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Cognitive Linguistic Abilities in an Elderly Population

Sampath Kumar Lagishetti, Ph.D. Candidate
Lakshmi Venkatesh, Ph.D.

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Abstract

Aging is an inevitable process of life, associated with special physical, emotional and social burdens imposed by mental decay in later life, and a general wear and tear at anatomical and functional levels. Some minimal changes in language abilities from a global communication point of view have been reported in literature. These changes are investigated in this study among Telugu-speaking persons.

Eighty Telugu speaking adults were divided into 8 groups starting from 40 to 45 years until 75 to 80 years. Each group consisted of 5 males and 5 females. Each participant was tested individually on cognitive-linguistic skills using the Cognitive Linguistic Assessment Protocol - Telugu (CLAP-T) adapted from the Cognitive Linguistic Assessment Protocol developed by Aruna (2001) for Kannada speaking adults and Addenbrooke's Cognitive Examination Revised - Telugu adapted [ACE-R (TA).

Age related effects were observed in all domains of cognitive linguistic skills among Telugu speaking adults. The age group at which, first signs of decline in performance occurred differed across the domains. For example, decline in attention skills on tasks involving the visual modality and semantic memory tasks was observed first among participants in the age group of 70-to-75 years of age. Age effects were also observed in the analysis of data from individual subtests in the domains of attention, memory, problem solving and organization in CLAP-T. For example, participants in the age group of 75-to-80 years demonstrated lower performance across all tasks in comparison to the other participants. A significant age effect was observed for all subtests across all domains of ACE-R (TA).

This study showed that cognitive skills declined from 40 to 80 years. CLAP-T can be used as assessment tool for identifying cognitive deficits in persons with cognitive communication disorders. This would help in planning intervention programs for persons with cognitive communication disorders.

Key words: Aging, cognition, language.

Introduction

Aging is a characteristic pattern of cognitive and behavioral changes. One of the most consistent is a general slowing of intellectual and physical performance (Keefover, 1998). Aging in humans refers to a multidimensional process of physical, psychological, and social change. Some dimensions of ageing grow and expand over time, while others decline (Bowen, & Atwood, 2004). Slowing affects mental processing as well as sensory input and motor responses and can impede other cognitive functions (Rabbitt & Lowe, 2000; Park, Smith, & Lautenschlager, 1996).

Attention and arousal become less efficient and the elderly have a decreased ability to concentrate over prolonged periods of time. Moreover, they may experience interference from redundant or relevant material. Early research has also reported of modality differences in attention, with the elderly having greater difficulty in visual modality (Maxim, 1999). Memory is the ability to remember past events, previously learned information or skills. Memory is also the storage system that allows for retaining and retrieving previously learned information. Age differences in memory performance are well documented with older adults showing poorer performance on many aspects of memory (Backman, Small, & Wahlin, 2004).

In contrast to other cognitive functions, language functions are relatively spared. There is no global decline in linguistic functions with age (Olber & Albert, 1981) although some minimal changes in language abilities from a global communication point of view have been reported in literature (Maxim, 1999).

There is a strong bond between cognition and language. Cognitive changes occurring with aging do impinge on linguistic abilities leading to such problems as difficulty in word retrieval processes (Kemper, 1992; Maxim, 1999) and decline in complex discourse processes.

This position statement by ASHA (2005) defined the roles of speech-language pathologists in the evaluation and management of individuals with communication disorders associated with cognitive impairments. This is due to acquired etiologies including and not limited to non degenerative and degenerative neurologic disorders such as the dementias, traumatic brain injury, anoxic or toxic encephalopathy, and stroke and brain tumor. Typically, screening tools measuring different constructs of mental status are used for identification of individuals with cognitive deficits in a time efficient way. Examples of screening tools include the Mini-Mental State Examination (MMSE; Folstein, Folstein & McHugh, 1975), Short Portable Mental Status Questionnaire (SPMQ; Pfeiffer, 1975), Alzheimer's disease Assessment Scale (Rosen, Mohs, & Davis, 1984, 1986) and Addenbrooke's Cognitive Examination-Revised (ACE-R; Hodges, 2005) among others.

Various assessment batteries have been developed for comprehensive evaluation of cognitive communicative functioning in individuals with cognitive communication disorders. For example, the Arizona Battery for Communication Disorders of Dementia (Bayles & Tomoeda, 1993) was designed to differentiate normal elders from persons with early dementia and to track functional abilities until advanced dementia. The Functional Linguistic Communication Inventory (FLCI; Bayles & Tomoeda, 1994) was developed to document functional communication abilities in individuals with dementia.). Effects are commonly reported in individuals who are in advanced old age (>75years) and on tasks requiring speed or a directed search of memory (Bayles & Tomoeda, 2007).

Indian context

Ethno- cultural differences exist in cognitive functioning of normal adults (young & middle-aged adults) and older adults within the framework of aging (Bateson, 1982) and neurogenic language disorders (Payne, 1997). Cognitive psychologists theorize that each culture has its own characteristic cognitive style (Bateson, 1982). Conceptual framework has been developed for the understanding of cohort differences in intelligence to identify those influences in the historical cultural context that might impact cohort differences in both the mean level and trajectory of mental abilities across adulthood (Schaie, 2005). An alternative theoretical approach to the study of historical influences on psychological aging with particular application to cognition has been presented by Willis and Sachie (2005).

Such ethno-cultural differences in cognitive functioning necessitate the study of cognitive linguistic skills within the Indian context. Few studies have explored the language abilities in the elderly, in the Indian context (Raksha, 1996; Mahendra, 1996; Aruna, 2001). Raksha (1996) found that that tasks of picture naming, word association, delayed story recall and picture discrimination differentiated patients with Alzheimer's disease from patients with aphasias. Generative naming, word association test, delayed story recall and picture description tasks differentiated patients with Alzheimer's disease from normal elderly. A similar study by Mahendra (1996) involving Hindi speaking adults found similar results.

Aruna (2001) developed a standardized procedure for assessment of cognitive linguistic skills for Kannada speaking adults, the Cognitive Linguistic Assessment Protocol (CLAP). Although slight declines were observed with age in a small group of adults in the age group of 40-to-60 year-olds, no significant age related decline of performance on cognitive linguistic tasks was observed in Aruna's (2001) study. Addenbrooke's Cognitive Examination-Revised (ACE-R; Hodges, 2005), a popular global cognitive screening instrument has been validated in various studies of educated populations in India (Mathuranath, Nestor, Berrios, Rakowicz, & Hodges 2004). The ACE-R incorporates the five sub-domains including orientation/attention, memory, verbal fluency, language and visuospatial tasks. The Telugu adaptation of ACE-R designated as ACE-R (TA) has been validated in Telugu speaking literate and illiterate populations (Alladi, Sailaja, Mridula, Sirisha & Kaul, 2008).

In the Indian context, there have been some attempts to develop and validate tools for assessment of cognitive functioning in general as well as for differentiation of performance of individuals with cognitive communication disorders from that of the normal elderly. There is a need for the development of tools for assessment of cognitive linguistic skills in different Indian languages, for assessment of cognitive communicative functioning in elderly, and for diagnosing deficits in cognitive communicative functioning.

Objectives of the study

The main objective of the study was to observe age-related changes and gender contingent variations on a range of cognitive linguistic skills among Telugu-speaking adults. The other objective was to correlate scores between CLAP-Telugu and ACE-R (Telugu).

Method
Participants

A total of 80 neurologically normal Telugu speaking adults in the age range of 40-to-80 years participated in the study. All participants in this study had at least primary education and were able to read and write Telugu. These participants were grouped into eight age groups with

an interval of five years each. All groups consisted of a total of 10 participants; five female and five male participants. The mean age and standard deviation of age in each age group for female and male participants is depicted in table 1.

Table 1. Mean age and standard deviation of age group for female and male.

		Age (years)			
		female participants (n = 5)		male participants (n = 5)	
Group	**Age range**	Mean	SD	Mean	SD
1	40 - 45;11	41.6	0.55	42.2	0.84
2	45 - 49;11	46	1.22	47.4	1.67
3	50 - 54;11	52.2	1.48	52.4	1.14
4	55 - 59;11	56.4	1.14	57.6	0.89
5	60 - 65;11	63	1.41	63	1.22
6	65 - 69;11	68	1.73	66.8	2.05
7	70 - 74;11	72.8	1.10	72.4	1.52
8	75 - 79;11	77.4	0.55	77.8	0.84

Screening protocol

A screening protocol was administered before testing began to confirm the inclusionary criteria. The Mini Mental State Examination, (MMSE; Folstein, Folstein & McHugh, 1975) was administered on all participants. All participants scoring greater or equal to 26 points on the MMSE were included in the study. The MMSE is a popular screening tool for identification of individuals with cognitive deficits and evaluates orientation to person, place and time, general knowledge, memory, communication and copying.

The MMSE requires 5-10 minutes to administer and the total possible score is 30. The cut off score of less than 26 was used as recommended by Monsch and colleagues (Monsch et al., 1995). A speech discrimination task consisting of five spondee words was performed to evaluate speech discrimination ability in the same environment in which the battery of cognitive-linguistic tasks would be administered. The spondees chosen were such that they contained both low- and high-frequency sounds. To participate in the study, all participants had to discriminate all five spondees correctly.

Procedure

Each participant was tested individually. Cognitive-linguistic skills were examined using the Cognitive Linguistic Assessment Protocol - Telugu (CLAP-T) adapted from the Cognitive

Linguistic Assessment Protocol developed by Aruna (2001) for Kannada speaking adults. All participants were also tested with the Addenbrooke's Cognitive Examination Revised -Telugu adapted [ACE-R (TA), Alladi, et al., 2008].

Cognitive Linguistic Assessment Protocol for Adults - Kannada (Aruna, 2001)

The CLAP consists of four domains including attention (visual & auditory category), memory (episodic, working & semantic), problem solving (sentence disambiguation, sentence formulation, comparing and contrasting two objects, predicting the outcome of a described situation, Predicting cause of a described situation, answering 'why' questions & sequential task analysis) and organization (categorization, analogies & sequencing of events). Transliteration of the test items in the protocol developed by Aruna (2001) was carried out with the help of a Kannada-Telugu bilingual speaker with adequate proficiency in both languages. The transliterations were verified and suitably modified if required by a linguist with considerable knowledge of syntactic, semantic and pragmatic constructs of Telugu to ensure a culture-fair test. Instructions specific to the task were given in Telugu.

Addenbrooke's Cognitive Examination Revised -Telugu adapted [ACE-R (TA), Alladi, et al., 2008]

Addenbrooke's Cognitive Examination- Revised version (ACE-R) is a global screening test of cognitive skills encompassing five domains including attention and orientation, memory, fluencies, language and visuospatial skills. The ACE-R includes the items of MMSE. The Telugu adaptation of ACE-R was developed at the Nizam's Institute of Medical Sciences (NIMS). The details of the test items included in each of the five domains in ACE-R are provided in table 3.3. The scoring was carried out simultaneously for each task as per the scoring procedure scheduled for each item.

Univariate two-way analysis of variance (ANOVA) was used to analyze the effects of age and gender on the performance scores in each domain of the CLAP-T and ACE-R (TA) separately. Post hoc comparisons of main effects were made using the Tukey honestly significant difference (HSD) procedure. An alpha level of .05 was used for all statistical tests. Effect sizes, indexed by the eta squared statistic, η^2 are reported for all significant effects in the ANOVA.

Results and Discussion

The CLAP-T completed by participants consisted of 4 domains including attention (visual attention & auditory attention), memory (episodic memory, working memory & semantic

memory), problem solving and organization. The results are discussed for each domain of the CLAP- T in the sections below.

Attention

Table 2 shows a decline in the attention skills of Telugu speaking adults with age. Decline in attention skills in tasks involving the visual modality first emerged among participants in the age group of 70-to-75 years of age($F(7, 64) = 246.494$, $p<0.001$, $\eta^2 = 0.95$). On tasks involving the auditory modality, the age group of 65-to-70 years showed the first signs of decline in performance in comparison to the age range of 40-to-65 years($F(7, 64) = 29.360$, $p<0.001$, $\eta^2 = 0.71$). No difference in performance of male and female participants was observed in tasks involving the visual modality. Female participants demonstrated lower performance than male participants in the tasks involving the auditory modality.

Table 2. Group mean and standard deviations (in parenthesis) of total scores for CLAP-T domains obtained by female and male participants in the eight age groups

Age Group	Gender	Visual attention	Auditory attention	Episodic Memory	Working Memory	Semantic Memory	Problem Solving	Organization
1	Female	29.8 (0.45)	29.4 (1.34)	10 (0)	8.2 (0.83)	39.2 (0.83)	62 (2.23)	58 (1)
	Male	30 (0)	29.8 (0.44)	10 (0)	7.8 (1.09)	40(0)	63.8 (1.78)	56.6 (1.81)
2	Female	30 (0)	29.6 (0.89)	9.6 (0.54)	6.8 (1.09)	39.4 (0.89)	61.6 (2.6)	55.8 (2.58)
	Male	30 (0)	29.4 (1.34)	10 (0)	8.2 (1.09)	40 (0)	61 (4.52)	56.6 (2.19)
3	Female	29.8 (0.45)	27.8 (1.92)	9.6 (0.54)	6.2 (0.83)	38.2 (1.30)	55.4 (5.8)	51 (4.06)
	Male	30 (0)	29.6 (0.89)	9.8 (0.44)	6.8 (0.44)	39.8 (0.44)	61 (1.58)	55 (2.82)
4	Female	29.4 (0.80)	29 (0.70)	8.89 (0.44)	6 (0)	38.8 (0.83)	58 (1.58)	51.2 (4.02)
	Male	30 (0)	29 (1)	9.2 (0.83)	6.2 (0.83)	39 (0.70)	58.4 (0.89)	53.6 (3.04)
5	Female	29.8 (0.45)	27 (1.41)	8.6 (0.89)	5 (1.22)	38.6 (0.89)	55.8 (2.58)	48.8 (2.04)
	Male	29.8 (0.45)	28.6 (1.14)	9.8 (0.44)	6.4 (0.89)	39.4 (0.54)	58.4 (1.94)	49.6 (4.09)

6	Female	29 (1)	26.2 (1.30)	7.4 (0.54)	4.8 (1.09)	37.4 (0.89)	53.2 (1.92)	46.2 (3.96)
	Male	29.8 (0.45)	28 (1.87)	9.4 (0.89)	6 (1)	39.2 (0.83)	57.4 (3.13)	48.2 (1.78)
7	Female	28.2 (1.3)	26.6 (1.51)	7.4 (0.54)	5 (1)	37.2 (1.30)	53.6 (2.07)	43.6 (2.07)
	Male	29.4 (0.80)	28.4 (1.51)	9.4 (0.89)	6 (1.41)	38.6 (0.89)	56.4 (2.79)	44.2 (2.86)
8	Female	21.2 (0.8)	22.8 (1.30)	6.8 (0.83)	4.4 (0.89)	30.6 (1.34)	45.4 (2.7)	44 (1.58)
	Male	20.6 (0.5)	22.6 (1.34)	6.8 (0.44)	4 (0)	31.4 (1.14)	47.4 (0.54)	44.2 (0.44)

The results of the current study are in consonance with Aruna's (2001) findings on Kannada speaking adults. The study found no statistically significant decline in the performance of Kannada speaking adults ranging in age from 40-to-70 years on visual and auditory attention tasks on the CLAP. The findings of the current study with respect to the significant decline in the performance of participants in the age groups of 70-to-75 years and 75-to- 80 years could not be compared with the study by Aruna (2001) as the participants included in the 2001 study of CLAP were limited to the age of 70 years and below. A speech discrimination task was used to ascertain that participants were able to respond appropriately to conversational levels of speech. Moreover, the participants above the age of 70 years did not complain of any hearing difficulties. Therefore the lower performance of participants above 70 years of age on auditory attention tasks may not be attributed to hearing deficits if any.

Memory

There is a significant decline in the performance of participants in the age range of 65-to-80 years in comparison to participants in the age group of 40-to-65 years for the episodic memory task ($F (7, 64) = 32.668$, $p<0.001$, $\eta^2 = 0.61$) shown in table 2. A decline in episodic memory skills with aging has been reported in literature (Craik, 1977). Retrieval from episodic memory involved recall of specific events from the past, and the elderly often appeared to recall from the remote past more rapidly than from recent past. Another study by Christensen, Henderson and Korten (1994) examined the episodic memory performance among 287 healthy adults (198 males and 89 females) in the age range from 68-to-95 years. Findings revealed a decline in episodic memory with increasing age.

In working memory tasks, a significant decline in performance was observed for participants in the range of 65-to-80 years in comparison to younger participants in the age

group of 40-to-50 years (F (7,64) = 16.658, p<0.001, η^2 = 0.58). Participants above 50 years of age were significantly different from the youngest group of participants in the age group of 40-45 years. Similar results have been reported by Gilbert (1941) who tested 174 individuals each in the age group of 60-to-69 years and 20-to-29 years. Participants in the ages of 60-to-69 years showed poorer performance than participants in the ages of 20-to-29 years on a range of separate memory tests including digit span to retention of a paragraph of text over a delay interval. Stine and Wingfield's (1987) study emphasized process and strategy in memory for speech among 24 young (17 – 21 years old) and 24 older adults (59 – 81 years old). Differences in overall performances were accounted for in terms of age related changes in working memory processing and strategy utilization.

The performance of participants in the age range of 70-to-75 years and 75-to-80 years showed a significant decline in comparison to performance of participants in other age groups on the semantic memory tasks (F (7, 64) = 102.348, p<0.01, η^2 = 0.88). Further, the semantic memory was relatively preserved in that the first signs of decline in performance were seen in participants above 70 years of age. In contrast, working memory showed earliest decline with age, with participants in the age group of 50-to-55 years performing significantly lower than youngest group of participants (40-to-45 years). For episodic memory tasks, the decline was first evident in the age group of 65-to-70 years.

The results of current study are in agreement with those of Aruna (2001) in terms of lack of age related decline for semantic memory tasks in the age groups of 40-to70 years. Semantic memory has been reported to be more resistant to aging as compared to other memory processes, though processing times may be longer, and more variable with age (Maxim; 1999, Raksha & Mahendra, 1994). These deficits in semantic memory processes are more a result of retrieval deficits than a lexical access problem. Organization within the semantic network does not change with increasing age, as seen on association tests (Bowles, Williams, & Poon, 1983).

Problem solving and Organization

Table 2 shows participants above the age of 50 years performed significantly lower in comparison to participants in the age group of 40-to-50 years. The first sign of decline was observed from the age group 3 (50-to-55years) on performance of participants in comparison to age groups of 1 and 2 (F (7, 64) = 33.693, p<0.01, η^2 =0.72). Two way analysis of variance of the performance on organization scores revealed a main effect for age group (F (7, 64) = 35.095, p<0.01, η^2 =0.76), indicating that there was a statistically significant difference in the performance of participants on organization tasks across the age groups. The age group of 50-to-55 years showed the first signs of decline in performance in comparison to the age group of 40-to-45 years; all participants above the age of 55 years performed significantly lower in comparison to the younger groups of 40-to-45 years and 45-to-50 years. Age effects in problem

solving found in the current study differed from the study by Aruna (2001). No significant decline in problem solving abilities in the elderly population in the age range of 40 to 70 years was detected by Aruna (2001).

Denney and Palmer (1981) examined age differences in the strategies that people used in their everyday problem solving. Older adults' more frequent use of others in their problem solving as compared to younger adults has led older adults to be deemed poor problem solvers. Result suggested that older adults are poor problem solvers. E.g. Procedural, verbal.

A recent study done by Aruna (2001) suggested that there was no decline in organization skills in elderly population (40 to 70 years). The results of the current study are in consonance with the findings of Bayles and colleagues (Bayles, Tomoeda & Boone, 1985) on discourse organization in adults. The best performance in discourse analysis in terms of organization of discourse was demonstrated by participants in their 30s and 40s in comparison to participants in their 50s, 60s and 70s. The participants in their 50s and 60s did not differ from each other and participants in their 70s were different from all other age groups.

ACE-R

As seen from table 3, main effect for the age groups was statistically significant for all domains including attention ($F (7, 64) = 54.049$, $p<0.001$, $\eta^2 =0.83$), memory ($F (7, 64) = 25.629$, $p<0.001$, $\eta^2 =0.71$), fluency ($F (7, 64) = 13.165$, $p<0.001$, $\eta^2 =0.57$), language ($F (7, 64) = 38.598$, $p<0.001$, $\eta^2 = 0.79$) and visuospatial perception ($F (7, 64) = 31.686$, $p<0.001$, $\eta^2 = 0.72$). The main effect for gender occurred for the domains of attention ($F (1, 64) = 4.811$, $p = 0.001$, $\eta^2 = 0.105$), and memory ($F (1, 64) = 5.848$, $p=0.019$, $\eta^2 =0.02$). Main effect for the gender was not observed on performance in the domains of fluency ($F (1, 64) = 3.236$, $p = 0.077$), language ($F (1, 64) = 0.396$, $p=0.532$) and visuospatial perception ($F (1, 64) = 3.175$, $p= 0.08$).

The interaction effect of age groups and gender was observed to be statistically significant on performance of participants on visuospatial perception. Post hoc analyses of comparisons among the age groups revealed that in attention and orientation, memory and fluency tasks, the participants in age group 6 (65-to-70), 7 (70-to-75years) and 8 (75-to-80 years) demonstrated significantly lower scores in comparison to all other participants in the age range of 40-to-65 years. However, in language and visuospatial skills, age group 8 (75-to-80 years) demonstrated significantly lower scores in comparison to all other participants in the age range of 40-to-75 years. The participants in the age group of 65-to-70 years showed the first signs of decline in performance on attention and orientation, memory and fluency tasks; whereas the first signs of decline were observed in the age group of 75-to-80 for language domain and in the age group of 70-to-75 years for visuospatial skills.

Table 3. Group mean and standard deviations (in parenthesis) of total scores for ACE-R domains obtained by female and male participants in the eight age groups

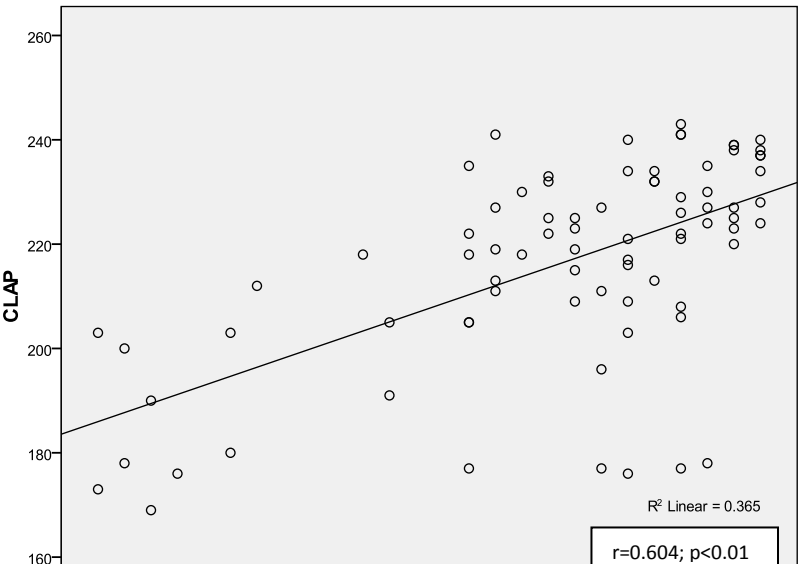
Age Group	Gender	Attention	Memory	Fluency	Language	Visuospatial Perception
1	Female	18 (0)	24.6 (0.5)	13.4 (0.5)	26 (0)	16 (0)
	Male	18 (0)	26 (0)	14 (0)	26 (0)	16 (0)
2	Female	17.8 (0.4)	24.8 (0.8)	13.2 (0.8)	26 (0)	16 (0)
	Male	18 (0)	25.2 (0.4)	13.8 (0.4)	26 (0)	16 (0)
3	Female	17.6 (0.5)	22.4 (1.1)	11.2 (2.3)	25.4 (0.8)	15.6 (0.5)
	Male	18 (0)	23.8 (1.09)	12.4 (0.8)	26 (0)	16 (0)
4	Female	17.4 (0.8)	23.4 (1.1)	12.4 (0.8)	25.4 (1.3)	15.8 (0.4)
	Male	17.4 (0.5)	23 (1.2)	12.2 (1.6)	25.8 (0.4)	15.8 (0.4)
5	Female	17 (0.7)	22.8 (1.09)	12 (0.7)	25.6 (0.8)	15.8 (0.4)
	Male	17.2 (0.4)	24.2 (2.3)	12.4 (1.1)	26 (0)	16 (0)
6	Female	16.6 (1.1)	21.8 (1.64)	11.2 (0.8)	25.8 (0.4)	15.6 (0.5)

7	Male	17.4 (0.8)	23.2 (1.7)	11.6 (0.8)	25.6 (0.5)	16 (0)
	Female	16 (0.7)	21.4 (1.14)	10.4 (0.5)	25.6 (0.5)	14.8 (0.8)
8	Male	17.2 (1.09)	21.6 (2.5)	11.2 (0.8)	25.8 (0.4)	15.8 (0.4)
	Female	13.4 (0.5)	18.4 (0.5)	10.4 (0.5)	22.2 (1.6)	14 (0.7)
	Male	13.2 (0.4)	18.4 (0.5)	10 (0.7)	21.6 (0.5)	13.4 (0.5)

Correlation between CLAP- T and ACE-R

The total scores obtained in CLAP-T were correlated with the total scores obtained in ACE-R across participants in all age groups. Figure 1 is the representation of total individual scores of all 80 participants on CLAP-T and ACE-R. There was a statistically significant positive correlation ($r = .604$, $p < 0.01$) between the total scores on CLAP-T and ACE-R suggesting that performance of participants across all domains on CLAP-T correlated with their performance across all domains in ACE-R. In general, participants performing poorer on CLAP also performed poorly on ACE-R.

Figure 1. Scatter plot of total individual scores obtained by all 80 participants on the Cognitive-Linguistic Assessment Protocol (CLAP-T) and Addenbrooke's Cognitive Examination-Revised (ACE-R).



Conclusions

The current study provided data on age related changes in Telugu speaking adults on performance of cognitive linguistic skills in the age group of 40-to-80 years. The performance of participants on individual subtests of CLAP-T was compared for age and gender effects using ANOVA. A significant age effect was observed for all subtests across all domains of CLAP-T. However, gender effects occurred only for some of the subtests across all domains of CLAP-T.

Age related effects were observed for all domains of cognitive linguistic skills among Telugu speaking adults. The examination of effect sizes (eta-squared - η^2) for the age effect across the domains indicated that the effect sizes ranged from a minimum of 0.58 in the working memory domain to a maximum value of 0.95 in the domain of visual attention in the cognitive linguistic protocol. Similarly the effect sizes for significant age effect in the domains of ACE-R ranged from 0.57 in the fluency domain to a value of 0.83 in the domain of attention. Effect sizes of 0.9 have been indicated as large (Cohen, 1992). The effect sizes for age effect observed in the current study across domains of cognitive linguistic skills may be considered as medium to large effect sizes.

The results of the current study revealed that as a group, male participants performed better than female participants for total scores in the domains of auditory attention, memory and problem solving in CLAP as well as attention and memory domains in ACE-R. No difference between male and female participants occurred for the total scores in other domains. Moreover, results of ANOVAs performed on individual subtests revealed that the gender effects were not consistent across the different subtests in a domain.

Implications of the study

The current study provided preliminary data on age related changes on a range of cognitive linguistic tasks, observed in a sample of Telugu speaking adults in the age group of 40-to-80 years. The data adds to the much needed corpus of research studying the changes in language and communication concomitant to the biological aging process and life span characterization of normal language skills within the Indian context. Quantitative data obtained in the current study on various cognitive linguistic tasks would help in differentiating normal elderly who perceive or experience age-related changes as dysfunctional from others who do not perceive the age related changes as dysfunctional. In the absence of tools for assessing various cognitive linguistic functions in Telugu, the tasks included in the cognitive linguistic protocol may serve useful for informal screening of a range of skills among clients diagnosed with dementia, traumatic brain injury, and aphasia as well as elderly with complains of impairments in daily functioning.

Considerations of caveats regarding the study as well as implications of the study facilitate further progress. The gender differences observed in the current study need to be systematically examined. Future studies may be directed towards the use of cognitive linguistic tasks included in the current study for differentiating cognitive communication disorders such as dementia and traumatic brain injury from each other as well as from age related decline due to normal aging. The sensitivity and specificity of the tasks for differential diagnosis can be determined.

Limitations of study

Any generalization of the results of the current study warrants caution due to the limited number of participants in each of the age groups of participants. Only participants who had completed a minimum of primary level education were included in the study. However, the education level of participants ranged from primary education to post graduation for a few participants. The effects of educational level of participants on their performance cannot be ruled out.

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Sampath Kumar Lagishetti (Corresponding Author)
Department of Speech Language Pathology
All India Institute of Speech and Hearing,
Naimisham Campus, Manasagangotri,
Mysore - 570 006
Karnataka
India
lagishettisk@gmail.com

Lakshmi Venkatesh, Ph.D.
Sweekaar Rehabilitation Institute for Handicapped
Secunderabad, Andhra Pradesh
India
lakshmi27@gmail.com