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Comparative Study of Memory Deficits in Younger and Older adults

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The present study aimed to investigate memory deficits in younger and older adults. A gender equated_sample of (N = 40) adults including older (n = 20) and younger adults (n = 20) was taken from Morgah, Rawalpindi. Wechsler Memory Scale (Wechsler, 1997), Benton Visual Retention Test (Sivan, 1992), and Controlled Oral Word Association Test (Benton & Hamsher, 1976) were administered to determine the memory deficits, visual spatial and visuo-motor abilities, and verbal memory of participant. The results showed that older adults have deficits in working and visual memory. The difference in verbal memory in the two groups was nonsignificant but there was a significant decline in working memory and visual memory with the age.

Keywords: Working memory, visuomotor abilities, verbal memory

There is always decline in physical, cognitive, emotional, social abilities, and skills occur with aging (Baddeley, 1986). The present study was carried out to compare the memory deficits in younger and older adults, the effects of memory deficits in their daily functioning and to compare the deficits of cognitive and visuomotor functioning in younger adults and older adults.

Memory can be defined as the acquisition, storage, and retrieval of information (Sternberg, 1999). Memories provide for maximum

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behavioral flexibility and allow humans to most efficiently adapt to their environment. This occurs because the brain not only stores information about the environment but able to modify these memories as circumstances change. Memories are not permanent but are capable of changing as associated stimuli in our environment change. This change can occur even through the information from the individuals' themselves in the form of thoughts (Loftus, 1996). According to Squire and Zola-Morgan (1991) long-term memory is maintained for years but short-term memory retains small amounts of information for very short periods of time.

Baddeley and Hitch (as cited in Sternberg, 1999) introduced the concept of working memory as a short-duration limited-capacity memory system capable of simultaneously storing and manipulating information in the service of accomplishing a task. Atkinson and Shiffrin (1968) differentiate the concept of working memory from short-term memory in two respects: (i) it is assumed to involve a number of subsystems, rather than a unitary module; and (ii) there is considerable emphasis on its functional role in other cognitive tasks such as learning, reasoning, and comprehension.

Working memory, a more current term for short-term memory temporarily stores and manipulates information needed in the execution of complex cognitive tasks such as learning, reasoning, and comprehension. It is thought to be highly active and responsible for the selection, initiation, and termination of processing routines (e.g., encoding, storing, and retrieving) (Mitchell, Johnson, Raye, Mather, & D'Eposito, 2000).

Memory deficits found in older adults are failures to form new memories, called anterograde amnesias, are often accompanied by limited inability to use or recall earlier memories. In retrograde amnesia it is hard to retrieve memories prior to an incident in which they suffer damage to the head. Wechsler Memory Scale can be used in identifying these deficits in older adults (Seharaie, 1998). Baddeley and Warrington (1970) reported that amnesic patients show a normal recency effect in free recall and may perform normally on the Peterson and Peterson short-term forgetting task, provided that they are otherwise not intellectually unimpaired (except for amnesia) and amnesia did not affect the other intellectual abilities.

On the other hand, Shallice and Warrington (1970) demonstrated a converse pattern in patients with typical damage to the perisylvian region of the left hemisphere. These patients performed poorly on verbal memory span tasks and no recent memory, but appeared to have

well preserved long-term memory. The research findings indicate the separation of long- and short-term memory systems.

Peterson (1999) reported that patients with "mild cognitive impairment" (MCI) performed like normal elderly persons on the "Mini Mental State Examination" (MMSE) and tests of general intelligence. However, their performance was worse than normals and slightly better than patients with Alzheimer's disease on tests of verbal and spatial memory. In the four year follow-up testing, the average decline on MMSE was approximately one point per year in patients with MCI, compared with approximately three points per year in the patients with Alzheimer's disease and zero points per year in normal elderly persons.

Harris, Rogers, and Qualls (1998) have shown that cognitive and linguistic factors associated with adult comprehension of figurative language, include age, working memory (WM), figurative language type, and reading comprehension. Older adults showed more difficulty completing the WM tasks than the younger adults. Age differences emerged on all WM tasks; however the most striking differences were on the alphabet span test, suggesting that this task may be more sensitive to age effects (Harris et al., 1998). Gerard, et al., (as cited in Reed, 2002) suggests that interference in retrieval processes is the key to decline in older adults' working memory.

Salthouse (1991) investigated the role of working memory and speed of processing play in the cognition of adults with reference to age. Cognitive performance was assessed by items answered correctly and the accuracy of attempted items. Working memory was also measured to assess the effects of cognitive effect on the functioning of working memory. Working memory was assessed with the computation span and listening span tests which required the subject to remember information while processing other information. Results indicated age related effects of cognitive functioning were mainly mediated by age related reduction in working memory. Further, a large proportion of age related differences WM was found to be mediated by processing speed. With age people's cognitive functioning is reduced because working memory is reduced because processing speed is reduced.

More recent studies by Babcock and Salthouse (1990) aimed to determine the relationship between capacity of storage and efficiency in processing. Age related working memory differences are cause of age related decline in one or both of these. The first study using only young adults was aimed at determining if greater processing requirements lead to more involvement of a central processor in

memory. The findings supported the assumption that there is greater involvement of the central processor when both storage and processing are required than when just storage is required. Babcock and Salthouse (1990) examined further that there is a decrease with age in the efficiency of central processing, greater performance impairments might be expected for older adults than for younger adults as the processing demands are increased. They found age differences in memory span seem to be independent of the amount of processing.

Age-related changes in memory and language reveal a consistent pattern of spared and impaired abilities in normal old age. Burke and Mackay (1997) studied old age memory performance involving highly practiced skills and familiar information including factual, semantic, and autobiographical information. Relatively impaired memory performance in old age requires the formation of new connections for example recall of recent autobiographical experiences, new facts, or the source of newly acquired facts.

This pattern of impaired new learning versus preserved old learning is consistent in semantic memory, episodic memory, explicit memory, and also implicit memory. However, familiar verbal information is not completely preserved when accessed on the output side rather than the input side. Aspects of language production, namely word finding and spelling, exhibit significant age-related declines (Burke & MacKay, 1997).

There is no evidence for any decline in prose comprehension with age. However, when there is a large load on memory (when the text is complex) for example older adults find retrieving general knowledge more difficult. It appears that encoding of new information might become less context-specific with age, but this may only relate to particular types of context information. The temporal and spatial contexts are also likely to be less important, older adults seem to encode less information about the source of new information (the circumstances in which the information was acquired) than younger adults (Cohen & Faulkner, 1986).

Norman, Kemper, and Kynette (1992) hypothesized that age related declines in working memory may affect elderly adults' reading comprehension and processing of complex syntax. They used the forward and backward digit span subtest from the WAIS-R and the Daneman and Carpenter Sentence Span Test for assessing working memory. Performance on all three working memory tests declined with age. Thus indicating that short-term memory has a very limited

capacity and storage can be lost rapidly unless it is preserved through rehearsal.

The above assumption is supported by findings that self-generated strategy training may have advantages over learning a classical mnemonic for preventing long-term forgetting of numeric materials in old age (Derwinger, Stigdotter, Macdonald, & Backman, 2005). Salthouse (1994) found the relationship between capacity of storage and efficiency in processing. The results supported the notion that there is greater involvement of the central processor when both storage and processing are required than when just storage is required. There is a decrease with age in the efficiency of central processing, greater performance impairments might be expected for older adults than for younger adults as the processing demands are increased.

In accordance with the above mentioned findings brain function declined with the process of aging. When it affects the brain it can cause the cognitive impairment and other disorder in the elderly people. Main objective of present study was to identify the memory deficits in younger and older adults. The study also aimed to examine working memory deficits, verbal fluency, visuomotor functioning, and spatial abilities of younger and older adults. It is assumed that:

1. Older adults manifest more memory deficits as compared to younger adults.
2. Older adults manifest more deficits of visuomotor functioning as compared to younger adults.
3. Older adults have working memory deficits as compared to younger adults.
4. Younger adults have greater verbal fluency as compared to older adults.

Method

Sample

Using purposive sampling technique 40 individuals were selected. Age range for older adults was 55 - 70 years (M = 58.90, $S.D$ = 4.12), where as age range for the younger adults was 20- 40 years (M = 26.40, $S.D$ = 7.26). 20 younger adults include men (n = 10) and women (n = 10) and similarly 20 older adults include men (n = 10) and women (n = 10). All participants were resident of

Morgah, Rawalpindi. None of the participant was recruited who have any head injury, pervious psychiatric or any other physical which could cause memory impairment. Wechsler Memory Scale first subtest information orientation (optional) was used to detect the dementia and other disorders. The demographic sheet, Wechsler Memory Scale, and Benton Visual Retention Test were used to collect data.

Instruments

Wechsler Memory Scale-3rd edition (WMS-III). The Wechsler Memory Scale – 3rd edition (WMS-III) (Wechsler, 1997) was designed to assess learning, memory, and working memory. This test was used for the individuals with in the age range of 16 - 89 years. Each correct response was scored as 1, and 0 for incorrect response. Raw score are taken after calculating the number of correct responses. Index score are calculated by using raw scores. Test interpretation was based on index scores as given in manual. Higher scores of indexes represent better memory and lower scores indicate the memory impairment. This scale was translated for the present research purpose. The cronbach alpha on the current data was .93 which shows high consistency and test is reliable for further use.

Benton Visual Retention Test (BVRT). Benton Visual Retention Test (BVRT) 5th edition was developed by Sivan (1992). The Benton Revised Visual Retention Test was widely used instrument that assesses visual perception, visual memory, and visuoconstructive abilities. The Benton has three alternate forms, each of which consists of ten designs. In addition, there were four possible modes of administration. Form C was used. Administration A was used in the research because it has norms for both younger and older adult. Scoring is 0 - 1 for each item.1 for correct drawing and 0 for poor drawing. Total numbers of errors are counted. Interpretation of types of errors is done as given in manual. Test interpretation was based on an assessment the number and types of errors made and involves several levels of analysis Lower errors scores shows better performance and higher error scores manifest the memory deficits. The cronbach alpha on the current data was found to be .62.

Controlled Oral Word Association Test (COWAT). The Controlled Oral Word Association Test (COWAT) was developed by Benton and Hamsher (1976). The purpose of test was to evaluate the

spontaneous production of words with for a given category with in a limited amount of time. The test was administrated to produce as many word in 1 minute as he or she think of that begin with one given letter of the alphabet excluding proper noun and the same word stem or with the different suffixes. The most commonly used letters are F, A, S, although C, F, L and P, R, W are commonly used as alternatives. Another alternatives that are usually given in addition to letters, but that can be substituted for them, is the use of conceptual categories for which words must be generated e.g. subject can be instructed to name as many fruits and vegetables or animals with in a minutes.

However, the category alternates is considered to be some what different than the letter version because it allows the subject to draw on a conceptual category that may permit a form of fluency that is enhanced by cues inherent to the conceptual category. Each correct word was scored 1 and 0 was given for incorrect word. Total numbers of errors were counted (Preservation, proper nouns and using same word stem). Test interpretation was based on an assessment of the number of correct words and types of errors made and involved several levels of analysis for diagnostic purposes. The test translation was done by researcher. The reliability of translated version was computed which was .70 which indicate test is reliable for further use. The words used in this study was S, س, R, ر and L, ل

Procedure

Translation of Wechsler Memory Scale 3rd Edition (WMS-III) into Urdu was carried out. In WMS the translation of information orientation, logical memory I& II, Verbal pair Associate I & II and word list I & II was carried out. For the pre testing the translated and original version of test were administered on 10 participants representing the age and gender to be tested in the main study.

The scores on English and Urdu (translated) were assessed for consistency. Subsequently, the final version of test in target language was formulated. A pilot study was also carried out for Benton Visual Retention Test (BVRT). Benton Visual Retention Test (BVRT) has 3 forms C, D and E and 4 type of administration A, B, C and D. On the basis of pilot studied it has been decided that form C which is slightly easier than other forms D and E was used. Form C can easily comprehend by older adults. Administration A was used in the research because it has norms for both younger and older adult.

The Controlled Oral Word Association Test (COWAT) had to be tested with change of stimulus word. Initially selected "*Alif*" ا and "*Qaf*" ق had to be changed as these were confused with آ and ك. Therefore it was decided to choose words with the highest frequency in dictionary usage to find out the frequencies of word in dictionary the *Feroz Laugat* Urdu was used (Din, 1990). There were 1,292 words with R in dictionary. There were 3,124 words with S in dictionary. There were 1,386 words with L in dictionary (Din, 1990). The selected Urdu alphabets were ر, ل, and س. The words identified were S, Rand L. Informed consent was taken from research participants who were agreed to participate and fulfilled the required criteria. Tests were administered as per manual.

Results

Table 1

Mean, Standard Deviation, and t-test showing the Differences of Younger and Older Adults on Wechsler Memory Scales (WMS)

Wechsler Memory-Scale	Younger Adults ($n = 20$)		Older Adults ($n = 20$)		
	M	*SD*	*M*	*SD*	*t*
Auditory Immediate	52.40	15.41	40.10	10.05	2.99
Visual Immediate	75.65	10.16	40.10	12.29	4.08**
Immediate Memory	128.05	22.29	101.25	20.00	4.02**
Auditory Delayed	30.15	8.98	23.75	7.76	2.41
Visual Delayed	75.60	11.32	61.90	12.88	3.57**
Auditory Recognition Delayed	48.65	3.12	45.85	4.12	2.42
General Memory	154.40	19.83	131.50	19.88	3.65**
Working Memory	24.50	5.66	17.85	4.99	3.94**
Visuomotor	301.90	54.91	239.95	40.23	4.07**
Verbal Memory	75.35	15.43	56.00	8.79	4.87**

df = 38. *$p < .01$. **$p < .001$

The Table 1 shows the mean scores of younger and older adults on the primary indexes and supplementary indexes of Wechsler Memory Scale (WMS). There are significant differences in the scores of younger and older adults on all primary indexes and Supplementary indexes. Younger adults have higher mean on the all primary index and Supplementary indexes show that performance of younger adults on WMS was better as compare to older adults, indicating that with the age individual ability of work become slower down.

Table 2

Mean, Standard Deviation, and t-test showing the Differences of Younger and Older Adults on Benton Visual Retention Test (BVRT)

Benton Visual-Retention Test	Younger Adults ($n = 20$)		Older Adults ($n = 20$)		
	M	*SD*	*M*	*SD*	*t*
Correct Scores	5.80	1.61	4. 05	1.60	3.44**
Errors	5.90	2.86	9.25	2. 95	3.64**
Omission	.70	.87	.85	1.39	0.41
Distortion	3.35	1.76	4.45	1.50	2.13
Preservation	1.85	1.09	2.85	1.98	3.54**
Rotation	.15	.37	.05	.24	1.04
Misplacement	.10	.308	.80	1. 32	2.31
Size Errors	.55	1.17	.25	.44	1.09

df = 38. *$p < .01$. **$p < .001$

Table 2 shows significant differences in the scores of younger and older adults on BVRT total scores and errors. Younger adults have higher mean on the correct score of BVRT which shows that younger adult's have better scores as compare to older adults. On the other hand older adults have higher mean on the errors of BVRT indicating the significant decline in the performances.

The scores of BVRT also correlated with the scores of WMS supplementary index (visuomotor). Scores of BVRT revealed that older Adults have higher mean score on the omissions, distortions, preservation and misplacement indicative of significant decline in the performances. Younger adults have higher mean Score on Rotation and Size errors. They showed more errors of size and rotation. The younger adults showed more errors on the error of rotation and size errors. There are no gender differences in the performance of Benton Visual Retention Test (BVRT).

Table 3

Mean, Standard Deviation, and t-test showing the Differences of Younger and Older Adults on Controlled Oral Word Association Test (COWAT)

Controlled Oral Word-Association Test	Younger Adults ($n = 20$)		Older Adults ($n = 20$)		
	M	*SD*	*M*	*SD*	*t*
Correct Scores	13.35	4.11	11.35	4.57	1.46
Errors	7.70	4.05	5.15	4.27	1.94

df = 38. *$p < .01$.

The Table 3 shows the mean scores of younger and older adults on the Controlled Oral Word Association Test (COWAT) total scores and errors. Younger adults have high mean on correct response and on errors as well. Results show that there was no significant difference in the performance on verbal fluency of younger and older adults.

Discussion

To examine the memory deficits in younger and older adults Wechsler memory scale (WMS) and Benton visual retention test (BVRT) and Controlled oral word association test (COWAT) was utilized. The older adults showed significantly poorer performance on memory tasks as compared to younger adults. Deficits were found on immediate and delayed indexes of WMS in younger adults. Deficits in the older adult's performances were found in delayed index as compared to their performance in immediate indexes. Older adults had similar performance on both auditory immediate and visual immediate indexes.

The older and younger adult's performance was better in the recognition tasks as compared to recall tasks. According to Gerard, et al. (as cited in Reed, 2002) interference in retrieval processes is the key to decline in older adults' working memory. Interference occurs because facts sharing the same concepts compete with each other at retrieval. They theorize that inhibitory attentional mechanisms don't function as well in old age and more irrelevant information gains access to working memory, causing interference. The older adults did indeed have greater problems with retrieval interference.

Older adults showed significant declined in working memory. There were two possible reasons of working memory deficits in older

adults. Older adults have difficulty in learning new information. The results also showed that deficits of working memory with age are due to the speed processing. Older adults took more time in completion the test as compare to younger adults. These are consistent with findings of Babcock and Salthouse (1990) that decreases with age in the efficiency of central processing led to, greater performance impairments in older adults than younger adults.

Results indicate that older adult performance declined in the Wechsler Memory Scale supplementary indexes. Older adults manifest the significant declined in the auditory indexes. These findings are similar to earlier reports where older adults recalled fewer words than younger adults, but both age groups showed characteristic phonological similarity and word length effects (Bunnell, Baken, Donald, Richard, & Llewellyn, 1999).

Results indicate that older adult performance declined in the Wechsler Memory Scale supplementary indexes. Older adults manifest the significant declined in the performance of visuomotor tests. The performance in visuomotor tests was declined due to older adults had less attention span and they forget the figure and had difficulty in drawing. The results of BVRT highly correlated with the results of Wechsler memory scale supplementary index Visuomotor. Results revealed the significant decline in the performances of older adults on BVRT. They showed more errors of distortions and preservation. The younger adults showed more errors on the error of rotation and size errors. There are no gender differences in the performance of Benton Visual Retention Test (BVRT).

Total errors on the Benton Visual Retention Test (BVRT) are increased in normal aging; there is little information on changes for specific error types. Cross-sectional analyses indicated that all errors increased with age, but differences between age groups in error profiles suggested relatively greater age effects for distortions, omissions, and rotations. These findings suggest that cerebral aging impacts all categories of BVRT errors but has differential effects on particular error types (Resnick, Trotman, Kawas, & Zonderman, 1995). Age but not gender was significantly associated with BVRT performance in both normal and normal with memory concerns. Level of cognitive deficit was a moderating factor in that age also contributed significantly to the BVRT performance of no/low deficit neurologic patients but had no impact in patients whose cognitive deficits were moderate/severe (Coman et al., 2000).

The Controlled Oral Word Association Test (COWAT) performance indicated a mild decline in the performance of older

adults. They took more time in registering new information as compare to younger adults. It appears that encoding of new information might become less context-specific with age, but this may only relate to particular types of context information. The temporal and spatial contexts are also likely to be less important. In other words, older adults seem to encode less information about the source of new information (the circumstances in which the information was acquired) than younger adults (Cohen & Faulkner, 1986).

Conclusion

It can be concluded from discussion that the older adults exhibited poorer performance on memory tasks as compare to younger adults. Results indicate the significant memory deficits in older adults. No deficits (as indicated by differences) were seen in younger adult's performance on immediate and delayed indexes. Older adult's performances declined as seen on delayed indices as compared to their performance in immediate indexes. On auditory immediate and visual immediate tasks the older adults had similar performance. These adults also had better scores on recognition as compare to recall. The younger adults had more or less similar results on the recognition and recall.

Limitations and Suggestions

Despite researcher attempt to explore memory deficits in younger and older adults there were some limitations in this research like difference between employed and retired older adult was not studied. May be retired older adults are not mentally active as the employed older adults. Participant's performance was affected by the duration of tests which was approximately 2 hours. Future studies could include education (educated vs uneducated) and working (employed retired or independently self-employed) status as variables to identify and if these have any influence on the cognitive functioning.

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