	22.623	10.530	1.489	50

Analysis of Variance comparing increase in group B between the IR, DR and RM

Source	Type III SS	Df	Mean Sq.	F - Statistic	'p' value	
Between treatments	22121.490	2	11060.745	19.753 significant	0.000 'p' < 0.01	**There is significant differenc between mean % increase in Group E**
Within treatments	82312.993	147	559.952			
Total	104434.482	149				

Post Hoc tests for Treatments mean values

Test	Group 1	Group 2	Mean Diff.	SE	q - Statistic	'p' value		
Tukey	IR	DR	-18.067	3.346	5.399	0.000	significant	p' < 0.0
	RM	RM	11.431	3.346	3.416	0.042	significant	p' < 0.0
	DR	RM	29.499	3.346	8.815	0.000	significant	p' < 0.0

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Y Variable	Group	Mean	SD
% increase in group B	IR	34.055	19.588
	DR	52.122	34.428
	RM	22.623	10.530

INFERENCE:

There is significant difference between mean % increase in Group B

% increase Maximum in DelayedRecall (DR) - Mean 52.122
followed by Immediate Recall(IR)- Mean 34.055
and Recognition Memory (RM) - Mean 22.623

RESULT:

From baseline to 6 Months a total of 120 Brain Gym Sessions and 120 Dynamic Movement Skill sessions are offered to the participants in the intervention group. No adverse events were reported (or) observed over 6 Monthsof study period.

i. **General Characteristics:**
There was no difference between the group in general characteristics. All participant had a high school or high education level.

ii. **Within group comparison of outcome:**
Participants in Group A and Group B improved significantly P<0.01. Post – test Immediate Recall (IR), Delayed Recall (DR) and Recognition Memory (RM) mean is greater than the pre – test mean (Table 3,4,6,7,9,10).

iii. **Between group % of increase comparison of outcome:**
There is significant difference in the Immediate Recall (IR), Delayed Recall (DR) and Recognition Memory (RM) % increase in post test scores between group A and group B P<0.01. Post-test % increase mean in Group B is greater than % increase in Group A (Table 5,8,11).

iv. **ANOVA is used to compare Immediate Recall, Delayed Recall, Recognition Memory % increase values in**
Group B:
There is significant difference between mean % increase in Group B. % of increase maximum in Delayed Recall- Mean 52.12 followed by Immediate Recall – Mean 34.05 and Recognition Memory - Mean 22.62 (Table 12).

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DISCUSSION:

The RAVLT is a very efficient neuropsychological instrument for assessing Verbal Memory. The test allows the evaluation of the components of acquisition and recall of information and permits the investigation of separate process (Mitrushinaet al., 2005) [27]. The aim of current study is to compare Brain Gym and Dynamic Movement Skill on verbal memory in Middle –Aged Women. Cognitive decline is the normal part of aging process. Aging related differences in cognition were detected in the transition from middle age (50) to old age (65). Several age-related differences were evidenced before the age of 50. A temporality of cognitive decline occurring between the age of 40 and 65 can be described by integrating all the results. Daniel Ferreira et al., 2014 conducted a study and report for a first time a differentiation and temporalization of different verbal, visual and procedural memory components during middle age. The typical ageing-related memory impairment defined by alterations in acquisition and or free retrieval but not in consolidation (Luo &craik, 2008) was present already before the age of 50. Difficulties in verbal learning during middle age have also been reported in a recent study (Singh Manouxet al., 2012) [28].

Brain plasticity is a lifetime developmental process and continues to play a significant role in older adulthood. Cognitive and motor activities have to be intellectually stimulating and physically appropriate to bring about maximal benefits to the aging brain (colcombeet al., 2003,2006). Brain plasticity, neural maturation and cognitive development play an important role in cognitive and motor learning (Ungerleider et al.,2002 ;Lacourseet al., 2004; Wright and Harding 2004). Neural Plasticity refers to the capacity of central nervous system (CNS) to alter its existing cortical structure and functions in response to experience, learning, training or injury (Hubel and Weisel 1970; kolb and Whishaw 1998; Wall et al., 2002; Kolb et al., 2003; Ballantyne et al., 2008). When an individual acquires novel or dynamic movement skill or information, the newly obtained experience will alter the neural map, network pathways or circuits made up of countless neurons and synapses (Wall et al., 2002). Neural Plasticity is therefore a biological foundation to the learning brain. Experience dependent changes in the lower neocortical region can reshape the activation pattern and the anatomy of cerebral cortex (Wall et al., 2002). Sensory input, knowledge and motor learning activities stimulate cortical changes (Rakie., 2002; Taubertet al., 2010). In skill learning or repeated exposure to stimulations and experiences, relevant neurons often fire together and wire together. The associated neurons of a given response will be activated simultaneously in response to similar stimuli in the future. Learning endeavors or experiences modify the existing cortical structures or mechanism via neurogenesis, gliogenesis and synaptogenesis (Buonomano and Merzenich 1998; Cotman and Berchtold, 2002; Dong and Greenough, 2004; oelcker-Rehage and Willimczik, 2006; Ponti et al.,2008)[6].

Brain Gym is a program of exercise that focus on performing of specific physical activities that activate the brain, thereby enhancing cognitive performance and making it more receptive to learning. Brain Gym exercise are designed to develop the brain neural pathways the way the nature does through movement [29].

Dynamic Movement Skill is a training and rehabilitation methodology that stimulate the CNS and PNS. The DMS methodology help to refine and develop neuromuscular efficiency and to change motor pattern to make movement more efficient. By combining unusual or new movement that require us to concentrate

and by using us many of the body driers as possible. The type of movement is directly linked to improvement of cognitive process like concentration, memory enhancement andreading[30].

This study demonstrates that both group shows significant difference in pre and post-testvalues P<0.01. Post-test mean is greater than pre-test mean in Group A and B (Table no: 1,2,3,4,6,7,9,10). Comparison of % increase in Group A and B in IR, DR, RM (Table no 5,8,11) shows there is significant difference P<0.01. Post-test IR, DR, RM % increase mean in Group B is greater than Group A.

ANOVA is used to compare IR, DR & RM % increase in Group B (Table 12). It shows that there is significant difference between mean % increase in Group B P<0.01. % increase maximum in DR – Mean 52.12 followed by IR – Mean 34.05 and RM – Mean 22.62. The findings in this study are similar to some previous studies showing positive results for the intervention group after implementing the Dynamic Movement Skill [6,14].

CONCLUSION:

This study concluded that both Brain Gym and Dynamic Movement Skill show a significant improvement of verbal memory in Middle Aged Women. Post – test mean values show higher % increase in Dynamic Movement Skill than Brain Gym.

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