Effect of Brain Boosting Exercise on Age Related Memory Loss among Elderly

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Abstract

Forgetfulness can be a normal part of ageing. As people grow older, changes occur in all parts of the body, including the brain. Neuroplasticity or brain plasticity is the ability of the brain to change throughout an individual's life. One of the ways to improve brain plasticity is by exercising the brain. The present study was undertaken to assess the effect of brain boosting exercises on age related memory loss among the elderly. The objectives of the study were to identify the prevalence of memory loss among the elderly, to determine the effectiveness of brain boosting exercise on age related memory loss among the elderly and to examine the association between age related memory loss scores and selected baseline variables. The research design used for the study was a quasi experimental prê-test post-test control group design and the sampling technique was purposive sampling. The investigator selected 60 elderly individual between 65 and 85 years of age from a selected old age home in Pathanamthitta district of these 30 samples belongs to the experimental group and 30 samples belongs to the control group. The base line data were collected using socio demographic questionnaire. A memory scale was used to assess the memory deficiency of the subjects. The experimental group received the interventions for three weeks. The Independent sample t - test was used to assess the effect of brain boosting exercises and to determine the association between pre interventional score and baseline variables. The result showed that there was a statistically significant difference between pre and post memory score ($p<0.01$) in the experimental group. The study also study established a significant association between age and memory related problem with pre interventional score ($p<0.01$, 0.008).The study concluded that brain boosting exercise were effective in improving memory among the elderly.

Key words: *Forgetfulness, Brain boosting exercise, Memory scale, Elderly, Memory lo*

Introduction

"Memory is the means by which we draw on our past experiences in order to use this information in the present" (Sternberg, 1999). Memory is essential to our lives. Without a memory of the past, we cannot function effectively or think about the future. We would not be able remember what we did yesterday, what we have done today or what we plan to do tomorrow. Without memory, we could not learn anything[1]. Memory is divided into short-term (also known as working or recent memory) and long term memory. Short term memory stores and retrieves information about recent events, whereas long term memory is concerned with recalling the more distant past.

As people get older, changes occur in all parts of the body including the brain. As a result some people may notice that it takes them longer to learn new things, they don't remember information as well as they once did or they misplace items such as their glasses[2]. Normal aging is associated with a decline in various memory and cognitive abilities . This condition is known as age related memory impairment (AMI) or age associated memory impairment (AAMI) [3]. Simple forgetfulness and delays or slowing in recalling names, dates and events can be part of the normal aging process. There are multiple memory processes including learning new information, recalling stored information and recognizing familiar information. Each of these processes can become disrupted, leading to the experience of forgetting[4].

Exercising the brain to improve memory, focus or daily functioning is a top priority for many people especially as they grow older. Research has shown that there are many ways to hone mental sharpness and help the brain remain healthy. Engaging certain brain exercises help to boost memory.

Need for the study

Age related memory decline affects approximately 40% of older adults and is characterized by a self perception of memory loss and a decline in objective memory performance. This memory decline has been termed age associated memory impairment. Individuals with more severe forms of age related cognitive decline such as mild cognitive impairment are at an increased risk of developing dementia. Dementia is highly prevalent with over five million people affected in India alone, a figure that is projected to exceed 10 million by 2040[5].

Objectives of the study

1. To identify the prevalence of memory loss among elderly.
2. To find out the effectiveness of brain boosting exercise on age related memory loss among elderly.
3. To find the association between age related memory loss score and selected baseline variables.

Hypothesis:

H1- There is a statistically significant difference between the post memory loss score of subjects among experimental group and control group.

H2- There is a statistically significant association between pretest memory loss scores of subjects with selected baseline variables.

Conceptual frame work

The conceptual framework for the present study is the Betty Neuman system model. It is based on general system theory and reflects the nature of living organisms as open systems interacting with one another and with the environment.

Review of literature

A quasi experimental study was conducted among elderly individuals aged 60 - 85 years residing at selected old age home in Mangalore for 4 weeks to assess the effect of brain boosting exercises on age related memory loss. The result of this study showed that there was a significant difference between pre-test and post- test memory score of the elderly participants in the experimental group. The mean post test memory score (77.95%) was higher than the prê-test memory score (56.36%) in the experimental group. The difference in memory score of experimental group was statistically significant at 0.05 level of significance ($t14 = 7.707$, $p<0.05$)[6].

A randomized control study was conducted in Japan to assess whether reading aloud and solving simple arithmetic calculation intervention improves inhibition, verbal episodic memory, focussed attention and processing speed in healthy elderly individuals. This single-blinded study included two groups. A learning therapy group (LT) and a waiting list control group (WL) .In the LT group elderly participants reading aloud exercises in Japanese and solving simple calculations training tasks for 6 months. WL did not participate in the intervention. The results showed that the LT group demonstrated significant improvements in inhibition performance within executive function $p=0.03$ and in verbal episodic memory adjusted $p = 0.015$.[7]

A study was conducted in to assess working memory training in older adults. The participants were recruited at the University of the third age or at social clubs in Pad ova. In this study examined the efficacy of a verbal working memory (WM) training program in old-old individuals (over 75 years of age). 36 adults aged 75 to 87 participated in the study, 18 were randomly assigned to receive training and the remaining participants served as active controls. Specific training gains in a verbal WM task and transfer effects on measures of visuospatial WM, short – term memory, inhibition, processing speed and fluid intelligence were examined. The trained old-old adults performed better than the controls on the criterion task and this benefit

persisted after 8 months. They also showed an increase in the efficiency of inhibitory mechanisms at follow up compared with pre-test. The results shows WM training program produces benefit maintained over time even in old - old adults.

Research approach

Quantitative approach was used.

Research design

In the present study researcher selected quasi -experimental pre-test post-test control group design to assess the brain-boosting exercise on age related memory loss among elderly.

Independent variable

. In this study the independent variable is brain boosting exercise for elderly between the age group of 65 – 85 years.

Dependent variable

Dependent variable of the present study is the age related memory loss in elderly between the age group of 65 – 85 years.

Baseline variables

In the present study baseline variables included age, gender, education, previous occupation, co morbid disease, leisure time activity, enjoyment in leisure time activity, type of family, food preference, memory related problem and sleep.

Extraneous variables

An extraneous variable is any variable that the researcher not investigating that can potentially affect the outcomes of research study.

In the present study the extraneous variables are underlying disease on treatment, mood.

Setting of the study

The setting selected for the present study included selected old age homes at Pathanamthitta district**,** Kerala, India. The researcher chose an old age home at Pathanamthitta district, Kerala, India with adequate hospital facilities. The criteria for selecting these settings were the availability of subjects and feasibility of conducting the study.

Population

The present study includes elderly between the age group of 65 – 85 years with VAMC SLUMS Examination score 21-30 in a selected old age home at Pathanamthitta district.

Sample and sampling technique

In the present study the sample consisted of elderly individual aged 65 to 85 years age who met the inclusion criteria at a selected old age home in Pathanamthitta district, Kerala.

The total sample size was 60 elderly participants with 30 assigned to the experimental group which received brain boosting exercises and 30 assigned to the control group which did not receive the intervention but continued with routine care.

Sampling Technique

The sampling method of the present study is non probability purposive sampling.

Inclusion criteria

- The elderly who are in the age group of 65 - 85 years residing at selected old age home.
- The elderly who are willing to participate in the study.
- The elderly person who knows Malayalam/English.
- The elderly people who attains score between 21-30 after VAMC SLUMS Examination screening tool.

Exclusion criteria

- Elderly who were on treatment with antipsychotic drugs.
- Elderly who were diagnosed to have Parkinson's disease/ Alzheimer's disease/ stroke / active epilepsy.
- Critically ill patient
- Those who are having visual impairment.
- Those who are having dementia after VAMC SLUMS Examination screening tool.
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Tool / Instrument

It is the devices or instruments used to collect data

Tool 1: Baseline Proforma

Tool 2: VAMC SLUMS examination screening tool

Tool 3: Memory scale.

Description of tool

Tool -1 Baseline proforma

Baseline proforma consists of demographic variables such as age, gender, education, previous occupation, comorbid disease, leisure time activity, enjoyment in leisure time activity, type of family, food preference, memory related problem, sleep pattern.

Tool -2 VAMC SLUMS examination screening tool

The Saint University Mental Status Examination is a method of screening for dementia and widely used as Mini – Mental State Examination (MMSE). Score range from 0 to 30. Score of 27 to 30 are considered normal in a person with a high school education, scores between 21 and 26 suggest a mild cognitive disorder, scores between 0 and 20 indicate dementia.

Tool - 3 Memory scale

It consists of ten subtests, namely – remote memory, recent memory, mental balance, attention and concentration, delayed recall, immediate recall, verbal retention for similar pairs, verbal retention for dissimilar pairs, visual retention, and recognition. The maximum dysfunction rating score for each sub test is 3 and there are 10 subtests, so total dysfunction rating score on memory scale would be 3 x 10 = 30. If there is complete normal memory the total scores will be 0 (zero).

Description of the intervention

Brain boosting activities involve multiple tasks that require communication, interaction and organization which enhance brain function and connectivity. These activities were planned for a period of four weeks.
In this study the brain boosting exercises included the following activities.

- **Enjoy Strategy Games and Puzzles:** This involves practicing Sudoku or solving jigsaw puzzle. Each individual completes one Sudoku or jigsaw puzzle every day. For the **Colour Sudoku** which is a 4 x 4 grid, some colours are already provided and the individual must fill in the remaining squares using the four given colours. For the **Number Sudoku puzzle** a 4 x 4 grid is provided with some numbers already filled in . The objective is to complete the grid using only the numbers 1 to 4, ensuring that no number is repeated in any row, column or block. For a **9 x 9 Number Sudoku puzzle,** the grid is divided into nine 3 x 3 blocks, with some numbers already filled in. The individual must complete the grid using the numbers 1 to 9, ensuring that each number appers only once in every row, column and block.

- **A Jigsaw puzzle** is a puzzle made up of many small pieces that are cut into various shapes and can be fitted together to form a picture.
- **Learning something new -** The client practices simple paper craft activities.
- **Practice simple math problems** – The individual solves one addition or subtraction problem per day.
- **Drawing and colouring -** Drawing is a sketch or design created using a pen or colored pencil.

❖ **Colouring** –With repetition and practice coloring enhances eye- hand coordination. The elderly participants colour printable pictures using their preferred colour.

Ethical consideration of the study

- Approval has been obtained from the Institutional Ethics Committee (IEC)
- Formal approval was obtained from the institutional authority
- Written informed consent was obtained from each study sample prior to data collection.
- The investigator explained the purpose of the study and assured to participants that the data will be kept confidential.

Pilot study

The pilot study was conducted among 10% of total sample other than the main study settings.

Data collection process

Approval from concerned authority was taken. The sample was identified based on the inclusion and exclusion criteria. After getting written informed consent from the study participants baseline variables were collected and VAMC SLUMS examination screening tool was used to select the subjects. Investigator used purposive sampling technique to select the sample and assigned the sample as control group and experimental group. After the selection of participant's pre -memory score assessment was done by using memory scale. Brain boosting exercises was given for three weeks (five days/week) in experimental group .After the intervention post memory score was assessed in both experimental and control group.

Data Analysis

Data analysis is the process of inspecting, cleaning, transforming, and modelling data with the objective of discovering useful information, arriving at conclusions, and supporting the decision making process

Presentation of data

Section 1: Distribution of participants based on baseline variables.
Section 2: Description of memory loss score among subjects
Section 3: Description of effect of brain boosting exercise on age related memory loss among elderly
Section 4: Association of pre-test memory loss score with selected baseline variable

Section: 1 Distribution of subjects based on baseline variable

Table 1(a): Distribution of subjects according to their age, gender, education, previous occupation, Diet, Co-morbidities, Leisure time activities

N = 60

Variable	Experimental group		Control group	
	Frequency	Percentage	Frequency	Percentage
Age 65 - 69	10	33.3	9	30.0
70 - 74	7	23.3	5	16.7
75 - 79	2	6.7	3	10.0
80 - 85	11	36.7	13	43.3
Gender Male	6	20.0	11	36.7
Female	24	80.0	19	63.3
Education				
Primary	6	20.0	4	13.3
Upper primary	3	10.0	4	13.3
High school	13	43.3	16	53.3
Pre degree	5	16.7	3	10.0
Graduate	3	10.0	3	10.0
Previous occupation				
Government	3	10	5	16.7
Private	11	36..7	11	36.7
other	16	53.3	14	46.7
Diet				
Vegetarian	4	13.3	0	0
Non vegetarian	26	86.7	30	100
Co-morbidities				
Diabetes	3	10	7	23.3
Blood pressure	4	13.3	2	6.7
DM and BP	6	20	6	20
Nil	17	56.7	15	50
Leisure time activities				
Everyday	5	16.7	3	10
Rarely	9	30	9	30
Never	16	53.3	18	60

Section1: Distribution of subjects based on baseline variable

Table 1(b): Distribution of subjects according to type of family, leisure time enjoyment, Memory related problem, Sleep, Family history of memory loss

N = 60

Variable	Experimental group		Control group	
	Frequency	Percentage	Frequency	Percentage
Family				
Nuclear	25	83.3	21	70
Extended	5	16.7	9	30
Leisure time enjoyment				
Everyday	2	6.7	0	0
Rarely	13	43.3	11	36.7
Never	15	50	19	63.3
Memory related problem				
Everyday	3	10	9	30
Rarely	18	60	16	53.3
Never	9	30	5	16.7
Sleep				
Everyday	10	33.3	15	50
Rarely	15	50	10	33.3
Never	5	16.7	5	16.7
Family history of memory loss				
No	30	100	30	100
Yes	0	0	0	0

Section 2 : Description of pre memory score among subjects

Table:2

Minimum score	12.0
Maximum score	29.0

Section 3:Description of effect of brain boosting exercise on age related memory loss among elderly

Table 3 (a): Comparison of pretest score of memory loss among elderly

Independent samples t –test (60)

Group	Mean	SD	N	t	P
Experimental	23.4	5.1	30	0.73	0.468
Control	24.3	4.8	30		

Table 3 (b): Comparison of post test score of memory loss among elderly

Independent sample t-test (60)

Group	Mean	SD	N	t	P
Experimental	12.2	5.4	30	9.13	p<0.01
Control	24.2	4.7	30		

Section 4: Association of pretest score with selected baseline variable

Table 4 (a) Association of pre test score with age, sex, education, previous occupation, co morbid disease.

Independent t-test (60)

		Mean	SD	N	T	p
Age	<75	21.6	4.8	31	4.2	p<0.01
	>=75	26.3	3.8	29		
Sex	Male	22.5	6.2	17	1.33	0.189
	Female	24.4	4.3	43		
Education	Up to high school	23.9	4.9	46	0.01	0.993
	Pre degree/Graduate	23.9	5.4	14		
Previous occupation	Govt./Private	23.8	5.2	30	0.1	0.918
	Other	23.9	4.7	30		
Co morbid disease	Yes	24.1	4.6	28	0.35	0.727
	No	23.7	5.2	32		

Table 4 (b) : Association of pre test score with leisure time activity, enjoyable leisure time, type of family, memory related problem and sleep.

Independent t-test (60)

		Mean	SD	N	T	P
Leisure time activity	Yes	23.0	4.2	26	1.25	0.217
	No	24.6	5.4	34		
Leisure time - enjoyable	Yes	22.5	4.5	26	1.98	0.053
	No	24.9	5.1	34		
Type of family	Nuclear	23.3	5.2	46	1.69	0.097
	Extended	25.8	3.6	14		
Memory related problem	Every day	27.2	1.6	12	2.73**	0.008
	Rarely/Never	23.0	5.1	48		
Good sleep	Every day	24.1	4.7	25	0.28	0.780
	Rarely/Never	23.7	5.1	35		

Results and Discussion

The researcher has organized the results and discussions under following headings

Section 1: Result and discussion about the distribution of baseline variables.

Section 2: Result and discussion of memory loss score among subjects

Section3: Comparison of effect of brain boosting exercise on age related memory loss among elderly

Section 4: Results and discussion about association of pre memory score with selected baseline variables.

Section 1: Discussion about the distribution of baseline variables.

Age and gender: In the present study, the age of the participants ranged from 65-85 years .Among the 60 participants the majority in the experimental group 36.7% and the control group 43.3% belonged to the 80-85 age groups. With regard to gender, the majority of the participants in the experimental group, 80%were female, while 20% were male. In the control group 63.3% were female and 36.7% were male.

A comparative study was conducted to assess performance and affect to determine whether there were gender differences among community residing older adults. The sample included adults from 2 states, Ohio and Texas, comprising a community sample (n=177), a retirement community sample (n = 97) and the senior wise study (n = 265). The total sample of 529 adults was 74% female, and the average age was 76.58 years. In this study males and females were similarly classified into four memory performance groups, with nearly half of each gender categorized in the poor memory

group. The study found no significant differences in memory performance by gender.[10].

Educational status and Food preference; It was also revealed that majority of them 43.4% from experimental group and 53.3% from control group had high school education status. The result showed that 86.7% of participants in experimental group and 100% of control groups were non-vegetarian

Previous occupation: Additionally, 53.3% subjects from experimental group and 46.7% subjects from control group did not have a government / private job.

Co morbid disease: The results further indicated that 56.7% of subjects in the experimental group and 50% in the control group did not have any co - morbid disease, Moreover, 10% of the experimental group 23.3% of control group had diabetes, 13.3% and 6.7% respectively had hypertension. Participants in the both groups had both diabetes and Hypertension.

Leisure time activity and enjoyment in leisure time activity: Regarding leisure time activity16.7% of subjects in the experimental group and 10% in the control group engaged in leisure time activity daily. 30 % of participants in both groups rarely engaged in leisure time activities. Furthermore, 53.3% of participants in the experimental group and 60% in the control group did not engaged in any leisure time activity. Half of the participants (50%)of subjects from experimental group and 63.3% from control group reported no enjoyment in leisure time activities. Additionally 100% of participants in both the groups did not have the family history of memory loss. 60 % of subjects from experimental group and 53.3% of subjects from control group had a rare history of memory related problem.

Type of family: The present study also showed that, in experimental group 83.3% from nuclear family and 16.7 % from extended family. In control group 70% from nuclear family and 30% from extended family.

Food preference: The result showed that 86.7% of participants in experimental group and 100% of control groups were non-vegetarian.

Memory related problem and family history: Additionally 100% of participants in both the groups did not have the family history of memory loss. 60 % of subjects from experimental group and 53.3% of subjects from control group had a rare history of memory related problem

Sleep: The result shows 33.3% of participants from experimental group and 50% from control group reported getting good sleep daily. In contrast, 50% of participants in the experimental group and 33.3% control group rarely got good sleep, while, 16.7 % experimental group and control group did not get good sleep

Section 2: Discussion of pre memory loss score among subjects

The result showed that participant's minimum memory score was 12 and maximum memory score was 29.

A study was conducted to assess how does aging affect visual short term memory for identifying objects in their spatial locations. The result showed that the older subjects had significantly lower performance compared to younger subjects, experiment 1:F (1,32) = 27.41, P<0.001; experiment 2:F (1,32) = 13.49, p = 0.001. The older subjects have reduced VSTM capacity for tasks that require object location binding[11].

Section 3: Comparison of effect of brain boosting exercise on age related memory loss among elderly

The comparison of pre-test score of memory loss among elderly, the t value was 0.73 and the p value shows 0.468,therefore there was no statistically significant difference.

In the comparison of post test score of memory loss among the elderly, the t value is 9.13 and p value was <0.01 Therefore, there was statistically significant difference. This finding indicates that the brain boosting exercises were effective in reducing age related memory loss among the elderly shows that the brain boosting exercises were effective on age related memory loss among elderly. Therefore the hypothesis stating that there is a statistically significant difference between the post memory loss score of subjects among experimental group and control group was accepted.

A quasi experimental study was conducted on elderly between the age group of 60 - 85 years residing at selected old age home to assess the effect of brain boosting exercise on age related memory loss. The result of this study showed that there was significant difference in pre-test and post test memory score of elderly in the experimental group. The mean post test memory score (77.95%) was higher than the pre test memory score (56.36%) in experimental group. The difference in memory score of experimental group was statistically significant at 0.05 level of significance (t14=7.707, p<0.05)[6].

Section 4: Discussion about association of pre memory score with selected baseline variables.

There was a significant association between age and memory related problem with pre test memory score. Therefore, the hypothesis there is significant association between mean pretest memory score and selected baseline variables was accepted.

A study was conducted to assess the declarative memory in 704 older adults in the age groups of 58-98 years. Participants were shown drawing of objects, and then were tested several minutes later on their memory of these objects, the investigator found that their memory performance become progressively worse with aging[12]..

Nursing implication

The researcher has drawn following implications from the present study which plays an innovative role in the field of nursing education, nursing service, nursing administration and nursing research. Some of the implications are as follows.

Nursing education

- In nursing education, students need to understand the importance of brain boosting exercise on age related memory loss among the elderly.
- Students should be trained by the nurse educators and motivated in nursing practiced as they influence the activities of the elderly.
- Nurse educators can assist in improving the standards of the nursing curriculum which should focus on the recent research evidence and EBP and research findings should be incorporated in to nursing curriculum.

Nursing practice

- Nurses have a significant role in improving patients outcomes and validating the science and art of nursing. Nursing is an essential discipline with the capacity to assess ,educate, support and care for elderly patients. Nurses should provide holistic care that addresses all aspect of the patient, including physical, psychological ,social ,spiritual ,economic and developmental needs.
- The skilled nursing personnel can plan, implement, organize, and evaluate various brain boosting exercise program to improve age related memory loss.
- Nurses working in clinical settings can teach brain boosting activities to the elderly.
- Nurses working in community health settings can also educate the elderly about the effectiveness of brain boosting exercise in improving memory.

Nursing administration

- The study findings may help formulate guidelines in the field of nursing administration. Written policies, standards and norms should be established to ensure the quality of patient care.
- Nursing service administrator play a crucial role in all dimensions of health care activities and can develop policies for the delivery of evidence based practice in clinical settings.
- Motivation plays an important role for nurses. The nurse administrator should motivate care giver to implement brain boosting exercise for the elderly.

- The nurse administrator should ensure the availability of library facilities that lend books and DVDs related to brain boosting activities for the elderly.
- The nurse administrator should ensure flexible scheduling and the provision of resources for leisure time activities for the elderly.

Nursing research

- Evidence based practice and research utilization are current priorities in nursing for the promotion of health and the restoration of life.
- Nurses need to practice according to empirical evidence to optimize client outcome, provide cost effective, safe care and enhance the credibility of nursing practice.
- Further studies can be conducted in this area with long term implementation and larger sample sizes to assess the effectiveness of brain boosting exercises on age related memory loss among the elderly.

Limitation

- The sample size for the present study was 60, which is a limited number therefore generalization is not possible.
- The brain boosting exercise was conducted for only three weeks.
- The study was limited to elderly individual residing in selected old age homes with and the result may not be generalizable to all elderly individual
- The study was limited to one old age home.

Recommendation

- The study can be replicated in different hospital and community settings with a larger sample size.
- Brain boosting exercises of more than one month duration can be administered to assess their effect on memory loss.
- It is recommended to include different types of brain boosting exercise with a larger number of participants.

Conclusion

Brain boosting exercises are effective in improving memory among elderly. Many studies have reported a significant effect of brain boosting exercises on the memory status of older adults. In the present study the researcher found a significant improvement in memory status of the elderly after the intervention

Reference

Saul McLeod.[Internet] [cited 2023),simply psychology, Memory Stages encoding storage and retrieval, Available from www.simplypsychology.org

National institute of Aging, Symptoms and Diagnosis of Alzheimer's Disease, Do memory problems always mean Alzheimer's disease[Internet][cited2018] Available from www.nia.nih.gov

Memory problems: what is normal aging and what is not[Internet][Cited 2019] Available from my.clevelandclinic.org

Anuradha Mascarenhas , [Internet] [cited2020],The Indian Express What the largest study on dementia hopes to achieve ,Available from indianexpress.com

Sunny Ann Gladis ,[2019], Nightingale institute of nursing times, Brain boosting exercise and age related memory loss,

Rui Nouchi 1,2,3, Yasuyuki Taki 4,5,6, Hikaru Takeuchi 6, Takayuki Nozawa 3,7,Atsushi Sekiguchi 5,8 and Ryuta Kawashima [2016],frontiers in human neuroscience, Reading aloud and solving simple arithmetic calculation intervention improves inhibition, verbal episodic memory, focus attention and processing speed in Healthy elderly people, Available from*

Erika Borella , Barbara Carretti , Giulia Zanoni , Michela Zavagnin , Rossana De Beni [Cited 2013] Working memory training in old age : an examination of transfer and maintenance effects[Internet] Archives and clinical neuro psychology, page no:331-347Avialiable

Rosenzweig Andrew, MD,[2021] Saint Louis University Mental Status Examination for Dementia ,Available from www.verywellhealth.com

Graham Joseph McDougall, Keenan A Pituch, Marietta P Stanton, Wanchen Chang.[2014]issues in mental health nursing Memory performance and affect : are there gender differences in community – residing older adults

Shahina Pardhan, Rajusapkota, Ian vander linde[2014],,ARVO journal, A study was conducted to assess how does aging affect visual short term memory for identifying objects in their spatial locations, available from: iovs.arvojournals.org

Jana Reifegerste [1,2,3], João Veríssimo [3], Michael D Rugg [4], Mariel Y Pullman [5], Laura Babcock [6], Dana A Glei [7], Maxine Weinstein [7], Noreen Goldman [8], Michael T Ullman ,[2020],national library of medicine, Early-life education may help bolster declarative memory in old age, especially for women, page no:218-252, pmc.ncbi.nlm.nih.gov