Age Related Changes in Auditory Memory and Sequencing

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Abstract

The study aimed at investigating the effect of age and gender on auditory memory and sequencing abilities in individuals with normal peripheral hearing. The study also evaluated the relation between perceived memory problems (evaluated using a checklist) with actual memory problems (evaluated using 'Auditory Memory and Sequencing Test in Kannada'). Sixty participants, divided into three groups based on their age were recruited. Group-I and Group-II included older adults in the age ranges of 50 to 64;11 years and 65 to 80 years respectively. Group-III included younger adults in the age range of 20 to 30 years. The results of the study revealed a significant decline in memory and sequencing abilities with age. In all three groups, higher scores were obtained on the memory subtest compared to the sequencing subtest. In both the older adult groups, males performed superior to the females on the sequencing subtest. Such a gender difference was not seen in the younger group. The gender difference in the older groups was attributed to the educational difference between the males and females in these participants which was not present in the younger group. Also, in all but Group-I, the self-report scores regarding their memory abilities corresponded with their actual memory abilities.

Keywords: *Aging, auditory memory and sequencing, perceived memory problem*

Introduction

Aging has been referred to as a multidimensional process of physical, physiological and social change (Hamilton, 2006). It is reported to be deeply rooted in the genetic makeup and metabolic working of an organism (Braver & Barch, 2002) and sensitive to many environmental influences (Arking, 1991). As adults grow older, physical, sensory, emotional, psychological and social changes are reported to occur (Dugan & Kivett, 1994). The rate at which these changes occur and how they affect an individual are noted to be based on a number of factors.

Changes in the structure and function are also reported to occur throughout the peripheral and central auditory nervous system as a result of the aging process. Many investigators have examined age-related changes in processing non-speech signals (McCroskey & Kasten, 1982; Newman & Spitzer, 1983) and complex speech signals (Jerger & Hayes, 1977; Konkle, Beasley & Bess, 1977; McCroskey & Kasten, 1982; Rastatter & Hood, 1986). Karlin (1942) noted that tests of conventional auditory acuity had little value in predicting auditory behaviour in more complex social situations in older adults. The effect of degenerative changes were reported to become evident only when older listeners were perceptually stressed, such as when they were required to listen to complex signals or in a noisy environment where more complex auditory processing was required.

Normal aging has also been associated with a decline in memory abilities and the phenomenon has been termed as age-related memory impairment or age-associated memory impairment. A large number of elderly individuals have been reported to live with mild memory problems that are a part of a normal aging process (Schroder, et al., 1998). Timothy (2009) reported that the steady decline in many cognitive processes was observed across the lifespan, accelerating from the twenties or thirties. The author claimed that due to aging, attention and memory were the most affected basic cognitive functions.

Older adults have also been reported to exhibit deficits on temporal ordering tasks (Parkin, Walter & Hunkin, 1995). Neils, Newman, Hill and Weiler (1991) found that elderly individuals performed significantly poorer than the younger adults on auditory memory and sequencing of tones. Gregoire and Linden (1997) noted that a major part of the adult lifespan was characterized by slight decline in memory abilities. Studies by Mitrushina and Satz (1991), Youngjohn and Crook (1993), Small, Stern, Tang and Mayeux (1999), Oberauer, Wendland and Kliegl (2003), and Moral, Tomas, Bataller, Oliver and Navarro (2010) have also documented a significant decline in auditory memory with age.

Several reasons have been speculated by Light and Leah (1999) to explain why older adults use less effective encoding and retrieval strategies as they age. The first was the 'disuse' view, which implied that memory strategies were used less by older adults as they moved further away from the educational system. Second was the 'diminished attentional capacity' hypothesis, which meant that older people engaged less in self-initiated encoding due to reduced attentional capacity. The third reason was the 'memory self-efficacy', which indicated that older people did not have confidence in their own memory performances, leading to poor consequences.

The ability to encode new memories of events or facts

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has been shown to decline in both cross-sectional and longitudinal studies (Park, 1996; Park 2002; Hedden & Gabrieli, 2004). Chisolm, Willott and Lister (2003) reported that the most prevalent but most often overlooked skill deficiency in elderly subjects was auditory memory. In a study by Schroder et al. (1998), the prevalence of age-associated memory impairment was found to be 13.5% in individuals between the age range of 60 to 64 years. Hanninen et al. (1996) reported a higher (38.4%) prevalence of age-associated memory impairment using the National Institute of Mental Health criteria in an elderly population in Finland.

The vast majority of the studies regarding the auditory memory problems of the elderly have been done in other countries. In India, the auditory memory and sequencing problems have been studied more in children. The tests for auditory memory and sequence, developed in India (Yathiraj & Vijayalakshmi, 2006; Yathiraj & Mascarenhas, 2003) have focused on children and not on the older generation.

A high correlation between memory skills and educational level has been found (Gathercole, Pickering, Knight & Stegmann, 2004). It was found in the National Sample Survey report (2004-2005) that only 63.6% of the total population of India is literate. The literacy percentage of males and females was found to be 78.0% and 51.10% respectively. Hence, there is a need to see if age related changes seen in the older population in India are similar to that found in the other parts of the world where the literacy level is noted to be higher.

Additionally, there is a need to have information regarding deficits in auditory memory and sequencing since these aspects can affect the audiologic rehabilitation goals and outcomes for older adults. Knowledge about the individual's auditory memory and sequencing skills can help to plan the rehabilitation goals or modify the activities/tasks appropriately. Hence, it is necessary to see the relation between age and auditory memory.

Rehabilitation outcome can also be affected if there is a mismatch between the perceived degrees of memory impairment, as reported by the client and the actual degree of impairment. Therefore, it is essential to study if there exist any relation between perceived and the actual degree of memory impairment in older individuals.

Thus, the present study aimed to investigate the effect of age and gender on auditory memory and sequencing in older adults with normal hearing sensitivity and to compare them with young adults. The study also aimed to examine the relation between the perceived degree of memory impairment and the actual degree of impairment.

Method

Participants

The participants were divided into 3 groups based on their age (Group I, Group II and Group III). Each group included 20 participants with 10 males and 10 females. Group-I and Group-II included older adults in the age ranges of 50 to 64;11 years and 65 to 80 years respectively. Group-III included normal hearing individuals in the age range of 20 to 30 years. The educational levels of all the participants were noted and are presented in the Table 1.

The participants were native speakers of Kannada. They had normal AC and BC pure-tone thresholds after applying a correction factor for age as recommended by Indrani (1981), whenever required. Their speech identification score was 80% or more on the 'Phonemically

Table 1: Educational levels of the participants

Educational level	Group I (50 to 64;11 years)		Group II (65 to 80 years)		Group III (20 to 30 years)		TOTAL
	Males	Females	Males	Females	Males	Females	
Primary	1	0	1	2	0	0	4
Secondary	1	4	2	5	0	0	12
High school	1	2	2	3	0	0	8
Pre-university	2	4	0	0	0	0	6
Graduation	4	0	5	0	6	5	20
Post-graduation	1	0	0	0	4	5	10
TOTAL	10	10	10	10	10	10	60

balanced Kannada word test' developed by Yathiraj and Vijayalakshmi (2005). None of the participants reported of any history of middle ear pathology or any major neurological problem. An informed consent was taken from all the participants prior to carrying out the evaluations.

Material

To obtain information about early signs of dementia, a checklist was developed based on the information reported in literature and the opinion of experienced Speech and Hearing professionals. The initial checklist contained 12 questions which required responses on a 3-point scale ('never', 'sometimes' and 'always'). A symptom that occurred less than 25% of the time was required to be labelled 'never', while those that occurred 25% to 75% and more than 75% of the time were required to be labelled 'sometimes' and 'always' respectively. Further, the checklist was scored by awarding a response 'never' a score of 0, while 'sometimes' was scored 1 and 'always' was scored 2. Thus, the total possible score ranged between 0 and 18 on the developed 'Memory ability checklist' (Appendix).

Item validity was checked by obtaining the opinion of five speech and hearing professionals who had at least 10 years of experience in the area of cognition. After incorporating the modifications and suggestions of the speech and hearing professionals, the checklist had nine questions. As no changes were recommended for the procedure to obtain the responses, the 3-point rating scale was retained. To test the auditory memory and sequencing abilities of the participants, they were tested using the 'Auditory Memory and Sequencing Test in Kannada' developed by Yathiraj and Vijayalakshmi (2006). The test contained four lists of words with different inter-stimulus intervals (250 msec, 500 msec, 750 msec and 1 sec). Each list commences with a three-word token and gradually increased to an eight-word token with a total of twenty tokens. The list with an inter-stimulus interval of 500 msec was used for the present study.

Instrumentation

Madsen Orbiter-922 type-I diagnostic audiometer with calibrated TDH-39 headphones was used to estimate the air conduction thresholds and to carry out speech audiometry (ANSI S3.6, 1996). Calibrated Radio Ear B-71 bone vibrator was used to estimate bone conduction thresholds. The same audiometer was also used to route the stimuli for the auditory memory and sequencing test in Kannada from a laptop to loud speakers. A calibrated Grason StadlerInc-Tympstar, clinical immittance meter used to rule out any middle ear pathology.

Test Environment

All tests were administered in an acoustically treated suite. It was ensured that the noise levels were within the permissible limits as recommended by ANSI S3.1 (1991).

Procedure for Participant Selection

Pure-tone thresholds were obtained in octave intervals between 250 Hz to 8000 Hz for air conduction and between 250 Hz and 4000 Hz for bone conduction using the modified Hughson - Westlake procedure (Carhart & Jerger, 1959). Speech identification scores (SIS) were obtained under headphones using the phonemically balanced word list (Yathiraj & Vijayalakshmi, 2005) at 40 dB SL. Participants with a pure-tone threshold of less than 25 dB HL, after applying a correction factor for age as recommended by Indrani (1981) and a SIS of greater than 80% were selected.

Tympanometry and reflexometry were carried out to rule out any possibility of middle ear pathology using a 226 Hz probe tone. Ipsilateral and contralateral reflexes at 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz were obtained. Participants with type-A tympanogram with bilateral reflexes present were considered for further assessment.

The developed 'Memory ability checklist' was administered to obtain demographic details of the participants and to obtain information regarding the perception of their memory abilities. Each participant was required to respond on the three point scale. Only those participants with a total score of less than 9 were selected. This was done to avoid including those with considerable memory problems who may not be able to give adequate responses on the Auditory Memory and Sequencing Test.

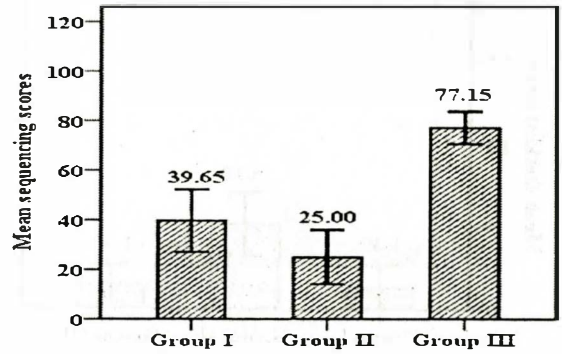
Procedure for administering the Kannada Auditory Memory and Sequencing Test

The Kannada Auditory Memory and Sequencing Test (Yathiraj & Vijayalakshmi, 2006) was administered on participants who met the participant selection criteria. A CD containing the test stimuli were played on a laptop with Intel Core i3 processor. The signal from the laptop was fed to the CD input of the Madsen Orbiter-922 type-I diagnostic audiometer. The output of the audiometer was given to a loud speaker which was placed 1 meter from the head of the participants at 0o azimuth. The signal was presented at 40 dB HL.

The participants were instructed to listen to the group of words present in each token and repeat them in the same order. A score of one was awarded for every correct word that was recalled. An additional score of one was awarded if the words recalled were in the correct sequence. The responses were noted on a scoring sheet and the total score for the memory subtest and the sequencing subtest was calculated.

Analysis

The raw scores obtained from the 60 participants on the 'Kannada auditory memory and sequencing test' and the 'Memory ability checklist' were tabulated. The data thus obtained was subjected to statistical analyses, using SPSS (Version 18). MANOVA was done to see the effect of age and gender on the scores of the auditory memory and sequencing subtests. To study the effect of age and gender on the total score of the 'Kannada auditory memory and sequencing test', ANOVA was carried out. Non-parametric Kruskal-Wallis test was used to see the impact of age on the scores obtained on the 'Memory ability checklist'.



*Note:# Maximum score is 118; * p < 0.05*

Figure 2: Mean and standard deviation of the sequencing subtest scores for the three age groups.

Results

Based on the statistical analyses, a comparison was made between the scores obtained across the three age groups (50 to 64;11 years, 65 to 80 years & 20 to 30 years) for four different scores. The scores included the auditory memory subtest score, auditory sequencing subtest score, total auditory memory and sequencing score, and the 'Memory ability checklist' score. A comparison was also made between the genders on the same parameters.

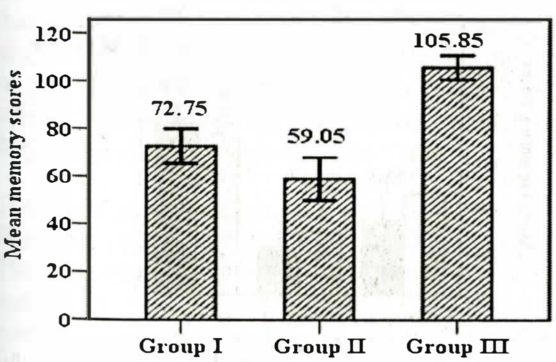
Effect of Age

Effect of age on the auditory memory subtest score: The mean and standard deviation of the auditory memory subtest score was determined for each age group (Figure 1). From the figure it is evident that the mean memory score of the two groups of older adults was lesser than that of the younger adults.

To check if this difference was statistically significant, MANOVA was carried out. The results indicated that there was a significant main effect [F (2, 54) = 216.113, $p < 0.05$]. Further, Duncan post-hoc test was used to see whether each age group differed significantly from the other on the memory subtest scores. The results indicated that the scores of Group-I and Group-II differed significantly from the Group-III ($p < 0.05$) and differed significantly from each other ($p < 0.05$).

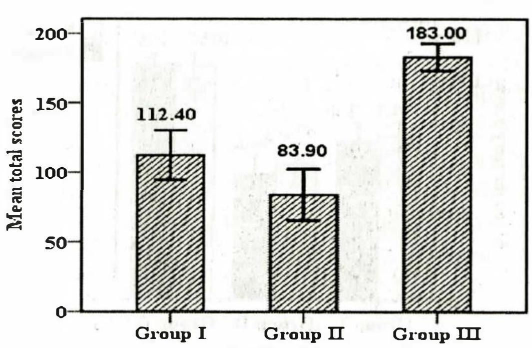
Effect of age on the auditory sequencing subtest score: From the descriptive statistics (Figure 2) it is apparent that the mean sequencing score of the younger adults (Group III) was higher than that of the two older groups (Group I & Group II). Also, the variability for the older adults was more compared to the younger adults. The results of MANOVA also indicated a significant main effect of group [F (2, 54) =154.082, $p < 0.05$]. The findings of the Duncan post-hoc test showed that the mean sequencing scores of Group-I and Group-II differed significantly ($p < 0.05$) from the Group-III. Additionally, the two older groups also differed significantly from each other ($p < 0.05$).

Effect of age on the total auditory memory and sequencing score: The findings of the descriptive statistics (mean and SD) for the total memory and sequencing score across age groups are presented in the Figure 3. It can be observed that the scores decreased with in-



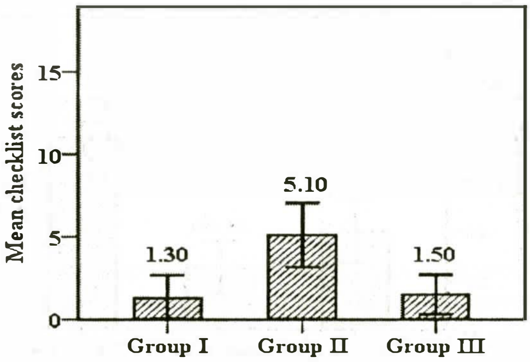
*Notes: # Maximum score is 118; * p < 0.05*

Figure 1: Mean and standard deviation of the memory subtest scores for the three age groups.



*Note: # Maximum score is 236; * p < 0.05*

Figure 3: Mean and standard deviations of the total auditory memory and sequencing scores for the three age groups.



*Note: # Maximum score is 18; * $p < 0.05$*

Figure 4: Mean and standard deviations of the scores on the 'Memory ability checklist' for the three age groups.

crease in age. To determine the effect of age on these total scores of the 'Kannada auditory memory and sequencing test' ANOVA was carried out. A statistically significant main effect for groups [$F(2, 54) = 224.600$, $p < 0.05$] was seen. Duncan post-hoc test indicated a significant difference in the mean total auditory memory and sequencing scores of Groups I and II ($p < 0.05$), Groups I and III ($p < 0.05$) as well as between Groups II and III ($p < 0.05$).

Effect of age on the 'Memory ability checklist' score: The mean and SD of the 'Memory ability checklist' scores of the three age groups are depicted in Figure 4. To compare the age effect on the 'Memory ability checklist' score, non-parametric Kruskal-Wallis test was carried out. The results showed a significant age effect [$\chi^2(2) = 31.344$, $p < 0.05$]. The findings of the post-hoc analysis carried out using the non-parametric Mann-Witney test showed a significant difference between Group-I and -II ($p < 0.05$) and Group-II and -III ($p < 0.05$) but not between Group-I and -III ($p > 0.05$).

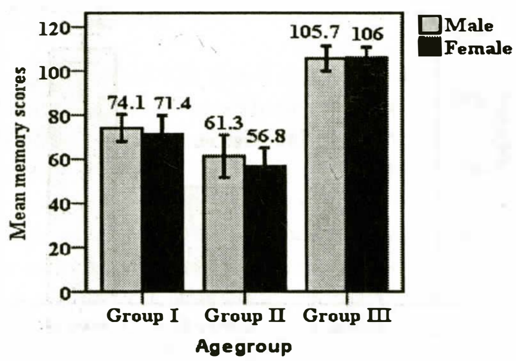
Effect of Gender

Effect of gender on the auditory memory subtest score: The mean and standard deviation of the auditory memory subtest score was determined across genders for each of the three age groups (Figure 5). The MANOVA results indicated that there was no significant gender effect [$F(1, 54) = 1.481$, $p > 0.05$] when the three age groups were combined. To determine if this lack of gender difference was maintained for each of the three age groups, group wise comparison using MANOVA was done. It was seen that in each of the age groups, both males and females performed equally ($p > 0.05$) on the memory subtest.

Effect of gender on the auditory sequencing subtest score: The descriptive statistics of the sequencing subtest (Figure 6) indicated that the females in the older two groups performed poorer than the males. Such a difference was not observed in the younger age group. The results of MANOVA indicated a significant difference [$F(1, 54) = 6.680$, $p < 0.05$] between the genders, when the age groups were combined. However, the group-wise comparison revealed that the significant difference between genders was present in Group-I ($p < 0.05$) and Group-II ($p < 0.05$) and not in Group-III ($p > 0.05$).

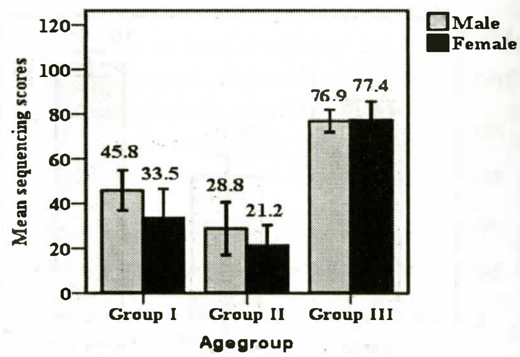
Effect of gender on the total score: ANOVA was carried out to see the effect of gender on the total score of the 'Kannada auditory memory and sequencing test'. The overall results indicated significant difference [$F(1, 54) = 4.861$, $p < 0.05$] between genders. However, a significant difference was present only in the older two adult groups ($p < 0.05$) and not in younger adults group ($p > 0.05$) on the Duncan post-hoc test (Figure 7).

Effect of gender on the 'Memory ability checklist' score: Figure 8 shows the mean 'Memory ability checklist' scores across genders for all the three age groups. To study the gender effect on the 'Memory ability check-



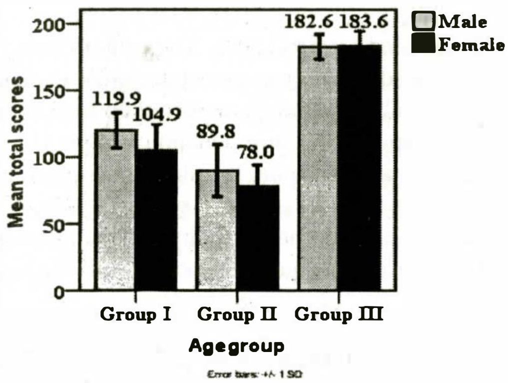
Note: # Maximum score is 118

Figure 5: Mean memory subtest scores for males and females across the three age groups.



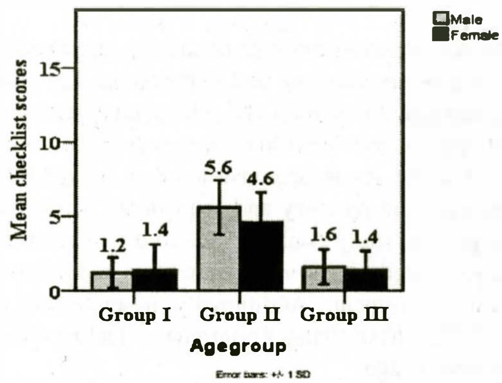
*Note: # Maximum score is 118; * $p < 0.05$*

Figure 6: Mean sequencing subtest scores for males and females for the three age groups.



*Note: # Maximum score is 236; * p < 0.05*

Figure 7: Mean total memory and sequencing scores for males and females across the three age groups.



Note: # Maximum score is 18

Figure 8: Mean scores on the 'Memory ability checklist' for males and females across the three age groups.

list' score, non-parametric Kruskal-Wallis test was carried out. The results showed no significant difference [χ^2 (2) = -0.158, p>0.05] between genders across all the three age groups.

The findings of the study are discussed in the light of the available literature. This is done to see if the findings support or refute the findings of studies reported in literature.

Discussion

The comparison of the scores obtained on the auditory memory and sequencing test and the 'Memory ability checklist' are discussed for three age groups as well as across the genders. The comparison of the 'Memory ability checklist' scores with the total auditory memory and sequencing scores for each age group are also discussed.

Comparisons of memory and sequencing abilities across age groups

The results of the present study showed that the younger adults aged 20-30 years (Group-III) performed better than the two older groups aged 50 to 64;11 and 65 to 80 years (Group-I & -II respectively). This was observed on auditory memory subtest as well as the sequencing subtest. Similar results are also seen on the total auditory memory and sequencing scores.

These results are in agreement with those of Anders, Fozard and Lillyquist (1972) and Neils et al. (1991). They reported of considerable decrement in the memory and sequencing scores of the elderly compared when compared younger adults on a recognition task and free recall task respectively. Kester, Benjamin, Castel and Craik (2002) also opined that the elderly experience trouble retrieving information from memory, particularly when retrieval required effortful processing, as in un-cued recall.

In the current study, a comparison of the two older groups of adults (Groups I & II) revealed that the younger of these two groups (50 to 64;11) got significantly higher scores than the older of these groups (65 to 80 years). This was observed on the memory as well as sequencing subtests.

Similar findings have been reported by Park (1996) in a longitudinal comparison study. The study revealed that age-related changes from age 20 to 60 tended to be small. In contrast, changes after the age of 60 had a steeper slope. Park (2002) too found that memory scores showed a linear life-long decline with an accelerated decline in the later decades. Several other studies have also reported of a generalized slowing in brain function which resulted in a decline in problem solving, reasoning, memory, and language (Cerella, 1990; Lindenberger & Baltes, 1994; Salthouse, 1996). Additionally, a slowing of behaviour in old age has also been documented (Birren, 1965; Salthouse, 1991, 1996).

Age related decline in memory and sequencing has been ascribed to several reasons in literature. Salthouse (1996) suggested that age-related impairments on tasks that do not have an obvious speed component, such as free recall tasks, could be explained via the simultaneity mechanism where the products of earlier processes were lost before later processes were carried out. The reduction in the memory and sequencing scores with aging has also been attributed to inadequate signal processing due to aging of the sensory systems by Murphy, Craik, Li and Schneider (2000). Yet another reason for a reduction in performance with aging, according to Craik and Byrd (1982), had been the depletion of attentional resources available for cognitive processing. Further, Kester et al. (2002) noted that age-related decrement in executive control over cognitive processes has lead to a decline in memory ability in the elderly.

Thus, the findings of the present study are in consonance with that reported in literature. These results add to the corpus of findings regarding age related decline in auditory memory and sequencing. The current study highlights that such age related changes are universal and not restricted to certain regions or communities. Further, it can be construed that the age related changes seen in memory and sequencing performance in the present study could be due to a combination of inadequate signal processing, attention reduction and cognitive decrement. Additionally, in agreement with Park (2002), these changes continue to decline with advancement in age.

Comparisons between memory and sequencing scores across age groups

Overall, in the present study, all three groups obtained higher scores on the memory sub-test compared to the sequencing sub-test, indicating that the latter task was a more challenging one. The drop in score was similar for the two older groups (33.1 & 34.05 for Groups I & II respectively). However, their drop in score was more than that of seen in the younger group (28.7). This indicates that the older two groups found the sequencing task more difficult than the younger group.

Similar findings have been reported by Yathiraj and Vijaylakshmi (2006) in children aged 11 to 12 years. The authors found that the memory subtest scores ranged between 101 to 105, with the maximum attainable score being 118. However, the scores for the sequencing subtest dropped to 69 to 78 for the same maximum attainable score of 118.

Comparison across gender in each age group

It was found in the present study that both males and females performed equally on the memory subtest. Similar findings were seen across all three age groups. This finding is consistent with that of Susan, Susan, Benjamin and Hannah (2004) who found no significant between genders on a working memory task.

However, on the sequencing subtest, the present study revealed that the performance of the female participants was poorer than that of the male participants. This was observed in the two older adult groups (Group-I & -II) but was absent in the younger adult group (Group-III) where both genders performed equally. A possible reason for the presence of a gender difference in the older two groups could be due to the educational differences in the males and females. From the Table 1 presented in the method section, it is evident the males in both the elderly groups had higher educational levels when compared to the females of the same age group. Such a difference in educational level was not present between the genders in the younger adult group.

The effect of education on the performance of males and females has been reported by Coffey, Saxton, Ratcliff, Bryan, and Lucke (1999). The authors found that each year of education was associated with an increase in peripheral CSF volume (a marker of cortical atrophy) of 1.77 mL ($p < 0.03$) in a nonclinical population. In the present study, since the females had comparatively less education than the males, they were likely to have a greater degree of cortical atrophy which in turn could have resulted in poor performance on the sequencing subtest.

In contrast to the findings of the present study, Alexander, Packard and Peterson (2002) and Lowe, Mayfield and Reynolds (2003) documented better scores in young and older females on various memory and sequencing tasks. Subject variability, material used for the task and education level of the subjects may have accounted for the difference in the findings between their study and that of the present one.

Craik and Byrd (1982) reported that difficult tasks required more attentional capacity than simpler tasks. In the current study, the sequencing task was more taxing. This is evident from the lower scores on this task compared to the memory subtest. Since the sequencing subtask was relatively more complex than the memory subtask, the differences in the gender could probably be picked-up with the former and not with the latter subtest.

Comparisons of the total auditory memory and sequencing test scores and 'Memory ability checklist' score

The results of the study revealed that all the three age groups differed significantly from each other on the total auditory memory and sequencing test score. The younger adults (20 to 30 years) performed better than the two groups of older adults. Among the two groups of older adults, Group-I (50 to 64;11 years) performed superior to the Group-II (65 to 80 years).

The younger adults (Group-III) had lowest scores on the 'Memory ability checklist' which indicated that they did not perceive themselves as having any memory problems. This was in agreement with their scores obtained on the memory and sequencing test. The 65 to 80 years old participants (Group-II) had the highest scores on the 'Memory ability checklist' which was also evident from their poor scores on the Kannada auditory memory and sequencing test. On the other hand, the participants in the Group-I, aged 50 to 64;11 years, did not report of any decline in their memory ability. However, their test scores were significantly low when compared to the younger adults.

The above findings are in accordance with that of Taylor, Miller and Tinklenberg (1992). The authors found that among the older adults (< 60 years), the decline in memory ability is not significant enough to cause an increase in the scores of self-report questionnaires. Hertzog and Dixon (1994) reported that the self-reports of the older individuals do not necessarily correspond with their actual memory ability unless the memory problem start occurring frequently. Hence, it can be concluded that a memory test is able to detect a decline in memory and sequencing abilities before the individual starts perceiving the deficit.

Conclusions

Overall, from the results of the present study it can be inferred that memory and sequencing abilities show a linear life-long decline with an accelerated decline in the later decades and these age related changes are universal and not restricted to certain regions or communities. In addition, the educational level of the participant plays an important role on the performance of complex tasks such as sequencing. In elderly individuals aged less than 65 years, self-report scores of the memory abilities may not necessarily correspond with their actual memory abilities.

From the present study it is clear that memory abilities deteriorate with age. This must be kept in mind while counselling / rehabilitating older adults Also, due to the possible influence of education in the performance of complex memory tasks, emphasis needs to be given to encourage higher levels of educations in all individuals.

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