Profiling Cognitive-Communication Impairments in the Elderly

Project under AIISH Research Fund (ARF)
(2013-2014)

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Chapter 1

INTRODUCTION

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INTRODUCTION

1.1 Typical Ageing Process.

Aging is a normal process that occurs in every human being, bringing about changes in the individual that could be both overt and covert. Ageing involves a reduction in metabolic activity and increase in mortality that occurs progressively as individuals age (Kirkwood &Austad, 2000). Changes in motor, sensory, cognitive and also the communicative skills become gradually evident as the individual grows older, and at some stage these changes are inevitable. Thus a gradual and progressive deterioration may be seen when the changes are a result of normal aging process, unlike in pathological conditions such as in dementia, aphasia, parkinsonism, etc wherein sudden and more pronounced deficits are seen.

All over the world the demographics of the elderly population is changing and this change is unfortunately not in proportion to the facilities for care of the elderly that is available. Ensuring a good quality of life for the elderly involves more than just prolonging their life with medical intervention. Throughout the world the number of elderly in the 1950s was 200 million. In the year 2000, data showed 550 million persons over the age of sixty years and the estimated figure is expected to rise to 1.2 billion elders in 2025 (Goswami, Reddaiah, Kapoor, Singh,Dey, Dwivedi and Kumar, 2006). Adding to this scenario that the elderly face, there is an increase in nuclear families in many tier 1 and tier 2 cities in India. This picture indicates the requirement for an overhaul in the system that takes care of the elders. This is because the rate of increase of the elderly population has risen from 5.63 per cent in 1961 to 7.2 percent in 2001 and is expected to be approximately 8.94 percent by 2016 as reported by Goswami, et al (2006). Rajan (2007) discusses that developing countries like India have an exceedingly large population of individuals aged over 60 years. With the 2001 census, the population of elderly aged 60 and above was found to be 77 million. Thus with increasing populations of elderly individuals, the demand for better services have increased. Hedden and Gabrieli (2004) report that differentiating normal age related changes from the pathological processes are difficult. Care of the elderly in India who are increasing at the rate of approximately 8 percent also involves taking care of those with cognitive impairment which is an added responsibility on the shoulders of service providers.According to the study by Goswami et al (2006), 18.03 percent of the cohort elders had cognitive impairment in an area of rural India. In this scenario one need to know what changes might occur in an individual on account of the normal aging process.

1.1.1. Communication and aging.

Communication is an act of exchanging ideas, and conveying thoughts and may be verbal or non-verbal. It may involve functions of listening, speaking, gesturing, reading, and writing in all domains of language (phonology, morphology, syntax, semantics, and pragmatics). With the aging process, the communication abilities of an individual may get affected gradually. Clark-Cotton, Williams, Goral and Obler (2007), report that the speech in older adults are generally slower and less precise in articulation, thus affecting their communication. Yet this difficulty becomes more evident only at the listener's end.

The elderly population express greater frustration when they face difficulty finding words in conversation, especially when these are words that they might use more frequently. The reason for their frustration over naming difficulties could be due to the fact that they perceive their naming errors to increase each day. These difficulties could be trouble recalling names of person, place or things. Nicholas, Obler, Albert and Goodglass (1985) reported that elderly individuals experience more problems when retrieving nouns and verbs during conversation, and these problems are sharply increased after an age of 70 years.

1.1.2. Cognition and aging.

Cognition as defined by Best (1999), involves a wide range of mental processes such as attention, recognition, memory and storage of information, organisation of information, and also higher level processes such as language, reasoning, problem solving, classification and categorization. Similar to any other functions in the human body, there can be subtle changes in the cognitive functions of the individuals with ageing (Morrison & Hof, 2002). Evidence for changes in cognition comes from both behavioural neuroimaging and post-mortem studies. Authors Haug and Eggers (1991) and Resnick, Pham, Kraut, Zonderman and Davatzikos (2003) reported that when compared to young adults, a lower volume of grey matter in the brains of older individuals was observed. Earlier studies have also shown that as children grow, the volume of grey matter increases by 13 percent towards their adolescence, and thereafter, the volume reduces linearly by about 5 percent in each decade of their life. A difference in terms of the intracranial space volumes being 10 percent smaller in female than males has also been observed (Bradely, Waluch, Brant-Zawadzki, Yadley, &Wyeoff, 1984).

There are however other studies that show that these changes in grey matter volumes are not uniform across all regions of the brain. The prefrontal and medial temporal regions of the cortex are more susceptible to the changes (Resnick et. al., 2003). In other words, it can be said that while in some regions of the cortex the neural connections are strengthened, other regions may have weaker connections due to cell death and resulting reduction in synaptic density. Hence, in the absence of a pathological cause, a decline in the cognitive functions may only be the result of active aging processes.

Difficulties in recalling names of people, places and objects and, difficulty in processing complex information are some of the common complaints that have been reported in literature. Hedden and Gabrieli (2004) in their review of both cross-sectional and longitudinal studies found that within the normal aging population, a cognitive decline was found in three main domains, episodic memory especially for new information, executive processes, and speed of processing information. Cognitive impairment on the other hand, referring to a pathological aging result in rapid deterioration in the areas of behavioural self-regulation, skills of social interaction, learning and encoding of new information and vocational performance, thus severely affecting the individual's activities of daily living and life participation skills (American Speech and Hearing Association, 2005).

1.1.3. Motor functions and aging.

Neuronal changes that occur at the level of the motor cortices can lead to motor declines affecting the balance and gait of the individual (Seidler, Bernard,Burutolu, Fling, Gordon,Gwin,Kwak&Lipps, 2010). There might also be slowing of movements and difficulties in fine motor movements, thus affecting skills such as eating with a spoon, dialling numbers on a phone, holding a pen to write, etc. In order to explain about the age-associated neuronal changes in the motor system, Seidleret. al., (2010) stated that the degeneration of neurotransmitter systems, majorly affecting the dopamine pathwaysleads to gross and fine motor difficulties.

1.1.4. Sensory abilities (auditory, visual) and aging.

With increase in age, the elderly individuals generally face some changes related to the structure of the ear, hearing sensitivity, and/ or balance problems. Examples of changes related to the structure of the ear are thickening of the tympanic membrane, ossification of cartilages, loss of Eustachian tube elasticity and excessive hair growth in the pinna. Studies report that hearing loss as one of the more common problems in elderly individuals. Busacco (1999) reports hearing loss with aging, or presbycusis, is the fourth most common health condition in individuals above 65 years of age. Irreversible changes in hearing might occur with aging, changes as high frequency sensorineural hearing loss, difficulty understanding speech in noise are commonly observed. Another important sensory function is vision abilities. It may also gradually deteriorate with respect to the visual acuity. The individual may face difficulties such as not being able to read smaller font, difficulty recognizing things at a certain distance, and problems such as cataract. These changes are generally perceived earlier by the individual. Any visual acuity related changes can be improved in the elderly by providing corrective lenses, or corrective surgery.

1.1.5. Cognitive linguistic assessment in elderly.

There is a rapid demand for assessing the cognitive-communication skills in the elderly population. This demand increased since the awareness/acknowledgement of cognitive decline in elderly has improved over the years. However, rapid or atypical patterns of cognitive decline may signal abnormal aging in this population. Hence there is a necessity to demarcate between the healthy and unhealthy aging.

To disentangle a subjective complaint of cognitive communication problem to be a norm referenced ageing related pattern or a cognitive dysfunction requires a combination of keen observation, clinical skills and a robust cognitive-communication test battery. The use of cognitive-linguistic assessment aids in differentiating what is normal cognitive ageing from cognitive-communication disorders such as dementia (Alves, Magalhães, Machado, Gonçalves, Sampaio, Petrosyan, 2013). In the Indian context tests such as Cognitive Linguistic Assessment Protocol (Aruna&Prema, 2001) have been developed for the Kannada speaking population and this has been validated into other regional languages such as Cognitive Linguistic Assessment Protocol – Telugu (Lagishetti&Venkatesh, 2011). Another standardized cognitive-linguistic test is the Addenbrooke’s Cognitive Examination-Revised (ACE-R; Dudas, Berrios& Hodges, 2005), which is a tool that has been validated to the

Indian population and has some sections similar to the Mini Mental Status Examination (MMSE; Folstein, Folstein& McHugh, 1975; Cockrell &Folstein, 2002). ACE-R has also been adapted and validated in Telugu for both literate and illiterate populations (Alladi, Sailaja, Mridula, Sirisha&Kaul, 2008). Yet an overall dilemma prevails in the ability to differentiate between what findings are parts of normal aging and what signs and symptoms are parts of disorders such as Alzheimer's disease and dementia? This scenario leads a clinician to ensure that one must be able to differentiate whether an elderly person is undergoingnormal ageing or pathologic ageing through cognitive assessment.

Cognitive-linguistic changes that occur with age are a complex web of various factors that interplay in ways that are continuously being examined by researchers all over the world. Some of these factors that have been explored are the gender and brain dimorphism and their role in cognitive abilities. Apart from this to add to the confounding conundrum of factors that may affect cognition in the elderly is the interaction between demographic factors such as level of education, occupation, habits and health condition of an individual. Thus the present study aims to profile cognitive-communication impairments in the elderly and seeks to further explore some of the potentially important predictor variables of cognitive-communication status in a cohort sample of Kannada speaking individuals.

1.2. Need for the study

Life expectancies have improved with the increase in medical care over recent decades. But it is questionable as to how many report to medical care for cognitive-communication decline. Even when an individual seeks professional attention, not all health care providers are equipped with the knowledge to differentiate normal aging processes and cognitive impairment. The study was planned to profile cognitive-communication abilities in elderly and create awareness in them about the changes that can happen as age advances. This study helps in understanding the greater depth about the normal aging process, in turn aiding to differentiate between cognitive decline and cognitive-communication impairment.

1.3 Aim of the study

The present study is aimed at profiling cognitive communication skills and impairments in elderly population.

1.4. Objectives of the study

- To investigate cognitive communication skills in the elderly using paper-pencil test.
- To profile the changes (if any) in cognitive communication skills in the elderly using paper-pencil test.
- To explore the various demographic and health related variables that could possibly influence cognitive-communication changes with respect to aging in elderly.

Chapter 2

REVIEW OF LITERATURE

Contents

REVIEW OF LITERATURE

Communication is a remarkable distinctive feature that human beings have when compared to other species. It also serves the purpose of maintaining and establishing social affiliation. Communication plays a very important role in all the successful transactions in the entire lifespan. The multidimensional process of change in physical, psychological and social aspect of humans is commonly referred to as aging (Bowen & Atwood, 2004). Aging refers to decreased fertility and increased mortality rate along with a proportional decline in functions (Kirkwood & Austad, 2000). Few of these dimensions of aging grow and expand overtime whereas others decline. Ryan (1996) supports this by stating that not all the language skills decline, some of them will remain intact. Generally the process of aging is differentiated among biological, chronological, psychological and social functions.

A complex biological process which causes changes at cellular, molecular and organ levels resulting in progressive, inevitable and unpreventable decrease in the ability of the body to respond either to internal/external stressors is termed as Biological Aging (Chodzko-Zajko & Ringel, 1987). Environmental and genetic features determine the rate at which biological aging takes place. While Biological aging is caused due to the collective damage that occurs over a period of time to the genetic information and also due to the inaccuracy in the transfer of data from the DNA to the final protein product (Medvedev, 1964), the yearly measurement of age which happens at a steady rate with all individuals is commonly referred to as the chronological age (Adams & White, 2004).

Cognitive function includes both higher and lower order mental processes. Generally, cognitive aging encompasses variety of disturbances in the cognitive processing. Thus Cognitive Aging refers to the changes in cognitive processes such as attention, memory, reasoning, etc., and Troyer, D'Souza, Vandermorris and Murphy (2011) suggest that normal aging leads to disproportionate decline in these cognitive processes, especially episodic memory.

There has been an exceptional growth in the rate at which population of elderly is increasing in recent times. This can be attributed to the factors such as high fertility and declining mortality. Census taken during the year 2001 in India of the people aged 60 and above, estimated the elderly population at 77 million and this figure is expected to increase to 179 million by 2031 (Rajan, 2006). Advances in medical science have resulted in the decrease in the rate of infant mortality and increase in the average age of death which has led to increase in population of elderly around the globe. On the whole physical, mental and social factors determine the overall health of the elderly population (Rajan, 1996). With reference to this, Shah (1993) reports that two thirds of the elderly population in Gujarat has poor vision, hearing loss and loss of memory.

Aging brings out changes in speech, language, hearing, swallowing and cognitive abilities which has a major impact on person's communication abilities. Lubinski (1995) anticipated that communication plays a very important role in maintaining sense of identity, relieving loneliness and anxiety in elderly individuals. Contrasting patterns of decline and stability in cognition across the lifespan has also been supported by behavioural studies. Of all the issues seen in elderly population, decline in cognition and communication abilities play a very important role in their everyday life.

2.1. Demographic factors affecting Cognitive-Communicative Abilities

2.1.1. Cognitive-Communicative Abilities and Aging.

Busacco (1999) in an ASHA statement stated that as we age there are normal changes that occur to systems that most concern us as speech language pathologists i.e., typically changes do occur to the speech, language, swallowing and hearing systems. This in turn impacts the ability of the elderly to communicate effectively. The age at which these effects begin to show evidence is still a topic under debate and research is ongoing regarding the same. Bayles, Tomoeda and Boone, (1985) studied organization of discourse in the elderly and found significant decline in this capacity for those above the age of 50 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. Certain studies on Chinese communities have generally reported a decline in cognitive abilities with age, with the decline being more evident in the older age groups. A study by, Meng, Tang and Biao (2000) found 3.2 percent cognitive decline in participants of 60-70 years of age, on standard measures and a 21.3 percent decline in participants above 80 years of age. Similarly, the study by Huadong, Juan, Jingcheng, Yanjiang, Meng and Hongbo (2003) and Park, O'Connell and Thomson (2003) also found a significant risk of cognitive decline that increased with increasing age.

Lagishetti and Venkatesh (2011) studied the impact of age on cognitive communication abilities in a cohort sample of Telugu speaking population. This study provides us with information regarding what age various cognitive-linguistic abilities begin to decline. Visual and auditory attention according to this study begins to decline around the age of 70-75 years. Evidence that the semantic memory is most resistant to change was provided in this study wherein semantic memory began to show a decline only in the participants in the age group of 70-75 years. Whereas tasks that required utilization of working memory showed a much earlier decline in the age range of 50 to 55 years itself. Episodic memory was found to be not as resistant to decline as semantic memory or as vulnerable as working memory and stood in between by showing signs of decline in the age range of 65-to-70 years. On tasks that required use of problem solving and organizational capabilities it was found that decline in this ability began in the age range of 50-to-55 years. Such organizational requirements are higher in tasks of discourse.

2.1.2 Cognitive-Communicative Abilities and Gender.

There are various views on the gender differences in performance on cognitive tests. Study by Jones and Gallo (2002) report females performing drastically better than the males on total MMSE scores whereas study by Rosselli, Tappen, Williams and Salvatierra (2006) report no gender differences in populations with equal educational status. The authors Munro, Winicki, Schretlen, Gower, Turano, Muñoz, Keay, Bandeen-Roche and West (2012) explored through their study whether there was any gender difference in cognitive performance in elderly participants as has been observed in younger adults. 957 participants of which 477 were males and 480 were females, ranging in age from 67 to 88 years, were selected for the study. A pattern was observed between the younger and older participants wherein the males outperformed the females on tasks of visuo-construction and visual perception. A similar pattern of differences between the genders was observed in this study, as has been documented previously in the younger population. The authors attributed the cause of the gender difference to effects of brain dimorphism. It has been postulated by McEwen (1983) that this difference is in terms of organization rather than activation of various brain centers. Since organization of the brain is different between the males and females, the pattern of cognitive performance has been maintained throughout the lifespan.

In contrast to this explanation for the reason gender differences are observed in cognitive performance, Foy, Chiaia and Teyler, (1984) have shown that it is possible for complete reversal in adult cognitive performances to be obtained by reversing the circulating hormonal environment. Decline in cognitive abilities was found to be less prevalent in males (10.7%) than in females (13.2%) in the study by Huadong, et al. (2003). Various other reasons have been cited in the literature to explain the gender differences in cognitive performance. One such example is vitamin deficiencies. Particularly, vitamin D is associated with regulation of the immune system, regulation of calcium levels and enhancing nerve conduction. Vitamin D insufficiency has been strongly linked to decline in cognitive performance, and specifically, visuo-spatial abilities in women compared to men (Annweiler, Schott, Rolland, Blain, Herrmann & Beauchet, 2010; Seamans, Hill, Scully, Meunier, Andrillo-Sanchez, Polito, Hininger-Favier, Ciarapica, Simpson, Stewart-Knox, O'Connor, Coudray & Cashman, 2010). An increasing incidence of dementia in women compared to men has been associated with higher prevalence of white matter disease (de Leeuw, de Groot, Achten, Oudkerk, Ramos, Heijboer, Hofman, Jolles, van Gijn, & Breteler, 2001).

2.1.3 Cognitive-Communicative Abilities and Number of languages known.

Chengappa (2009) argues that in studies since the 1960’s the advantages of being a bi/multilingual outweighs any possible concerns that were reported earlier since a maximum of the studies were not able to control for the socioeconomic status (SES) differences between bilingual and monolinguals. To add to the lack of consideration of SES was the ambiguity in the definition and degree of bi/multilingualism in the subjects that were tested. Much of the research on bilingualism and multilingualism has been done in the clinical population and children. In the area of healthy elderly there are fewer studies but the finding of research on children can be extrapolated for current purposes. Pearl and Lambert (1962) were able to prove that the bilingual children had a greater cognitive advantage over the monolingual children when factors such as socioeconomic status and other variables were well controlled for. A study by Bialystok, Craik, Klein, and Viswanathan (2004) examined the persistence of a 'bilingual advantage' in healthy adults. With the studies reviewed, these authors reported a definite advantage in the healthy elderly who were bilingual when their cognitive processing abilities were compared with monolinguals, and bilingual participants were able to perform exceptionally on tests of working memory and speed. Bialystok et. al. (2004) state that bilingualism can help delay the effects of aging on cognition, especially on certain executive processes.

Rajasudhakar and Shyamala (2008) studied the differences between bilingual and monolingual adults in their performance on the Cognitive–Linguistic Assessment protocol (CLAP; Aruna & Prema, 2001). Results on similar lines were found in a cross sectional study by Deepa and Shyamala (2011), where the cognitive-linguistic performance of persons with dementia and healthy elderly were compared. The study included bilingual participants in the age range of 70-85years. The cognitive-linguistic performance was examined using two specific tests: Addenbrooke's Cognitive Examination Revised (Mioshi, Dawson, Mitchell, Arnold, & Hodges, 2006; Krishnan & Lokesh, 2010) and CLAP. The results of these studies indicated that within the healthy elderly, bilinguals performed observably better than monolingual healthy elderly. Differences between the two groups of participants were specifically seen in terms of better topic management skills, better planning, organisation and repair strategies during discourse. The findings also maintained that cognition is gradually affected by the normal aging processes. Kavé, Eyal, Shorek and Cohen-Mansfield (2008) in their study also support that multilingualism emerged to be a significant predictor of the cognitive performance in participants who received no formal education.

2.1.4 Cognitive-Communicative Abilities and Education.

Peng, Zheng, and Zhu (1999) found a correlation between education level and the scores on MMSE, in their study of 4510 participants aged 65 years and above, stating that in persons with higher education levels, the risk of cognitive decline was lesser. A number of studies state a significant relationship between years of education and a risk of developing dementia (Fratiglioni & Rocca, 2001; Huadong et al., 2003). Authors, Rosselli et. al. (2006) and Crum, Anthony, Bassett and Folstein (1993) also reported a poorer performance of participants with lesser education on the cognitive tests. The relation of education and Fratiglioni, Winblad and von Strauss (2007), in their study on the cohort of subjects in the Kungsholmen project, found dementias to be more prevalent in persons with fewer years of education, that is, 2-7 years or less. They opine that education increases the brain activity and functioning, becoming an indicator of intelligence. Zahodne, Stern and Manly in 2014 sought to decipher the influence of early life educational attainment on late life cognitive experiences in a culturally, racially and educationally diverse population. This was a longitudinal study of 18 years where the participants were evaluated every 24 months on skills of language, memory, visuo-spatial abilities and processing speed. Two findings were stated from this long term study. Firstly higher educational attainment was associated with higher cognitive levels. Secondly the participants with a higher education showed a slower decline in their cognitive abilities.

Psaltopoulou, Kyrozis, Stathopoulos, Trichopoulos, Vassilopoulos and Trichopoulou (2008) examined the lifestyle variables such as education, occupation, medical conditions as diabetes, hypertension, habits such as smoking and alcoholism, along with the effect of age and gender on 732 Greek participants over the age of 60 years. In terms of education, Psaltopoulou et. al. (2008), found a positive correlation, meaning that more the years of formal education, better was the performance of participants on MMSE. The authors also reported that those participants who were found to perform satisfactorily on the baseline assessment had lesser cognitive decline during the follow-up assessments at 6 and 12 years after baseline.

In a similar study by Brewster, Melrose, Marquine, Johnson, Napoles, MacKay-Brandt, Farias, Reed and Mungas (2014) the effect of various life experiences and demographic variables had on cognitive function was studied through testing of episodic memory, executive functioning, and semantic memory and overall cognitive abilities. A baseline measurement was performed on all the 333 participants. Two groups of participants were evaluated in this study, one group having English as a primary language and another with Spanish as their primary language. Strong positive correlations were found between literacy levels and current recreational/social activities.

2.1.5. Cognitive-Communicative Abilities and Occupation.

There is a scarcity of studies that investigate the link between cognitive-communicative abilities and occupation although we spend a major part of our life at work (Finkel, Andel, Gatz, & Pedersen, 2009). The 'environmental complexity' hypothesis given by Schooler (1984) states that there is continued use of cognitive skills when exposed to complex situations at work and during leisure activities and this in turn leads facilitation of cognitive functioning. Finkel et. al. (2009) studied the effect of occupational complexity on the cognitive system by testing verbal, spatial, memory and processing speed abilities. To classify the complexity of various occupations three dimensions were specifically rated on i.e., with respect to data, people and things. The 1980 Swedish Population and Housing Census was used to code the occupations into various categories. The study in effect was able to find a positive correlation between primary life occupancy and cognitive status during the later years of one's life. In the data of 3012 participants, Huadong et al., (2003) observed a greater rate of decline in manual workers than the "mental labourers". Fratiglioni et al. (2007), support these observations stating that persons who did manual work as their principal work throughout their life, showed an increased risk of developing cognitive decline or dementia. They suggested that exposure to pollutants and the physical stress could be probable reasons leading to an increased risk of dementias in these individuals. The adage 'use it or lose it' applies very well to the cognitive system as expressed by Katzman (1995) and Salthouse (2006). Despite the studies pointing to an advantage of being in occupations that require more mental effort, Psaltopoulou et. al. (2008) reports the importance of a combination of physical activity along with mental and social activities to lead a healthy lifestyle and delaying the negative effects of aging on cognition.

2.2. Other medical, lifestyle and psychological factors affecting Cognitive Communicative Abilities

2.2.1. Cognitive-Communicative Abilities and Cardiac issues.

Elliot, Smith, Ernest, Murphy, Worcester, Higgins, Le Grande, Goble, Andrewes and Tatoulis (2010) studied the relationship between cognitive function and the patients who were to undergo coronary artery bypass graft surgery (CABGS). Cognitive deficits in tasks that require attention and memory have been reported among candidates for CABGS pre and post surgically (Rankin, Kochamba, Boone, Petitti & Buckwalter, 2003; Rosengart, Sweet, Finnin, Wolfe, Cashy, Hahn, Marymont & Sanborn, 2005). The present study examined relationships between a patient's self evaluation of his/her cognitive functioning, a caregiver's perception of the patient's cognitive function and performance on objective tests of cognition. The authors have included ratings of the patient's cognitive function by the significant others' such that it adds/improves both the quality and quantity of information gathered. Reports from significant others' also controls for bias and inaccuracies on the part of the patient in evaluating his/her own cognitive status (Magaziner, Bassett, Hebel, & Gruber-Baldini, 1996; Snow, Cook, Lin, Morgan, & Magaziner, 2005).

The author's first hypothesis was that the patients and their significant other would rate their cognitive performance similarly. The second hypothesis postulated that patient's problems in everyday cognitive functioning translates to poorer scores on the objective cognitive tests. The final hypothesis of the study predicted that the relationship between patient's self rating scores & patient's objective test scores would not be substantially different from the relationship between significant other rating & patient's objective test scores.

Although not a significant difference, it was observed that the patients rated their difficulty to be 10% more than the rating given by their significant others'. It was also found that there was a high level of correlation between the patient and significant other rating of cognitive function of 11 of the 12 EFQ items. Although the rating for level of difficulty in daily cognitive functions was similar, there was an observable difference between the cause of this difficulty, being attributed to different cognitive domains by the patients and their significant others. This can be explained by the notion that it is mainly the patients who can have a clearer idea as to what is going on during their cognitive lapses (Magaziner et al., 1996). A main finding of this research study was that there was a higher correlation between everyday cognitive functioning subscales and memory domain of cognition rather than with tests of attention and planning domains. Given this result the authors concluded that the Trail test and Stroop test were ineffective in assessing the everyday attention and planning abilities of an individual.

2.2.2. Cognitive-Communicative Abilities and Diabetes.

Incidence and prevalence of diabetes presents alarming numbers in India (International Diabetes Federation, 2014) with around 65 million cases prevalent in 2013. Several studies in literature report presence of cognitive impairments in diabetic patients and epidemiological studies have shown an increased risk for AD in type 2 diabetes mellitus (Erol, 2013).

Various authors have reported a link between diabetes and depression/ cognitive decline (Knol, Twisk, Beekman, Heine, Snoek, & Pouwer, 2006; Mezuk, Eaton, Albrecht & Golden, 2008; Elias, Wolf, D'Agostino, Cobb, & White (1993). These authors opined that when diabetes develops in adults, it increases the risk of depression in these persons, and vice versa. It was also observed by Ali, Stone, Peters, Davies and Khunti (2006) that around 20% of adults diagnosed with type 2 diabetes are susceptible to co-morbid depression. Similar observations were made in the study by Lu, Lin, and Kuo (2009) who reported that presence of diabetes in adults increased their risk of developing dementia by 47%, compared to healthy adults without diabetes and increased the risk of Alzheimers disease by 39% in these patients. The authors also reported that vascular dementia was very common among adults with diabetes.

On similar lines, a study by Katon, Lyles, Parker, Karter, Huang and Whitmer (2012), examined the association of diabetes and depression and whether this were an important factor in the development of dementia later in life. The 19,239 subjects in the ages of 30-75 years were selected from a cohort of individuals diagnosed with diabetes at local hospitals. Depression symptoms in the participants were screened for using the Patient Health Questionnaire 8 (PHQ-8), and the physician's reports and 19.6% of these were found to have symptoms of depression. The results of this study showed that depression symptoms were more prominent in persons with diabetes if they were in the lower age groups, and mostly in females. Other relevant factors were less education, positive history of smoking, and presence of any vascular/ cerebro-vascular diseases. At 3 and 5 years of follow up, 1.2% of the total participants with diabetes were diagnosed with dementia. Also, 2.1% of the participants with comorbid depression and diabetes, were diagnosed with dementia.

A longitudinal study by Spauwen, Köhler, Verhey, Stehouwer and van Boxtel (2013) presented a 12-year follow-up data of participants in the age range of 40-81 years, and investigated the effects of incident type 2 diabetes at baseline and follow-ups, on decline in several cognitive domains. Participants with any known etiology for cognitive impairments were excluded from the study. On the basis of three baselines taken over the 12 year period, 1,290 participants with/ without type 2 diabetes in the first baseline and incident diabetes (type 2) in either first or second follow up were retained. On the final baseline, the authors considered self-report by the participants, to rule out those participants with type 1 diabetes. They state the use of self reports by patients as a reliable measure in the diagnosis of type 2 diabetes and a reliable estimate of the actual prevalence of diabetes (also in Goldman, Lin, Weinstein & Lin, 2003). In this study, Spauwen et al. (2013) took into account whether the participants reported use of oral antidiabetic drugs, insulin at or after the age of 40 years, or were diagnosed with diabetes at or after the age of 40 years in order to identify and select those participants with type 2 diabetes.

To assess the cognitive function of the participants in this study, the authors used the following tests: The Visual Verbal Learning Test (van der Elst, van Boxtel, van Breukelen, &

Jolles, 2005), for assessing verbal memory; The Concept Shifting Test (CST; van der Elst, van Boxtel, van Breukelen, & Jolles, 2006), for measuring executive function; The Letter Digit Substitution Test (van der Elst, van Boxtel, van Breukelen, & Jolles, 2006), for assessing speed of information processing, and; The Mini-Mental State Examination (MMSE), for screening broad domains of cognitive function. The tests were administers at baseline and also at both the 6- and 12-year follow-ups. The results revealed that participants who had diabetes at the baseline assessment, showed poorer performance on tests of cognitions, compared to others especially in domains such as speed of information processing and executive functioning. The participants with incident diabetes at follow-ups 1 and 2, who had no diabetes at baseline, showed no difference in cognitive functioning from normal subjects, though a slight decrease in performance was noticed in speed of information processing and executive functioning domains. The authors concluded that presence of diabetes type 2 can actively increase the rate of cognitive decline, and also the duration of presence of this disease is an important factor to be considered.

2.2.3. Cognitive -Communicative Abilities and Hyper/Hypotension.

Studies in literature have documented effects of high blood pressure (hypertension) and low blood pressure (hypotension) on the cognitive- communicative functions in the elderly persons. The authors, Roman (1987) and Skoog (2003), reported long-standing hypertension as one of the major causes of changes occurring in the arterial walls and later resulting in ischemic white-matter lesions. Launer, Ross, Petrovitch, Masaki, Foley, White and Havlik (2000), in their longitudinal study within the cohort of subjects in the Honolulu-Asia Aging study, report that a high systolic and/or diastolic blood pressure in middle age was an important predictor in the diagnosis of dementia around two decades later. Alzheimers type and vascular dementia were commonly seen as reported by these authors. On analysis of the data in their study, they found a much stronger link between hypertension and risk of dementia later in life. Also, in another Honolulu-Asia Aging study, Petrovich, White and Izmirlian, (2000) found long-standing hypertension to be associated with more numbers of senile plaques, a lower brain weight, and large numbers of neuro-fibrillary tangles. A longitudinal study (Fratiglioni, Winblad & von Strauss, 2007) based on a large scale project, called the Kungsholmen Project reported a 50% increase in risk of cognitive decline and dementias in persons with long standing high systolic pressure.

Episodes of hypotension leading to hypoxia-ischemia and later loss of myelin have also been reported in literature (Skoog, 2003). Studies report a consistent association between prevalence of Alzheimers disease and hypotension, specifically, low diastolic pressure (Guo, Viitanen, Winblad, & Fratglioni, 1999b; Ruitenberg, Skoog, Ott, Aevarsson, Witteman, Lernfelt, van Harskamp, Hofman & Breteler, 2001; Fratiglioni et al., 2007). Similarly in persons with low systolic blood pressure, a three-fold increase in the risk of dementia was observed after a period of 4–6 years (Qiu, von Strauss, Winblad & Fratiglioni, 2004). Despite the extensive reports that hypertension and hypotension are related to cognitive decline in old age, there are studies that do not find such a positive correlation (Scherr, Hebert, Smith & Evans, 1991; Desmond, Tatemichi, Paik & Stern, 1993; Hebert, Scherr, Bennett, Bienias, Wilson, Morris & Evans, 2004; Psaltopoulou et. al., 2008) These studies state that presence of hyper/ hypotension might not affect the cognition of the individual.

2.2.4. Cognitive-Communicative Abilities and Smoking.

Smoking is a major health risk factor in most of the countries around the world, even in India, causing harm to both smokers and non-smokers. A large number of studies have reported the direct effects of smoking to major health issues as lung cancer, myocardial infarctions, cerebrovascular accidents, perfusional decline, white matter lesions, diabetes mellitus and hypertension (Choi & Kahyo, 1991; Chun, Dobson & Heller, 1993; Frishman, Sokol, Aronson, Wassertheil-Smoller, & Katzman, 1998, Meyer, Rauch, Crawford, Rauch, Konno, Akiyama, Terayama, & Haque, 1999). While most authors reported smoking as a serious risk for cognitive impairment, some authors suggested that smoking can improve cognitive abilities in persons with Alzheimer's disease and Parkinson's disorder due to reaction with a nicotine receptor (Kelton, Kahn & Conrath, 2000; Murray & Abeles, 2002), aiding attention, reaction time and to some extent, learning and memory.

In a prevalence study of 3012 participants aged 60 and above (Huadong et al., 2003), tests as MMSE and Activities of Daily Living (ADL) were used. The former was to screen for cognitive impairments and the latter, to measure the living ability of participants. The authors excluded those participants who had poor cognitive abilities as a result of mental retardation, cerebral trauma, extremely poor visual or hearing abilities or intoxication. The results on prevalence of cognitive impairment in participants who never smoked were 5.3 percent. In those participants who were past smokers, the prevalence was 4.5 percent and, in those who were active smokers, it was 11.8 percent. The authors found a significantly higher risk of cognitive impairment in these active smokers. They opined that smoking and/ or alcoholism were much greater risk factors for cognitive impairment than any of the other irreversible factors such as age, gender, education and occupation.

A systematic review of 28 publications describing 23 longitudinal studies between 1996 and 2007 by Peters, Poulter, Warner, Beckett, Burch and Bulpitt (2008), reported that majority of the studies found an increased risk of cognitive impairments in persons who were current smokers. A significant relationship between current smoking and Alzheimer's disease was observed and risks were also found for vascular dementia, dementia unspecified and cognitive decline. All of the studies reviewed showed some limitations with respect to level of smoking or time since a person had stopped smoking, etc. Even in the presence of these limitations, the majority of these studies opined that current smoking is a risk for cognitive decline, dementia and Alzheimer's disease.

As suggested in earlier studies by Kelton et al. (2000) and Murray and Abeles (2002), the protective effect of smoking in persons with incident Alzheimers disease was opposed by few other authors (Wang, Fratiglioni, Frisoni, Viitanen & Winblad, 1999; Fratiglioni et al., 2007). They opined that smoking affected the survival of persons with dementia, much more than it affected persons without dementia.

2.2.5. Cognitive-Communicative Abilities and Alcoholism.

Camacho, Kaplan and Cohen (1987), conducted a longitudinal study where only men residing in a particular region in California were investigated, and the level of alcohol consumption in each of these persons was estimated. A survey of the mortality rates in 15 years in that area revealed that chronic alcoholics were at a much higher risk than mild to moderate drinkers. On similar lines, the prevalence study by Huadong et al. (2003) in a population of 3012 participants, 60 years or above, found prevalence rates of cognitive impairment in abstainers (3.4 percent) and those who drank every week (6.4 percent), to be lesser than prevalence in persons who drank every day (17.5 percent). They observed a significant link between the duration of exposure to alcohol drinking and cognitive impairment.

Several studies in the western countries which are listed in this direction report intake of small amounts of specific types of alcohol being good for the general health of the person, and also claim that small intakes of these beverages help prevent dementia to some extent (Panza, Frisardi, Kehoe, Capurso, D'Introno, Colacicco, Vendemiale, Capurso & Solfrizzi, 2011). With an aim to investigate the relation between consumption of alcohol and cognitive-communicative abilities in the older populations, a systematic review by Peters, Peters, Warner, Beckett and Bulpitt (2008) considered articles from 1995 up to 2006. Criteria for selection of articles were age of participants being 65 years or more, and a diagnosis of unspecified dementia, Alzheimers or vascular dementias. Specific keywords as ‘alcohol’, ‘dementia’, ‘cognitive impairment’, etc., were searched in several databases for studies with a longitudinal design. 26 papers with an appropriate design were analysed in this study. The authors reported that follow-up period in all 26 of the studies selected varied from 1-25 years.

Most of the studies held a common ground that mild to moderate levels of alcohol consumption reduced the risks of dementia by 38 percent, although a meta-analysis of the studies reviewed by Peters et al., (2008), revealed an over-estimation of the positive effects of alcohol on the cognitive functioning. Study by Mukamal, Kuller, Fitzpatrick, Longstreth, Mittleman and Siscovick (2003), reported the possibility of risk for dementia in those who consumed one drink weekly to be lesser than those who drank 14 or more drinks every week.

2.2.6. Cognitive-Communicative Abilities and Depression.

A study of cognitive abilities in persons with depression and late life schizophrenia included 67 participants assessed at a memory clinic (Ting, Rajji, Ismail, Tang-Wai, Apanasiewicz, Miranda, Mamo, & Mulsant, 2010). The participants were divided into four groups, which were, late-life schizophrenia without dementia, depression, Alzheimers disease and normal controls. The following tests were administered to assess the subjects' cognitive abilities: Animal Fluency (Borkowski, Benton & Spreen, 1967), Boston Naming Test (Kaplan, Goodglass, Weintraub & Goodglass, 1983), Clock drawing test- Freedman clock scale (Freedman, 1994), California Verbal Learning Test II -Short Form (Delis, Kramer, Kaplan & Ober, 2000), Dementia Rating Scale-2 (Mattis, Jurica & Leitten, 1988), FAS Letter Fluency (Borkowski et al., 1967), Luria Alternating Diagrams (Golden, Hammeke & Purisch, 1979), Mini-Mental State Examination (Folstein, Folstein & McHugh, 1975), Trail Making Test - A and B (Reitan & Wolfson, 1993), and Wisconsin Card Sorting Test – 64 (Kongs, Thompson, Iverson & Heaton, 2000). The authors observed that persons diagnosed with depression performed poorer on these tests than healthy elderly, but better than persons with late-life schizophrenia. Persons with Alzheimers disease performed poorer than all three groups. Individuals with depression performed better than individuals with schizophrenia on tests of Animal Fluency, California Verbal Learning Test and Wisconsin Card Sorting Test – 64. On few tests, person with depression performed similar to the normal controls and showed poorer abilities on tests of attention, memory, and naming.

2.2.7. Self report of cognitive-communication difficulties.

Cognitive-communication gaps and declines with increase in age are a common occurrence according popular belief. Yet there is a dearth in the documentation of the type of memory errors that the elders make in everyday life (Ossher, Flegal & Lustig, 2012). In a study by the same authors where 105 healthy older adults completed the Everyday Memory Questionnaire (Sunderland, Harris, & Baddeley, 1983) episode of memory lapses in a period of 24 hours were recorded. The same subjects were also tested on cognitive and neuropsychology tests or otherwise referred to as 'laboratory tests'. Demographic variables of the subjects were also factored in as a part of the study. Tip-of-the-tongue errors were the most commonly reported cognitive-communication errors that the elders experienced. The correlation between the EMQ scores and laboratory tests such as MMSE was found to be poor. Thus the study concludes that identifying the specific errors that elders encounter on a daily basis and designing cognitive activities that tap these errors have a higher ecological and practical value. Study of self perceived memory abilities has been maximally investigated compared to other cognitive domains such as self perception of attention and language (Vanderhill, Hultsch, Hunter, & Strauss, 2010). In order to assess self perceived memory inconsistency over a long term duration 40 community dwelling elders were asked to complete a questionnaire assessing the same and also rate their inconsistencies 5 years back. Poor correlations were found between self reported memory inconsistencies and neuropsychological tests in this study by Vanderhill et al., 2010 as well.

2.3. Effect of time on serial assessments on the cognitive-communicative abilities in the elderly

Cognitive performance of healthy participants in the age range of 24-69 years was studied by Bartels, Wegrzyn, Wiedl, Ackermann and Ehrenreich (2010). The authors aimed to understand if there was any effect in the performance on repeated/ serial assessment, as in the case of a longitudinal study design. After the baseline assessment, the authors carried out follow-up assessments at 2-3, 6 and 9 week intervals, and 3, 6 and 12 month intervals. The results showed an improvement in the performance on the follow-ups till 3 months interval. The authors explained that this was an effect of practice, as the tasks assessed were in the recent memory of the participants. It was also observed that as the time interval increased, the effect of practice also reduced, especially after an interval of 3 months. Other authors have also made observations in repeated administration of cognitive tests (McCaffrey, Ortega, Orsillo, Nelles, & Haase, 1992; Basso, Bornstein & Lang, 1999).

In the study by Theisen, Rapport, Axelrod and Brines (1998), cognitive tasks as Logical Memory, Verbal Paired Associates, and Visual Reproduction were assessed in participants over three follow-ups. A maximal increase in the performance scores was observed in the first follow-up for the cognitive tasks assessed. Practice effects were thus clearly observed during the first follow-up assessment, but in the later two follow-ups, a ceiling effect was mostly seen. Similar findings were also observed by Collie, Maruff, Darby and Mcstephen (2003) during baseline and follow-up assessments over a one-day period. Lim, Jaeger, Harrington, Ashwood, Ellis, Stöffler, Szoeke, Lachovitzki, Martins, Villemagne, Bush, Masters, Rowe, Ames, Darby and Maruff (2013) also reported effects of practice in participants with Alzheimer's disease on certain domains of cognition over a three month follow-up.

Cognition in the elderly thus has been investigated by several studies, and the factors affecting the normal aging process of cognitive decline have also been examined. With the current knowledge, the present study aims to investigate and profile the effects of aging on cognition, and the influence of several demographic and lifestyle variables on cognition in the elderly.

Chapter 3

METHOD

Contents

METHOD

3.1. Aim of the study

The aim of the present study was to profile cognitive communication abilities in the elderly. With this aim, the study investigated the factors influencing the performance of healthy elderly during the tasks of cognitive-communication skills.

3.2. Objectives of the study

There were two primary objectives in the study.

1. To investigate cognitive communication abilities in the elderly using paper-pencil test.
2. To profile the changes (if any) in cognitive communication abilities in the elderly using paper-pencil test over a period of three months.
3. To explore the various demographic and health related variables that could possibly influence cognitive-communication status of the elderly

3.3. Research Design

Longitudinal cohort design was employed for the present study. The research design involved the evaluation of cognitive-communication abilities in cohort elderly participants with a three month interval between each evaluation.

3.3.1. Hypothesis.

Null Hypothesis

- It is hypothesized that the demographic and health related variables would not have an effect on cognitive communication status.

Alternative Hypothesis

- It is hypothesized that there would be no changes in cognitive communication abilities in the elderly population during the course of the study.

3.4. Participants

The participants for the study were healthy elderly individuals aged 60 to 80 years having Kannada as their first language. A total of 150 individuals participated in the present study. The participants were drawn from senior citizen homes/ laughter clubs/ residential places in and around Mysore, Karnataka, India.

3.4.1. Inclusionary criteria.

1. They should have undergone a minimum of five years of formal education.
2. All of them should have Kannada (Kannada is one of the major Dravidian languages predominantly spoken in the state of Karnataka, South India) as their first language (L1).
3. They should also have vision and hearing acuity within normal limits or corrected to normal/ near normal limits.
4. Participants had to be free from any neurological (such as stroke, dysarthria, etc) or psychological illness (such as, mental retardation, schizophrenia etc).

3.4.2. Ethical concerns.

- The management of the senior citizen homes and care givers of the participants in residential homes were informed about the aim and the testing procedure of the project.
- Feedback regarding the individual test performance was conveyed to the participants in a sensitive manner.

- Individual consent was obtained from the participants using AIISH Ethical Committee guidelines for bio-behavioral research (2009) before carrying out the study.
- The participants were informed regarding the test duration and requirement to re-administer the test during the second phase of the study.

3.5. Material

3.5.1. Selection of the test material.

A review of tests that assesses cognitive communication skills in adults was done by referring to books, journals and web based sources. Based on the search results the following test materials were found to be best suited for tapping cognitive communication skills.

a) Quick Neurological Screening Test (QNST) – as a screening instrument to rule out the presence of neurological soft signs (NSS) in the participants.
b) NIMHANS Mental Health Screening Questionnaire – to screen for the presence of any psychological disturbances such as anxiety, depression, etc that the participants may be undergoing.
c) Demographic information form – details regarding age, gender, languages known, education, occupation, medical history, habits such as smoking and drinking and self perceived report of any cognitive communication difficulties.
d) Addenbrooke's cognitive examination revised (ACE-R) – to comprehensively evaluate cognitive communication skills of the participants.
e) Cognitive Linguistic Assessment Protocol (CLAP) – To assess skills of cognitive communication in Kannada.

3.5.1.1. Quick neurological screening Test (QNST).

The QNST was developed by Mutti, Sterling and Spalding in the year 1978. Age range for the test is 5 years through above 80 years. Since QNST documents the presence of Neurological Soft Signs (NSS) and it has been used as a screening instrument in the first phase of the study. QNST tasks are commonly used in traditional neurological exams, and require no special equipment. The QNST is a 20 minute individual test which taps neurological integration. It examines fine-motor control, gross-motor control, balance, rhythm, strength, motor planning and sequencing, sensory awareness, spatial orientation, visual perception, auditory perception, distractibility, impulsiveness, left-right differences, and visual-motor skills, neurological signs as clear-cut differences from one side to the other in sensation or motor control, or disorders of control of movement, such as tremor, ataxia, etc in the individuals. It includes the tasks such as Hand skill, Figure recognition and production, Rapidly reversing repetitive hand movements, Palm form recognition, Eye tracking , Sound patterns, Finger to nose, Thumb and finger circle, Rapidly reversing repetitive hand movements, Arm and leg extension, Tandem walk, Stand on one leg, Skip, Left right discrimination, and Behavioural irregularities.

The two tasks namely ‘stand on one leg’ and ‘skip’ were not used as a part of screening procedure due to the inability for the majority of elderly participants to perform these tasks. The presence of behaviours is scored with numerical rating scale viz. a score between 0-25 is considered as typical, 26-50 as suspicious and above 50 as high. The time required to complete this test is around 20 minutes.

3.5.1.2. NIMHANS Mental Health Screening Questionnaire.

The NIMHANS Mental Health Screening Questionnaire is given by, Math, Murthy, Parthasarthy, Kumar, and Madhusudhan (2011). The questionnaire consists of 16 yes/no polar questions to screen for the presence of any mental health illnesses that the participants in the past or are currently undergoing. Questions regarding mental health, episodes of past or present depression, irritability, temperament and any substance abuse issues are screened using this questionnaire. Orientation of the participant is also screened using this questionnaire. The time required to complete this test is around 15 minutes.

3.5.1.3. Demographic information form.

Details regarding age, gender, languages known, education, occupation, medical history, habits such as smoking and drinking and self perceived report of any cognitive communication difficulties were collected. Previous literature has indicated the influence of these variables on cognitive status in the elderly. Data regarding the following variables was collected and the participants were grouped based on the categories as outlined below:

Table 3.1: *Participants' demographic details grouped according to following categories*

Variables	**Categories**
Age	60-70 years/ 70-80 years
Gender	Male/ Female
Number of languages known	Monolingual/ Bilingual/ Multi-lingual
Education	Less than 10 years education/ 10-12 years of education/ Graduates/ Post-graduates
Occupation	Homemakers/ Farmers/ Professionals (Teachers, Bank Employees and Nurses)/Doctors or Engineers/ Self-employed individuals
Cardiac issues	Present/ Absent
Diabetes	Present/ Absent
Hyper/ hypotension	Present/ Absent
Smoking habits	Present/ Absent
Consumption of alcohol	Present/ Absent
Self perceived report of any cognitive communication difficulties	Present/ Absent

3.5.1.4. Addenbrooke's Cognitive Examination Revised (ACE-R).

This is a test for comprehensive assessment of cognitive skills. ACE-R was initially developed in French by Mioshi, Dawson, Mitchell, Arnold, and Hodges, in the year 2006. Krishnan and Lokesh translated this test into Kannada in the year 2010. The test consists of five sub-tests. The sub-tests include five domains viz attention / orientation (18 points), memory (26 points), fluency (14 points), language (26 points) andvisuospatial abilities (16 points)

The maximum scores for the test are 100. Any score greater than, or equal to 93 points (out of 100) is effectively normal (intact). Below this, scores can show MCI (≤ 84.2 points), or dementia (≤ 65 points). The time required to complete this test is around 30 minutes.

Table 3.2:*Instructions and the administration procedure of ACE-R.*

Sl no.	**Domain**	**Instruction**	**Score**
1.	ORIENTATION	*"What is the day/ date/ month/ year/ and season?"* *"Which is the building/ floor/ town/ state/ country?"*	= 5 = 5
2.	REGISTRATION	*"I'm going to give you three words and I'd like you to repeat after me: lemon, key and ball'. After subject repeats, say 'Try to remember them because I'm going to ask you later".* *E. g:* [nimbehaɳɳu], [chenɖu]&[bi:gadkai]	= 3
3.	ATTENTION & CONCENTRATION	"*Could you take 7 away from a 100?"* After the subject responds, ask him or her to take away another 7 to a total of 5 subtractions. OR *"Could you please spell* ***WORLD*** *for me?"* Then ask him/her to spell it backwards.	= 5
4.	MEMORY		
	Memory- Recall	*"Which 3 words did I ask you to repeat and remember?"*	= 3
	Anterograde Memory	*"I'm going to give you a name and address and I'd like you to repeat after me. We'll be doing that 3 times, so you have a chance to learn it. I'll be asking you later".* E. g: "Sundara Murthy 73, Narayanashashtri road Gandhinagara	= 7

		Bangalore"	
	Retrograde Memory	*"I am going to ask you simple questions could you please answer in single words."* E.g: Name of current prime Minister.	= 4
5.	FLUENCY		
	Letters	*"I'm going to give you a letter of the alphabet and I'd like you to generate as many words as you can beginning with that letter, but not names of people or places. Are you ready? You've got a minute and the letter is 'P' ".*	= 7
	Animals	*"Now can you name as many animals as possible, beginning with any letter?"*	= 7
6.	LANGUAGE		
	Spontaneous speech	Observe the subjects spontaneous speech and record the fluency, paraphasias and word-finding difficulties.	
	Comprehension	Show the written instruction: ***"Close your eyes"***	= 1
	Writing	*"Could you please write a sentence"*	=1
	Repetition	*"Could you please repeat after me"*	
	• Word	*E. g: [dura:lo:cane]*	= 2
	• Phrase	*E. g: [a:che i:che]*	= 1
	• Sentence	*E. g: [mu:rtichikkada:daruki:rtidoɖɖadu]*	= 1
	Naming	*"Please name the following pictures".*	= 12
	Comprehension	*"Using the pictures please point appropriate to the statement which I say".* E. g., "*Point to the one which is associated with the monarchy".*(He has to point to________)	= 4
	Reading	*"Please read the following items"* E. g., 'Sew'	= 1
7.	VISUOSPATIAL ABILITIES Perceptual Abilities	*" Please copy the following figures"* Overlapping pentagons	= 1

	Cube	= 2
	"Could you please draw a clock face with numbers and the hands at ten past five"?	= 5
	"Could you please count the dots without pointing to them"?	= 4
	"Could you please identify the following letters"?	= 4
Memory Recall	*"Now tell me what you remember of that name and address we were repeating at the beginning".*	= 7
Memory Recognition	*"Okay, I'll give some hints: was the same X,Y,Z?"* and so on.	= 5

3.5.1.5. Cognitive Linguistic Assessment Protocol (CLAP).

Cognitive linguistic assessment protocol (Aruna & Prema, 2001; Rajasudhakar & Shyamala, 2005) is a test which assesses the cognitive and linguistic abilities in young and elderly. This test consists of four domains which included: viz, attention, perception & discrimination (60), memory (60), problem solving (60) and organization (60).

The maximum scores for the test are 240. The first domain comprises Attention, Discrimination and Perception. It consists of visual subset and auditory subsets separately. Under visual subset there are three tasks, letter cancellation, contingent letter cancellation and word cancellation. In letter cancellation task, individuals should cancel the letter /la/ how many ever times it is present. In contingent letter cancellation, the individual has to cancel the letter /ka/ which is adjacent to letter /i/ in a group of letters. In the word cancellation one has to cancel the word /*kittaLe*/ (meaning orange fruit) in a group of words.

Under auditory subset there are four tasks, sound count, letter pair discrimination, word pair discrimination and backward month naming. In sound count task, individuals are expected to listen to a series of sounds and count the number of times the sound /ba/ appears. In letter and word pair discrimination, individuals are expected to listen to paired items and say whether they sound same or different. The fourth task is to say the names of months in a year in the reverse order (Eg: December, November, October, etc).

The second domain is memory. This domain is further divided into three subtypes of memory, which include episodic memory, working memory and semantic memory. Under episodic memory, individuals will be tested by asking ten questions regarding orientation and recent memory. Under working memory there are two tasks, digit forward and digit backward. The person was expected to repeat the numbers after the examiner in the same order and in the reverse order consequently. Semantic memory consists of five tasks, co-ordinate naming, superordinate naming, word naming fluency, generative naming, sentence repetition and carry out commands. In coordinate naming individuals should name "any five items used for writing." During superordinate naming task, individuals were read out a series of items, and they are expected to name the group to which these items belong. Word naming fluency is where the individuals were given a letter and they were supposed to name five items beginning with that letter. Generative naming is where individuals were asked questions and are supposed to answer them in single word. Sentence repetition is where the examiner read out simple to complex level sentences and the individuals had to repeat after them. Carry out commands is the task where the examiner gave simple to complex commands for the individuals to perform in the sitting place.

Third domain in the test is Problem solving. This consists of seven tasks, sentence disambiguation, sentence formulation, predicting outcome, predicting cause, compare and contrast, 'why/wh' questions and sequential analysis. In sentence disambiguation task, individuals will be given a sentence which contains two meanings hidden in it. They are supposed to tell both the meanings to the experimenter. During sentence formulation task participants were given a sentence with wrong word order. Participants were expected to correct the order of the words and frame the right sentence. Predicting cause is the task where in the individuals read out with an incident and they were supposed to provide two causes for the same (Eg: Your plants dried up). During compare and contrast task, the individuals were given two items and they were supposed to say the similarities and the differences between them (Eg: Airplane vs. bird). In predicting outcome the participants had to state two outcomes as a consequence of the given incidence (Eg: what would you do if your key is not matching with the lock?). In "why question" participants were asked "wh" questions. In sequential analysis task, individuals were expected to elaborate at least four steps in each event analysis (Eg: Planting a sapling).

Final domain in the test is organization. This domain consists of three tasks namely categorization, analogies and sequential events. In categorization task participants were presented a word verbally following which they were provided a series of five words. Participants were supposed to choose two words among the series of five which belong to the group of the word provided in the beginning (Eg: "Dog" is the word and series of five words are flower, cap, rat, pencil, and lion. Here lion and rat belong to dog's group i.e. animals). Analogies are where the experimenter read out three words with a relationship between first two. The participants have to come out with fourth word with the similar relation to the first two words (Eg: car: road:: aeroplane: sky). Finally during sequential analysis task the participants were given paragraphs with wrongly ordered sentences starting from simple to complex. The participants have to place sentences in right order and make meaningful paragraph. Maximum score in the test is 240. The test takes approximately one to one and a half hour for administration.

3.6. Procedure

3.6.1.Phase I of the study.

During the first phase of the study 150 participants were located at various senior citizen homes and residential areas in and around Mysore. The management of these centres were contacted and details of the study were explained comprehensively. Following this, data was collected and participants were evaluated on their cognitive-communication skills using the following protocol

- General information
- Quick neurological screening Test (QNST)
- NIMHANS Mental Health Screening
- Addenbrooke's cognitive examination revised (ACE-R)
- Cognitive Linguistic Assessment Protocol (CLAP)

3.6.1.1. Section I.

After the participants were identified at various senior citizen homes the data collection procedure was started. It was ensured that the participants were assessed in a quiet environment. The first five minutes of the procedure involved an introduction of self and along with providing general information about All India Institute of Speech and Hearing (AIISH). Specific focus was given to the activities pertaining to the elderly that is carried out at AIISH. The participants were then asked a few general questions with regard to their health or their native place with the purpose of building a positive rapport with the participants. During this interaction information regarding the education level of the participants was also obtained such that they should meet the preliminary inclusion criteria of the study.

An explanation regarding the purpose of the study was given, also the timeline (tests would take 3 hours totally) of the study was provided to inform the participants that their cooperation would be required again after three months to carry out the second phase of the study. Following this an informed consent sheet was provided and the participants were asked to sign a document from the AEC, after going through the same.

3.6.1.2. Section II.

In order to gain a better understanding of the participants a general information sheet was prepared. Demographic details regarding date of testing, name, age and gender was collected at this point. Following this significant inclusionary criteria details regarding education level, hearing and visual acuity was enquired on. Important information regarding health conditions such as diabetes, hyper/hypo tension, smoking, drinking habits was noted with details of duration.

3.6.1.3. Section III.

After this a neurological and psychological status screening was done to ensure the participants met these inclusionary criteria of the study. The Quick Neurological Screening Test and NIMHANS Mental Health Screening Questionnaire were administered for this purpose. The primary part of the study was continued with the administration of the Addenbrooke's Cognitive Examination (Revised) (ACE – R) in Kannada. After the administration of ACE – R the participants were given adequate amount of break along with refreshments such as biscuits/juice since a majority of the participants found the testing procedure lengthy and tedious. If the testing was not completed in one sitting the same was scheduled for immediate next day or two. Following this break the data collection procedure was continued with the administration of Cognitive Linguistic Assessment Protocol (CLAP). After the completion of CLAP, the participants were given a brief statement regarding their performance. Care was taken to be sensitive with providing information in case of a poor performance by the participant. Each participant was informed when the second phase of the study would be carried out such that they may make themselves available during that period of time.

3.6.2. Phase II of the study.

The second phase of the study involved revisiting the participants and reassessing their cognitive communication skills after a period of three months. The assessment procedure was carried out in a similar manner as was followed during the phase 1 of the study. Only redundant demographic information such as age, gender, handedness, education and occupation were omitted from this phase of data collection. The second round of assessment of cognitive-communication skills was carried out in order to profile any changes in these skills that may have occurred in the interim period following the first phase. The management of the senior citizen homes were given an overview of the performance level of their inmates. In case, any of the participants performed below average levels the caretakers were informed as such and advised to avail speech language therapy services at AIISH.

3.7. Scoring and Analysis

In line with the aim of the study the statistical analysis were performed using SPSS (version 17.0). The raw scores were tabulated. The same were entered in SPSS program. Appropriate statistical measures were employed in order to check the performances of all the participants among all the parameters of the tests and between the two time intervals (first and after three months). The Descriptive statistics to obtain Mean, median and standard deviation for the data of the study were carried out. Non-parametric tests were used for further analysis of the data.

Chapter 4

RESULTS & DISCUSSION

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4.2. Results of Cognitive Linguistic Assessment Protocol

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RESULTS & DISCUSSION

The aim of the present study was to profile cognitive communication impairments in the elderly. To profile and investigate cognitive communication impairment in the elderly using two paper-pencil test viz. Addenbrooke's Cognitive Examination – Revised (ACE-R) and Cognitive Linguistic Assessment Protocol (CLAP) were used. The domains in ACE-R are (i) attention/orientation, (ii) memory, (iii) fluency, (iv) language, and (v) visuo-spatial abilities. The subtests in CLAP are (i) Attention, perception, discrimination- visual and auditory, (ii) memory, (iii) problem solving, and (iv) organisation. The tests ACE-R and CLAP were administered on 150 elderly participants in the age range of 60 to 80 years, in two phases (phase I & II) with an interval of three months between the phases. The independent variables considered in the study were age, gender, languages known, education, occupation, medical conditions (cardiac issues, diabetes, blood pressure issues), smoking habits, drinking habits, self report of cognitive-communication difficulties. The test scores obtained by the participants on the subtests of ACE-R and CLAP were considered as the dependent variables.

Outline of statistical analyses

In line with the aim of the study the statistical analysis were performed using SPSS (version 17.0). Descriptive statistics was used to obtain mean, median and standard deviation for the data of the study. The Kolmogrov-Smirnov Test was used to check for the normality of the data. Wilcoxon Signed rank test was used to compare participants' performance in the two phases across various levels. Comparison was made for the performances of the participants in the subtests of ACE-R and CLAP during phase 1 and phase 2. And the comparison with respect to each independent variable was performed for phase 1 and phase 2. Further, the Kruskal-Wallis test was used to compare between more than two independent variables within the phases. A Mann-Whitney U test was used to compare between two independent variables within each phase. Before carrying out any further analysis, the data was initially screened using box-plots and the outliers were removed. The participants who had scored lower than the average scores on the tests, and in those whom a cognitive-communication disorder could be suspected were termed as outliers. Of the data collected from 150 participants, data of nine participants were identified as outliers, and were excluded. For the final analysis, 141 participants were included.

On descriptive analysis of the data, the distribution of the participants across each of the variables was observed. Since there was an unequal distribution of the data, it was required to check for the normality of the data in the study. For this reason Kolmogrov-Smirnov Test was used. On the dependent variables analysed for normalcy within the independent variables, except scores on the fluency subtest in ACE-R, the p value was observed to be < 0.05, indicating a significant difference from the normal distribution. Due to this non-parametric tests were applied to analyse the data further.

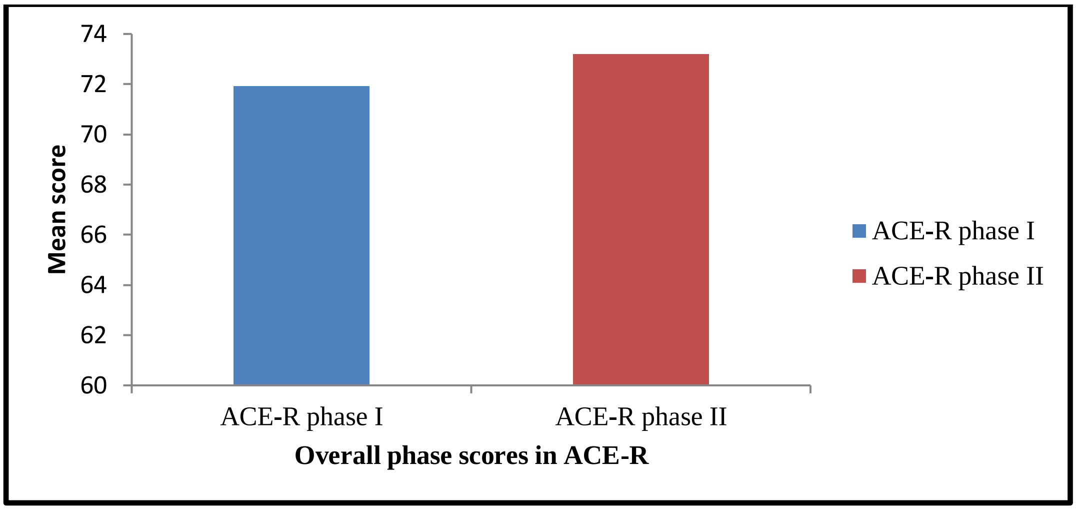
4.1. Results of Addenbrooke's Cognitive Examination - Revised

Addenbrooke's Cognitive Examination Revised (ACE-R) in Kannada has five subtests which are attention/orientation, memory, verbal fluency, language and visuo-spatial abilities. The test was administered in phase 1 of the study and then re-administered during phase 2 of the study on the same group of participants. The overall difference in performance of the participants during phase 1 and phase 2 was analysed initially. Wilcoxons signed-ranks test was done for the same and there was a significant difference between phase 1 and phase 2 scores of ACE-R ($|z| = 2.551$, $p < 0.05$).

Table 4.1.: *Descriptive statistics for ACER*

Test	N	Mean	Median	SD
ACE-R phase 1	141	71.91	75.00	12.358
ACE-R phase 2	141	73.18	75.00	11.401

Note: N= total number of participants within the category; SD= standard deviation



Graph 4.1: *Mean of the total scores on ACE-R during each phase of the study*

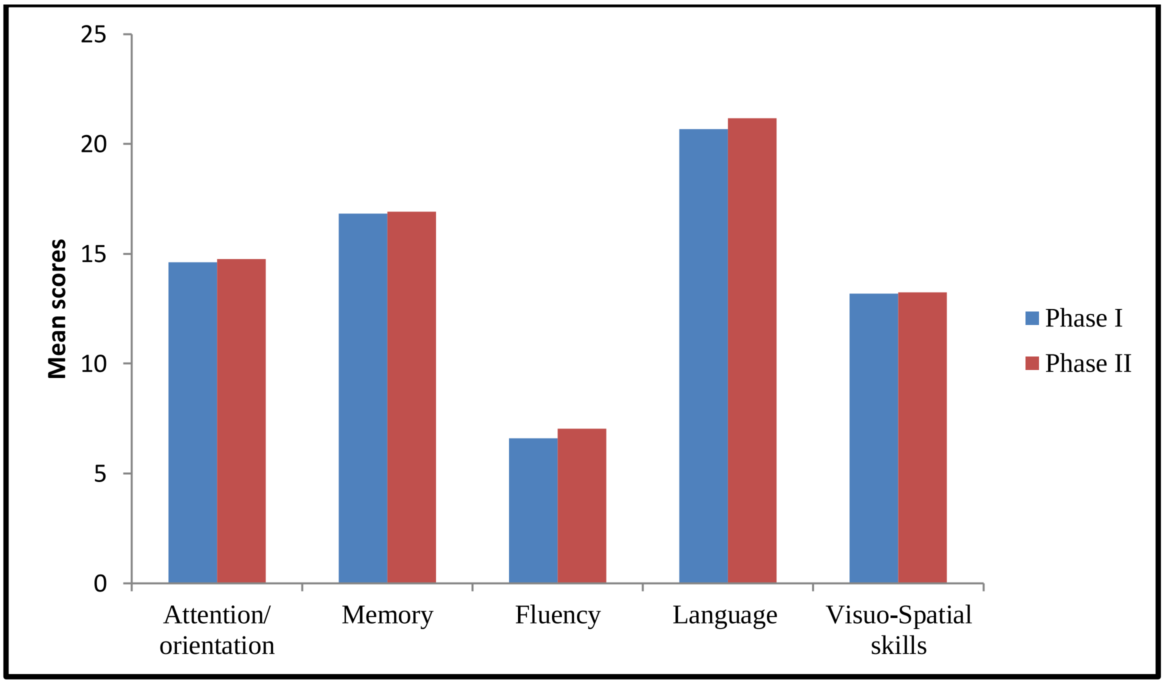
In effect there was an improvement in the performance of participants in phase II of the study. Although the second phase of the study was carried out after a three month interval, a decline in performance was not expected since the study involved participants who are healthy elderly with normal cognitive function. A study by Lim, Jaeger, Harrington, Ashwood, Ellis, Stöffler, Szoeke, Lachovitzki, Martins, Villemagne, Bush, Masters, Rowe, Ames, Darby and Maruff (2013) using the CogState software showed that cognitive performance in healthy older adults did not decline over a 12-week period. Moreover in our study there was an improvement on the ACE-R scores which could be explained by the 'practice effect' as also documented by Collie, Maruff, Darby and McStephen (2003). On the language based subtests of ACE-R, an evident practice effect was observed resulting in the improvement of scores.

4.1.1. Analysis of phase difference within each subtest of ACE-R.

Table 4.2: *Descriptive statistics for subtests of ACER*

Phase difference in subtests	**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Mean	14.62	14.77	16.83	16.93	6.59	7.04	20.67	21.18	13.20	13.26
Median	16.00	16.00	18.00	18.00	6.00	7.00	21.00	22.00	14.00	14.00
SD	3.733	3.610	3.574	3.818	3.291	2.942	2.326	2.126	2.936	2.557

Note: N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; SD= standard deviation



Graph 4.2: *Mean of total scores on each subtest of ACE-R during the two phases*

Attention/ Orientation subtest: In the subtest of attention /orientation the overall difference between the phases was examined using the Wilcoxon signed ranks test. No significant difference was observed in the overall score comparison of phase 1 and phase 2 ($|z| = 1.089$, $p > 0.05$).

Memory subtest: In the subtest of memory the overall difference between the phases was examined using the Wilcoxon signed ranks test. No significant difference was observed in the overall score comparison of phase 1 and phase 2 ($|z| = 0.688$, $p > 0.05$).

Fluency subtest: The fluency subtest of ACE-R was administered in both phase 1 and phase 2 of the study. The scores obtained by the participants in the fluency subtest differed significantly from phase 1 to phase 2 ($|z|= 2.402$, $p < 0.05$).

Language subtest: In the subtest of language the overall difference between the phases was examined using the Wilcoxon signed ranks test. A significant difference was observed in the overall score comparison of phase 1 and phase 2 ($|z| = 2.463$, $p > 0.05$).

Visuo-Spatial skills subtest: In the subtest of Visuo-Spatial skills the difference between the phases was examined using the Wilcoxon sign ranks test and it was found that there is no significant difference in the overall comparison of phase 1 and phase 2 score of visuo-spatial skills ($|z| = 0.066$, $p > 0.05$).

Interestingly there was improvement in the scores of participants during the second phase evidencing for the practice effect on the scores of ACE-R. Practice effect is when prior exposure to testing stimuli and procedures lead to improved scores on cognitive linguistic tests (Collie, Maruff, Darby & McStephen, 2003). On observation, in the subtests of Fluency and Language there was a significant phase difference with an improvement of scores indicating the influence of practice effect. The fluency subtest in ACE-R consists of two tasks of semantic naming and phonemic naming. Previous exposure to these tasks could have prompted the activation of previously established neural networks. This observation is in consonance with the study by Bartels, Wegrzyn, Wiedl, Ackermann and Ehrenreich (2010) wherein verbal fluency subtest showed a highly significant improvement in test scores on serial testing even at 3, 6 and 12 month follow-ups implying the influence of practice effect on language tasks. On other cognitively loaded subtests of attention/ orientation, memory and visuo-spatial skills, an improvement in scores was not evident; implying that for the cognitively loaded tasks in ACE-R the influence of practice effect was not evident. In the same study when the repeat assessment was done after an interval of three months, maintenance of performance was observed. This observation was in consonance with Theisen, Rapport, Axelrod, and Brines (1998) who examined practise effects on the general memory test of Wechsler Memory Scale-Revised and found practice effects to be present. This effect has been observed on the findings of the five subtests of ACE-R where practise effects were evident which is on par with the results of Collie et. al. (2003).

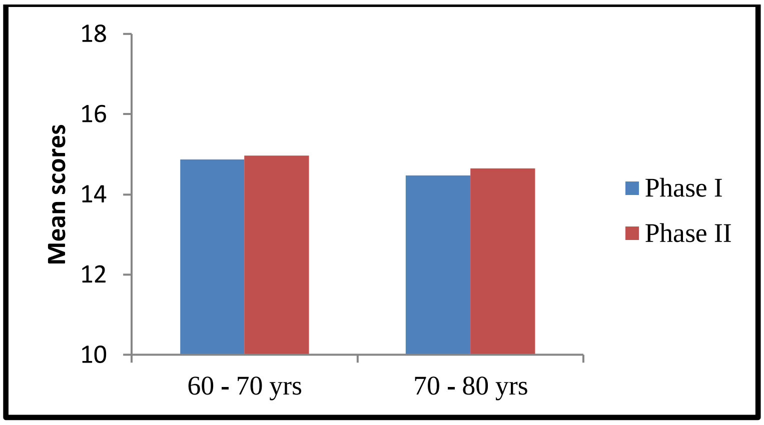
4.1.2. Analysis of cognitive communication skills with reference to demographic variables.

4.1.2.1. AGE: Analysis of results with age and phase as the independent variable.

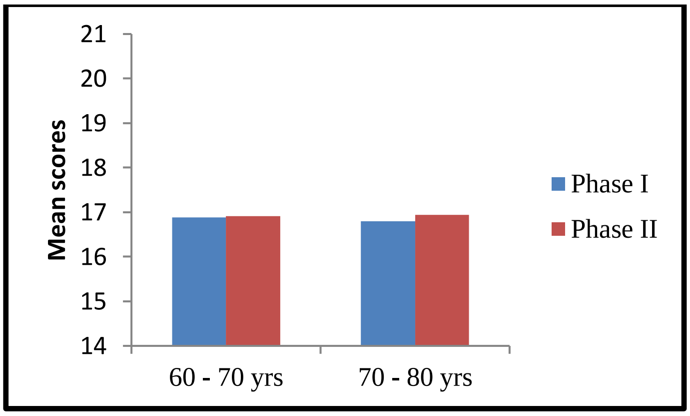
Table 4.3.: *Descriptive statistics for subtests of ACER with phase and age groups as independent variables (60-70 yrs, n= 55; 70-80 yrs, n=86; N= 141)*

Age group/ Subtests of ACE-R		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
60-70 yrs	Mean	14.87	14.96	16.89	16.91	6.82	7.45	20.67	21.38	13.44	13.27
	Median	16.00	16.00	18.00	17.00	7.00	8.00	21.00	22.00	14.00	14.00
	SD	3.389	3.232	3.489	3.586	3.198	2.943	2.144	2.248	2.787	2.361
70-80 yrs	Mean	14.47	14.65	16.79	16.94	6.44	6.78	20.66	21.05	13.05	13.26
	Median	16.00	16.00	18.00	17.00	6.00	7.00	21.00	21.00	14.00	14.00
	SD	3.949	3.846	3.646	3.980	3.359	2.928	2.448	2.046	3.033	2.688

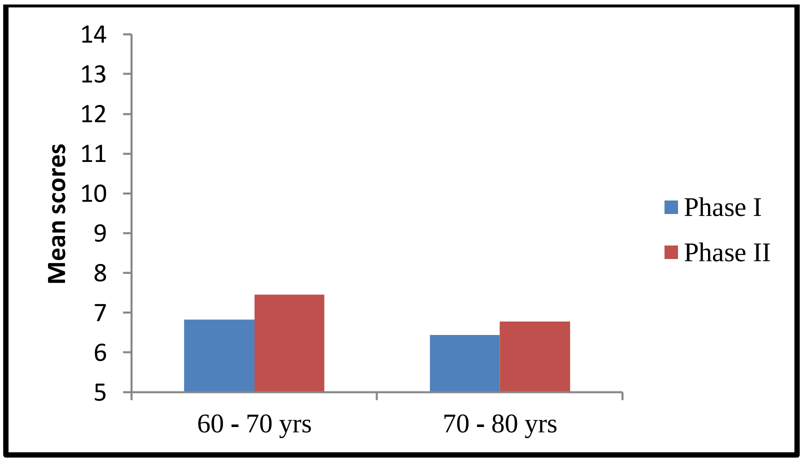
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; 60-70 yrs= participants in the age range of 60-70 years; 70-80 yrs= participants in the age range of 70-80 years; SD= standard deviation



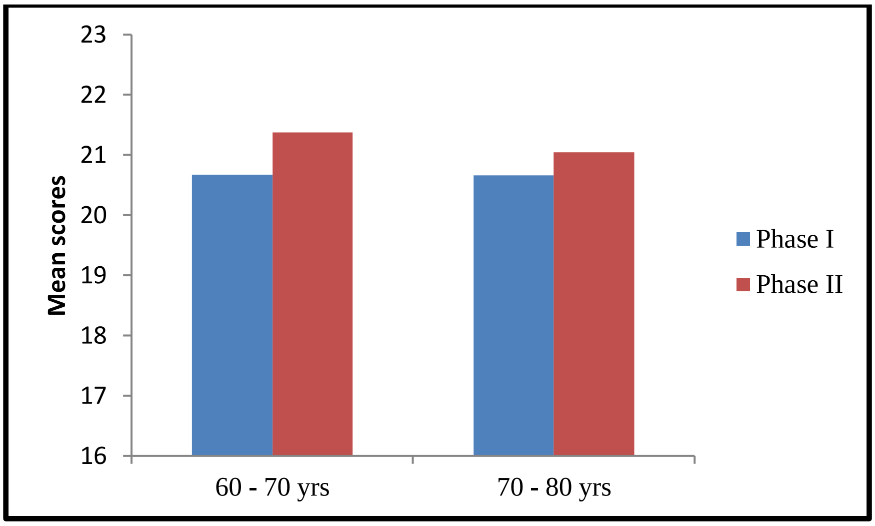
Graph 4.3: *Mean scores of Attention/Orientation subtest between the phases for 60-70 and 70-80 year old participants.*



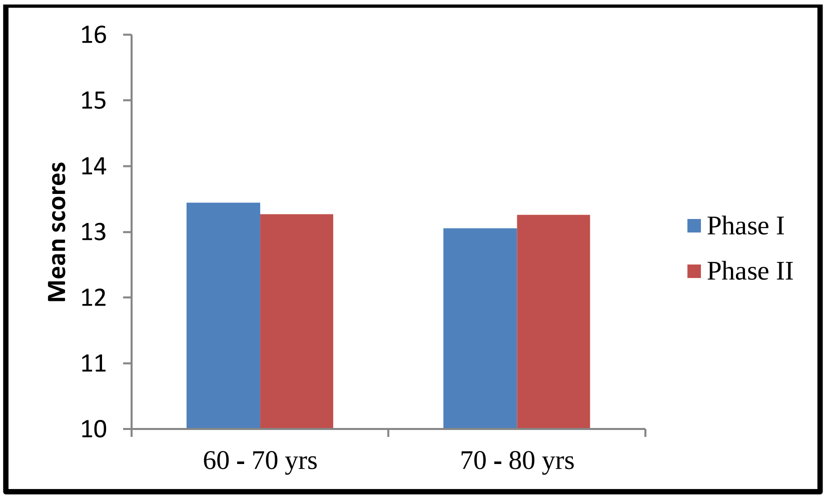
Graph 4.4: *Mean scores of Memory subtest between the phases for 60-70 and 70-80 year old participants.*



Graph 4.5: *Mean scores of Fluency subtest between the phases for 60-70 and 70-80 year old participants*



Graph 4.6: *Mean scores of Language subtest between the phases for 60-70 and 70-80 year old participants.*



Graph 4.7: *Mean scores of Visuo-spatial skills subtest between the phases for 60-70 and 70-80 year old participants*

Attention/ orientation subtest: Within the age group of 60-70 year old, there was no significant difference between phase 1 and phase 2 ($|z| = 1.094$, $p > 0.05$). Similarly, within the 70-80 year old participants, no significant difference between phase 1 and phase 2 was observed ($|z| = 0.639$, $p > 0.05$). Analysis of scores of attention/ orientation subtest in phase 1 revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.355$,

$p > 0.05$). Even in attention/ orientation scores of phase 2, significant difference between 60-70 and 70-80 year old participants were not found ($|z| = 0.024$, $p > 0.05$).

Memory subtest: Within the age group of 60-70 year olds, the difference between phase 1 and phase 2 was found to be not significant ($|z| = 0.417$, $p > 0.05$). Similarly, within the 70-80 year old participants, no significant difference between phase 1 and phase 2 was observed ($|z| = 0.481$, $p > 0.05$). Analysis of scores of Memory subtest in phase 1 revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.064$, $p > 0.05$). Even in Memory scores of phase 2, significant difference between 60-70 and 70-80 year old participants were not found ($|z| = 0.245$, $p > 0.05$).

Fluency subtest: In the 60-70 year old adults, a significant difference was observed ($|z|= 2.122$, $p < 0.05$) between the two phases when Wilcoxon-sign ranked test was done. The performance of the older individuals in the age group of 70-80 years differed from phase 1 to phase 2 but this difference was not significant 1 ($|z|= 1.302$, $p > 0.05$). Within phase 1 ($|z|= 0.741$, $p > 0.05$) and phase 2 ($|z|= 1.413$, $p > 0.05$), when the 60- 70 year olds and the 70-80 year olds were compared using the Mann-Whitney test, the results did not show a significant difference in both phases.

Language subtest: Within the age group of 60-70 year olds, the difference between phase 1 (mean = 20.67) and phase 2 (mean = 21.38) was found to be significant ($|z| = 2.731$, $p > 0.05$). Although, within the 70-80 year old participants, no significant difference between phase 1 and phase 2 was observed ($|z| = 1.042$, $p > 0.05$). Analysis of scores of language subtest in phase 1 revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.537$, $p > 0.05$). Even in language scores of phase 2, significant difference between 60-70 and 70-80 year old participants were not found ($|z| = 1.259$, $p > 0.05$).

Visuo-Spatial skills: Within the age group of 60-70 year olds, the difference between phase 1 and phase 2 was found to be not significant ($|z| = 0.496$, $p > 0.05$). Also within the 70-80 year old participants, no significant difference between phase 1 and phase 2 was observed ($|z| = 0.335$, $p > 0.05$). Mann-Whiney test was done for analysis of scores of visuo-spatial skills subtest within phase 1 and phase 2. These results revealed no significant difference between 60-70 and 70-80 year old participants in phase 1 ($|z| = 0.785$, $p > 0.05$). Even in scores of phase 2, significant difference between 60-70 and 70-80 year old participants were not found ($|z| = 0.120$, $p > 0.05$).

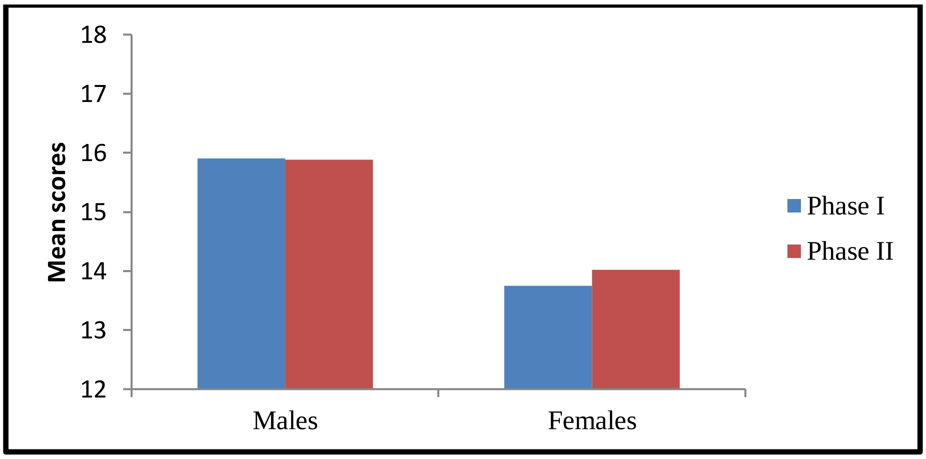
Overall on examination of the results of the performance of the 60-70 year old group and the 70-80 year old group, only the 60-70 year old group have improved their performance in the second phase of the study in the fluency and language subtests. On the remaining subtests of attention/orientation, memory and visuo-spatial abilities the 60-70 year group maintained their performance. The 70-80 year group maintained a steady cognitive –linguistic performance through the study on all the subtests of ACE-R. There is no consensus between the various studies to the rate at which there is a cognitive decline (Park, O’Connell & Thomson, 2003). Yet there is a general agreement that with advancing age, cognitive decline is inevitable as has been quoted by Park et al (2003) and Psaltopoulou, et al (2008). In the present study when comparison was made between the 60-70 year and 70-80 year groups’ median scores, the younger group is higher than median scores of older group in both phases of the fluency subtest. On all other subtests of ACE-R though the difference is not significant, the 60-70 year group have performed better than the 70-80 year group.

4.1.2.2. GENDER: Analysis of results with gender and phase as the independent variable.

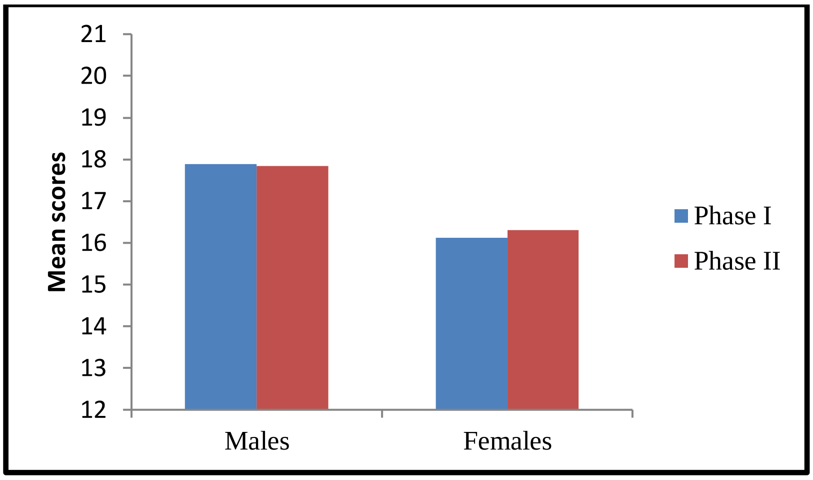
Table 4.4: *Descriptive statistics for subtests of ACER for gender and phase as independent variables (males, n= 57; females, n= 84; N= 141)*

Gender/ Subtests of ACE-R		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
M	Mean	15.91	15.88	17.88	17.84	6.84	7.40	21.25	21.42	13.98	13.93
	Median	17.00	17.00	19.00	20.00	7.00	8.00	22.00	21.00	15.00	15.00
	SD	3.158	3.180	3.500	3.565	3.453	2.921	1.766	1.451	2.460	2.282
F	Mean	13.75	14.02	16.12	16.31	6.42	6.80	20.27	21.01	12.67	12.81
	Median	15.00	14.00	16.50	17.00	6.00	7.00	21.00	22.00	14.00	13.50
	SD	3.855	3.709	3.466	3.881	3.186	2.948	2.576	2.476	3.121	2.646

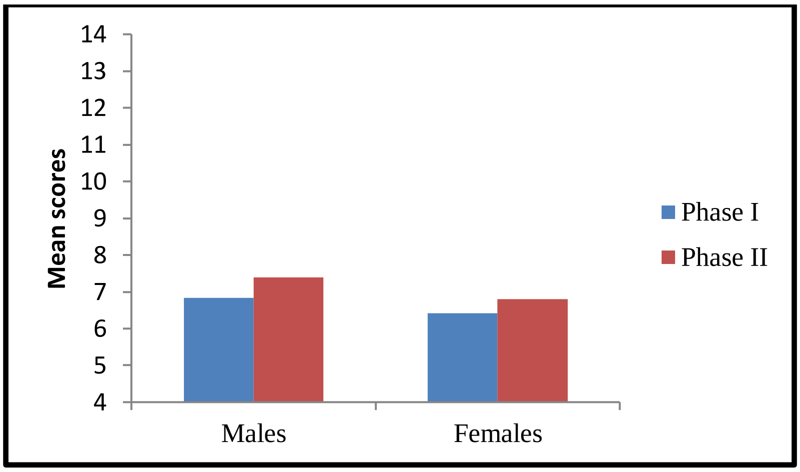
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; M= participants who were males; F= participants who were females; SD= standard deviation



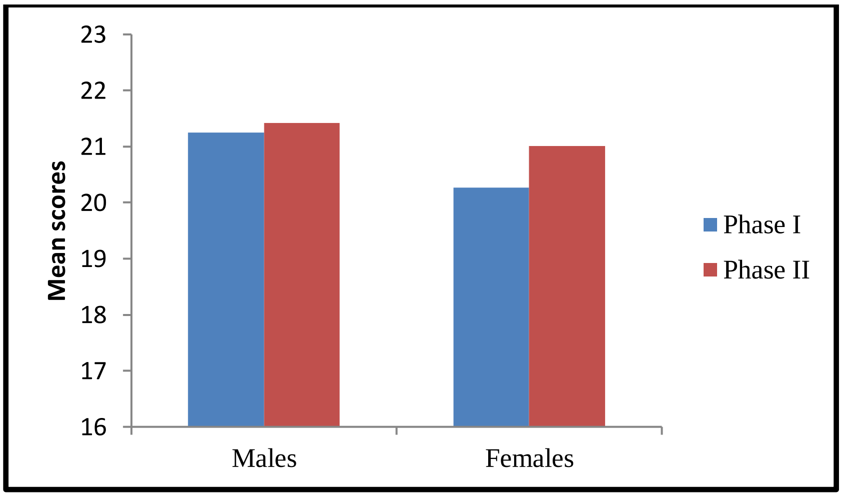
Graph 4.8: *Mean scores of A/O subtest between the phases for males and females*



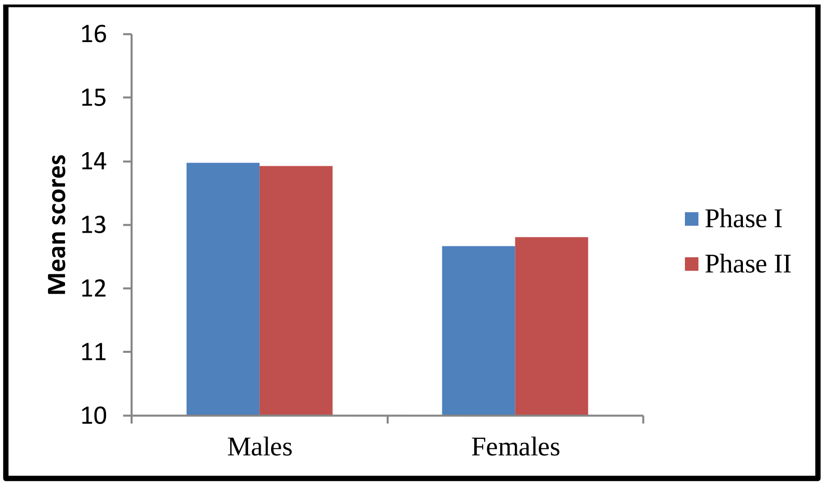
Graph 4.9: *Mean scores of Memory subtest between the phases for males and females*



Graph 4.10: *Mean scores of Fluency subtest between the phases for males and females*



Graph 4.11: *Mean scores of Language subtest between the phases for males and females*



Graph 4.12: *Mean scores of Visuo-spatial skills subtest between the phases for males and females*

Attention/ orientation subtest: Performance of males on comparison of scores in attention/orientation subtest between phase 1 and phase 2 did not differ significantly ($|z| = 0.269$, $p > 0.05$). The performance of the females also did not differ significantly ($|z| = 1.069$, $p > 0.05$) between the two phases. Within the phase 1 ($|z| = 3.633$, $p < 0.05$) significant difference was observed between males (mean= 15.91) and females (mean= 13.75) in their performance on attention/orientation subtest. Within the phase 2 ($|z| = 3.112$, $p < 0.05$) a similar significant difference was observed between the males (mean= 15.88) and females (mean= 14.02).

Memory subtest: Performance of males on comparison of scores in Memory/orientation subtest between phase 1 and phase 2 did not differ significantly ($|z| = 0.242$, $p > 0.05$). The performance of the females also did not differ significantly ($|z| = 0.681$, $p > 0.05$) between the two phases. Within the phase 1 ($|z| = 3.467$, $p < 0.05$) significant difference was observed between males (mean= 17.88) and females (mean= 16.12) in their performance on Memory/orientation subtest. Within the phase 2 ($|z| = 2.449$, $p < 0.05$) a similar significant difference was observed between the males (mean= 17.84) and females (mean= 16.31).

Fluency subtest: The performance of males when compared between phase 1 and phase 2 showed a significant difference ($|z|= 2.030$, $p < 0.05$) with phase 2 scores (mean= 6.84) being better than phase 1 scores (mean= 7.40). Performance of female participants showed no significant difference from phase 1 to phase 2 ($|z|= 1.462$, $p > 0.05$). On Mann-Whitney test, performance of males and females were compared within the two phases, and it was seen that no significant difference was present in phase 1 ($|z|= 0.696$, $p > 0.05$) and in phase 2 ($|z|= 1.174$, $p > 0.05$).

Language subtest: Performance of males on comparison of scores in language subtest between phase 1 and phase 2 did not differ significantly ($|z| = 0.554$, $p > 0.05$). The performance of the females however differed significantly ($|z| = 2.706$, $p < 0.05$) between the two phases. Within the phase 1 ($|z| = 2.059$, $p < 0.05$) significant difference was observed between males (mean= 21.25) and females (mean= 20.27) in their performance on language subtest. Within the phase 2 ($|z| = 0.29$, $p < 0.05$) a significant difference was not observed between the males and females.

Visuo-Spatial skills: Performance of males on comparison of scores in visuo-spatial skills subtest between phase 1 and phase 2 did not differ significantly ($|z| = 0.510$, $p > 0.05$). The performance of the females also did not differ significantly ($|z| = 0.479$, $p > 0.05$) between the two phases. Within phase 1 of visuo-spatial skills males (mean= 15.91) were found to perform significantly better than the females (mean= 13.75) ($|z| = 2.378$, $p < 0.05$). Also within the phase 2 ($|z| = 2.456$, $p < 0.05$) a similar significant difference was observed between the males (mean= 15.88) and females (mean= 14.02).

Analysis of the results regarding the performance of the males and females in the subtests of ACE-R the males performed consistently better than the females in all the five subtests. In general it was observed that the males maintained their performance through the two phases on all the subtests of ACE-R. Although the males showed considerable improvements in their performance on the fluency subtest in phase II. Females showed an improvement on all of the subtests of ACE-R but a considerable improvement on the language subtest. Gender differences on cognitive tasks have been reported by Munro et al (2012). Who documented that the males performed better than the females on visuo-construction and visual perception and attributed these gender differences to effects of brain dimorphism. Improved performance in phase II of the study could be attributed to short duration gap between the two phases of the study and the slight improvement could be attributed to practise effect caused by testing during phase I. Thus a possible reason for the males performing consistently better than the females in our study may be attributed to the Indian social structure and exposure rates of elderly female participants. The findings are supported by, Psaltopoulou et al (2008) who found that with respect to MMSE scores, more women than men scored lower than 24, but these univariate characteristics are not directly interpretable because women had lower average educational level.

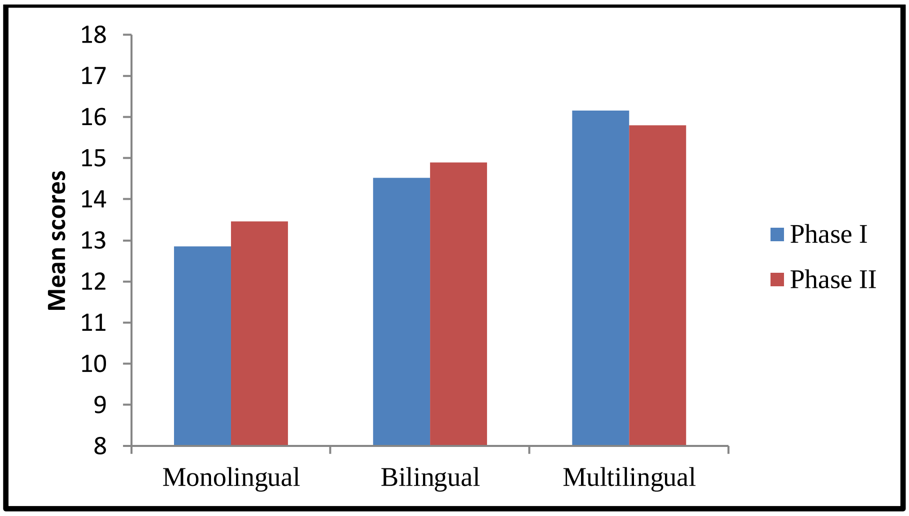
4.1.2.3. NUMBER OF LANGUAGES KNOWN: Analysis of results with number of languages known and phase as the independent variable.

Table 4.5: *Descriptive statistics for subtests of ACER for number of languages known and phase as the independent variable (monolinguals, n= 50; bilinguals, n= 31; multilinguals, n= 60; N= 141)*

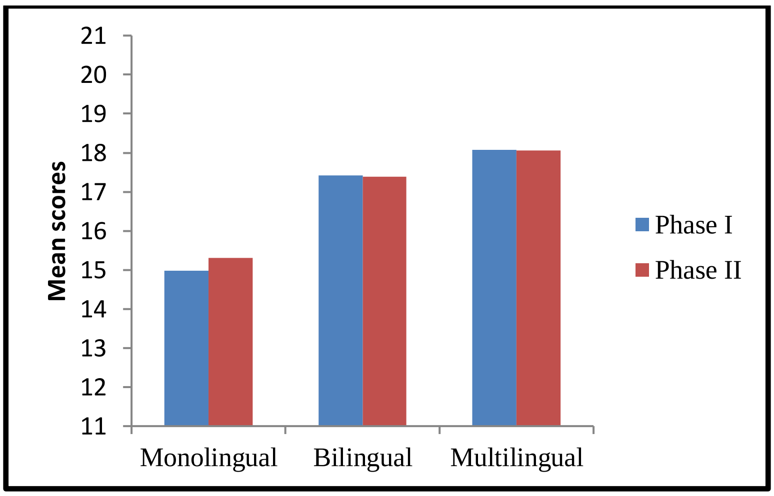
Number of languages known/ Subtests of ACE-R		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Mono	Mean	12.86	13.46	14.98	15.30	5.80	5.96	20.24	20.86	12.08	11.92
	Median	14.00	14.00	16.00	15.50	6.00	6.00	21.00	21.00	12.00	12.00
	SD	4.031	3.924	4.167	4.022	3.232	2.857	2.592	2.424	3.148	2.570

Bi	Mean	14.52	14.90	17.42	17.39	7.00	7.97	20.42	20.84	13.90	13.77
	Median	16.00	16.00	18.00	18.00	8.00	8.00	21.00	21.00	15.00	14.00
	SD	3.548	3.390	2.778	3.393	3.416	2.738	2.680	2.051	2.508	2.061
Multi	Mean	16.15	15.80	18.07	18.05	7.03	7.47	21.15	21.62	13.77	14.12
	Median	17.00	17.50	18.00	19.00	7.00	8.00	21.50	22.00	15.00	15.00
	SD	2.857	3.123	2.705	3.417	3.205	2.885	1.783	1.833	2.714	2.337

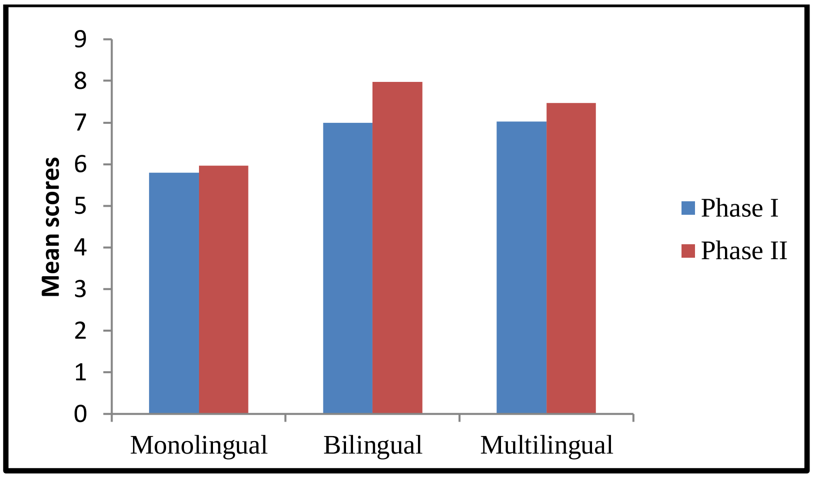
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; Mono= participants who were monolinguals; Bi= participants who were bilinguals; Multi= participants who were multilinguals; SD= standard deviation



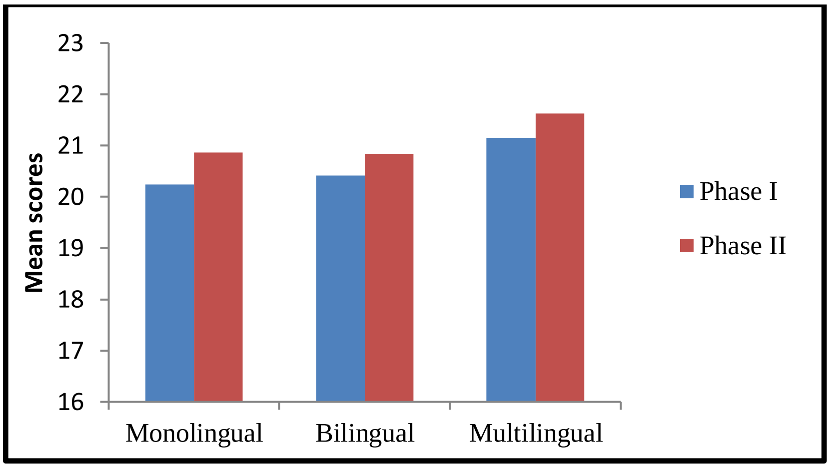
Graph 4.13: *Mean scores of A/O subtest between the phases for monolinguals, bilinguals and multilinguals participants*



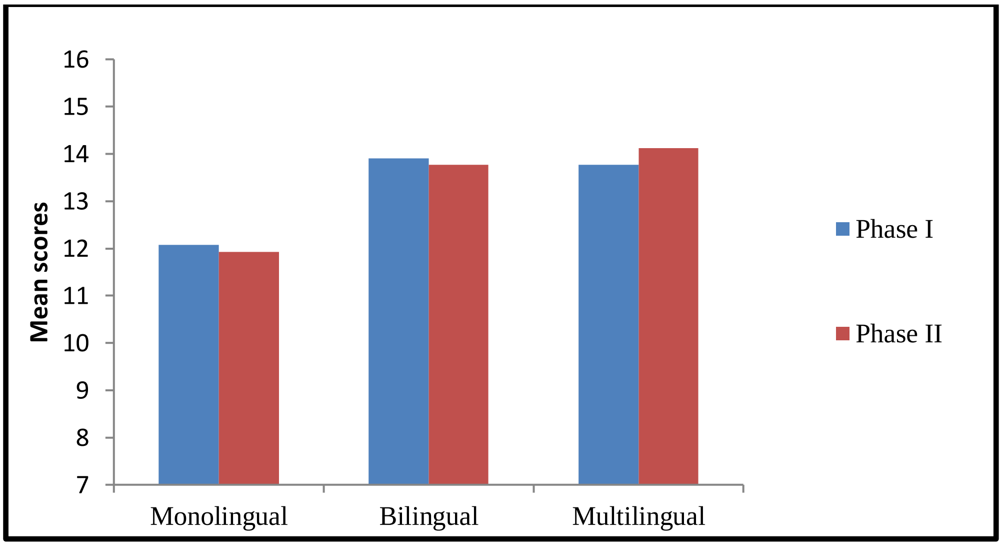
Graph 4.14: *Mean scores of Memory subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.15: *Mean scores of Fluency subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.16: *Mean scores of Language subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.17: *Mean scores of Visuo-spatial skills subtest between the phases for monolinguals, bilinguals and multilinguals participants*

Attention/ orientation subtest: When the performance of monolinguals were compared between phase 1 and phase 2, differences were found to be not significant ($|z| = 1.500$, $p > 0.05$). In bilinguals, the difference between phase 1 and phase 2 was also found to be not significant ($|z| = 0.700$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 0.380$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was observed between the three groups in both phase 1 ($H = 23.649$, $p < 0.05$) and phase 2 ($H = 13.167$, $p < 0.05$). Pair-wise comparisons were done using Mann-Whitney test since a significant difference was observed between the three groups. Monolinguals and bilinguals showed no significant difference in both phase 1 ($|z| = 1.843$, $p > 0.05$) and phase 2 ($|z| = 1.639$, $p > 0.05$). A significant difference was observed between the bilinguals (mean= 14.52) and multilinguals (mean= 16.15) in phase 1 ($|z| = 2.573$, $p < 0.05$), but the difference was not significant in phase 2 ($|z| = 1.504$, $p > 0.05$). When the monolinguals (mean= 12.86) were compared with the multilinguals (mean= 16.15), a significant difference was observed in phase 1 ($|z| = 4.752$, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 13.46) and multilinguals (mean= 15.80) were seen in phase 2 ($|z| = 3.621$, $p < 0.05$).

Memory subtest: When the performance of monolinguals were compared between phase 1 and phase 2, differences were found to be not significant ($|z| = 0.374$, $p > 0.05$). In bilinguals, the difference between phase 1 and phase 2 was also found to be not significant ($|z| = 0.522$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 0.331$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was observed between the three groups in both phase 1 ($H = 18.273$, $p < 0.05$) and phase 2 ($H = 15.153$, $p < 0.05$). Pair-wise comparisons were done using Mann-Whitney test since a significant difference was observed between the three groups. Monolinguals (Mean = 14.98) and bilinguals (Mean = 17.42) showed a significant difference in both phase 1 ($|z| = 2.755$, $p < 0.05$). In phase 2 also there was a significant difference ($|z| = 2.315$, $p < 0.05$) between the monolinguals (Mean = 15.30) and the bilinguals (Mean = 17.39). A significant difference was not observed between the bilinguals and multilinguals in phase 1 ($|z| = 1.087$, $p > 0.05$), and also the difference was not significant in phase 2 ($|z| = 1.084$, $p > 0.05$). When the monolinguals (mean= 14.98) were compared with the multilinguals (mean= 18.07), a significant difference was observed in phase 1 (|z| = 4.4.099, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 15.30) and multilinguals (mean= 18.05) were seen in phase 2 ($|z| = 3.809$, $p < 0.05$).

Fluency subtest: Monolinguals did not perform significantly different between phase 1 and phase 2 ($|z|= 0.639$, $p > 0.05$), whereas bilinguals showed significant difference between phase 1 and phase 2 ($|z|= 2.114$, $p < 0.05$). The multilinguals in the study did not perform significantly different in phase 2 compared to phase 1 ($|z|= 1.569$, $p > 0.05$). Kruskal-Wallis test was done for the comparison of the three categories of the participants for the number of languages known. The results revealed that within phase 1 no significant difference was seen between the three categories ($H= 4.555$, $p > 0.05$). Within phase 2 of the study, comparison of scores of the three groups showed a significant difference ($H= 10.46$, $p< 0.05$). Further, Mann-Whitney test for pair-wise comparisons was done only for the category pairs in phase 2, since there was a significant difference only in phase 2. Comparison of phase 2 scores of monolinguals (mean= 5.96) and bilinguals (mean= 7.97) showed a significant difference between the two groups ($|z| = 2.818$, $p < 0.05$). Scores of bilinguals and multilinguals showed no significant difference in phase 2 ($|z| = 0.662$, $p > 0.05$). Lastly, comparison of scores of monolinguals (mean= 5.96) and multilinguals (mean= 7.47) in phase 2 showed a significant difference ($|z| = 2.674$, $p < 0.05$).

Language subtest: When the performance of monolinguals were compared between phase 1 and phase 2, differences were found to be not significant ($|z| = 1.537$, $p > 0.05$). In bilinguals, the difference between phase 1 and phase 2 was also found to be not significant ($|z| = 0.837$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 1.946$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was not observed between the three groups in phase 1 ($H = 2.77$, $p > 0.05$) and hence further analysis of phase 1 results for the effects in monolingual, bilingual, and multilingual participants was not carried out. However in phase 2 ($H = 6.363$, $p > 0.05$) a significant difference was observed between the three groups. Pair-wise comparisons was done using Mann-Whitney test since a significant difference was observed between the three groups in phase 2. Monolinguals and bilinguals did not show a significant difference ($|z| = 0.266$, $p > 0.05$) in phase 2. Between the bilinguals (mean = 20.84) and the multilinguals (mean = 21.62) a significant difference ($|z| = 2.115$, $p < 0.05$) was observed in phase 2. The difference was also significant in phase 2 ($|z| = 2.112$, $p < 0.05$) when the monolinguals (mean = 20.86) were compared with the multilinguals (mean = 21.62) .

Visuo-Spatial skills: When the performance of monolinguals were compared between phase 1 and phase 2, differences were found to be not significant ($|z| = 0.669$, $p > 0.05$). In bilinguals, the difference between phase 1 and phase 2 was also found to be not significant ($|z| = 0.605$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 1.200$, $p > 0.05$). The Kruskal-Wallis test was done for the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants. A significant difference was observed between the three groups in both phase 1 ($H = 9.408$, $p < 0.05$) and phase 2 ($H = 22.286$, $p < 0.05$). Since a significant difference was observed between the three groups in both phases, pair-wise comparisons were done using Mann-Whitney test. Monolinguals and bilinguals showed significant difference in phase 1 scores ($|z| = 2.486$, $p < 0.05$). Performance of monolinguals (mean= 11.92) and bilinguals (mean= 13.77) in phase 2 also differed significantly ($|z| = 3.232$, $p < 0.05$). Between the bilinguals and multilinguals, there was no significant difference in both phase 1 ($|z| = 0.343$, $p > 0.05$) and phase 2 ($|z| = 1.102$, $p > 0.05$). When the monolinguals (mean= 12.08) were compared with the multilinguals (mean= 13.77), a significant difference was observed in phase 1 ($|z| = 2.705$, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 11.92) and multilinguals (mean= 14.12) was seen in phase 2 ($|z| = 4.4.453$, $p < 0.05$).

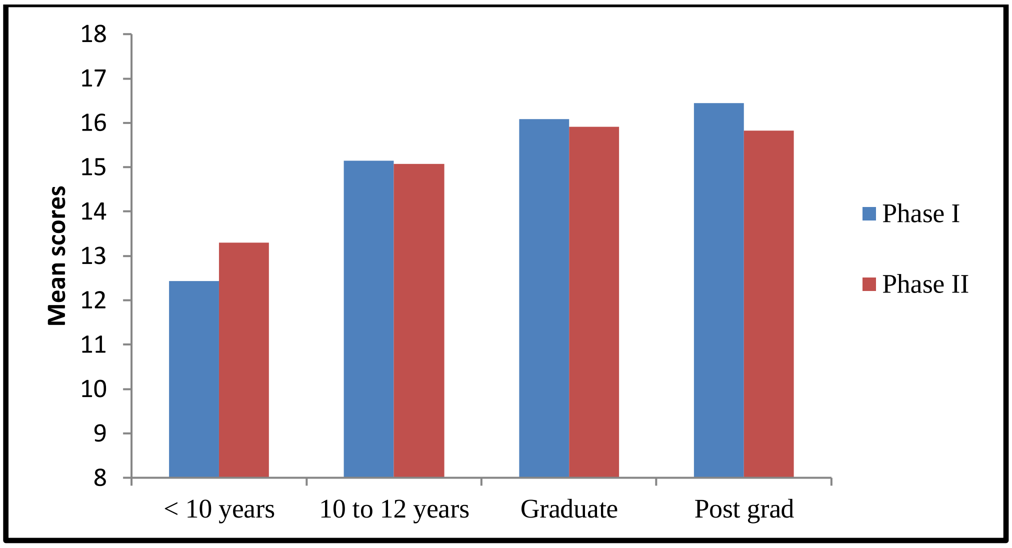
In general the cognitive linguistic performance of the monolinguals, bilinguals and multilinguals was observed to be similar during both phases of the study. Only on the fluency subtest the bilinguals improved their performance. On comparison of the three language groups it was observed that the multilinguals performed consistently better than the monolinguals. The multilinguals performed slightly better than the bilinguals on specific cognitive subtests such as attention/orientation and language. This finding is in line with the work done by Kavé, Eyal, Shorek, Cohen-Mansfield (2008) analyses showed cognitive test scores were related to the number of languages spoken irrespective of the influence of other demographic details, such as age, gender or education. Bialystok, Craik, Klein and Viswanathan (2004) also reported bilinguals performed better than monolinguals on cognitive tasks. They explained that bilinguals utilised more effective processing and this aided in overcoming any age related cognitive decline as opposed to monolinguals.

4.1.2.4. EDUCATION: Analysis of results with education and phase as the independent variable.

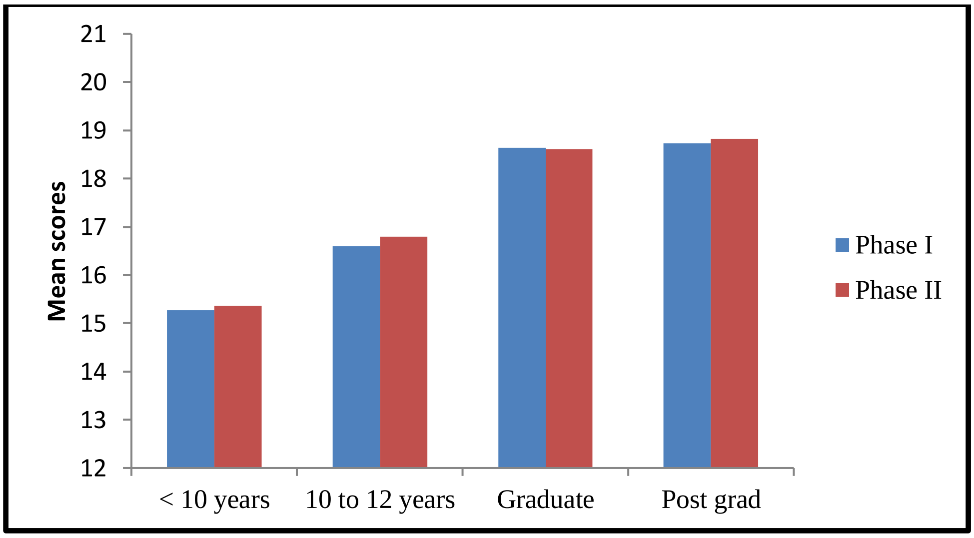
Table 4.6: *Descriptive statistics for subtests of ACER for years of Education and phase as the independent variable (<10 yrs, n= 44; 10-12 yrs, n= 53; Graduates, n= 33; Post-graduates, n= 11; N= 141)*

Years of Education/ Subtests of ACE-R		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
< 10 yrs	Mean	12.43	13.30	15.27	15.36	5.48	6.11	19.57	20.68	12.48	12.48
	Median	12.50	14.00	16.00	16.00	5.00	6.00	20.00	22.00	13.00	12.50
	SD	3.836	3.974	3.878	4.075	3.023	2.713	2.999	2.752	3.084	2.173
10-12 yrs	Mean	15.15	15.08	16.60	16.79	6.91	7.26	20.75	21.08	13.17	12.94
	Median	16.00	16.00	17.00	18.00	7.00	7.00	21.00	21.00	14.00	14.00
	SD	3.455	3.496	3.254	3.743	3.206	3.083	1.890	1.940	3.099	2.983
Grad.	Mean	16.09	15.91	18.64	18.61	7.18	7.45	21.79	21.79	14.03	14.64
	Median	17.00	17.00	19.00	20.00	7.00	8.00	22.00	21.00	15.00	15.00
	SD	2.898	2.650	2.498	2.669	3.548	2.851	1.166	1.269	2.430	1.747
Post-grad.	Mean	16.45	15.82	18.73	18.82	7.73	8.45	21.27	21.82	13.73	13.82
	Median	18.00	17.00	20.00	20.00	8.00	10.00	22.00	23.00	15.00	14.00
	SD	3.078	3.601	3.663	3.601	3.165	2.697	2.054	1.779	2.453	2.316

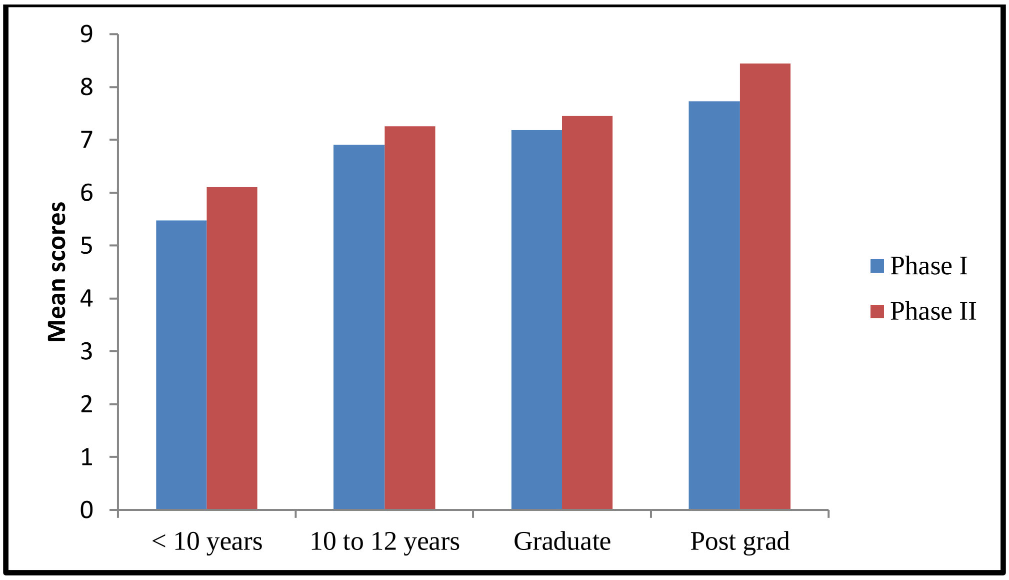
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; <10 yrs= participants with <10 years of formal education; 10-12 yrs= participants with 10-12 years of formal education; Grad.= participants who had attended university; Post-grad.= participants with higher educational qualifications; SD= standard deviation



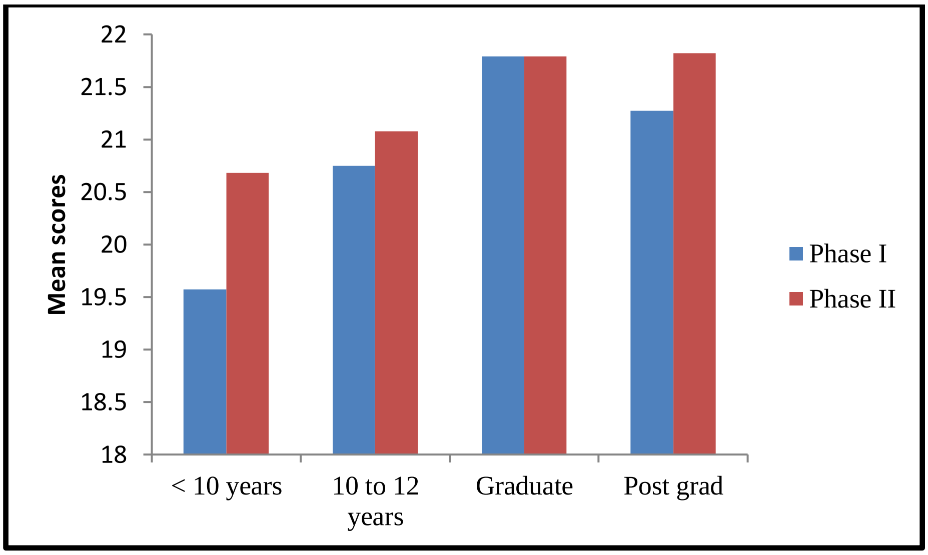
Graph 4.18: *Mean scores of A/O subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



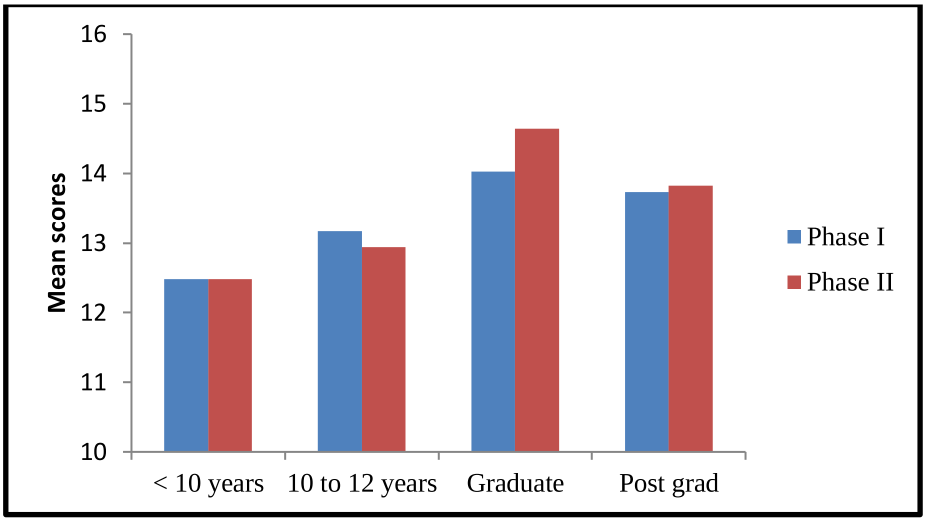
Graph 4.19: *Mean scores of Memory subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.20: *Mean scores of Fluency subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.21: *Mean scores of Language subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.22: *Mean scores of Visuo-spatial skills subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*

Attention/ orientation subtest: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show any significant difference ($|z| = 1.892$, $p > 0.05$). When scores of persons with 10-12 years of formal education ($|z| = 0.190$, $p > 0.05$), graduates ($|z| = 0.358$, $p > 0.05$), and post-graduates ($|z| = 0.707$, $p > 0.05$) were compared between the two phases no significant differences were found. When the four groups under years of formal education (less than 10 years, 10-12 years, graduate and post-graduate groups) were compared within phase 1 ($H = 27.431$, $p < 0.05$) and phase 2 ($H = 10.578$, $p < 0.05$) of attention/ orientation subtest, significant differences were observed in both phases. Further, when pair-wise comparisons were done using Mann-Whitney test, the following observations were made. In phase 1, the participants with less than 10 years (mean= 12.43) and the participants with 10-12 years of education (mean= 15.15) showed significant differences ($|z| = 3.683$, $p < 0.05$). Even in phase 2 of attention/ orientation subtest, these groups, that is, the less than 10 years education group (mean= 13.30) and the 10-12 years of education group (mean= 15.08) showed significant differences between each other ($|z| = 2.294$, $p < 0.05$). The differences in scores of persons with 10-12 years of education, and graduate groups were not significant in both phase 1 (|z| = 1.486, $p > 0.05$) and phase 2 (|z| = 0.716, $p > 0.05$). Comparison of scores of graduates and post-graduates within phase 1 (|z| = 0.858, $p > 0.05$) and also in phase 2 (|z| = 0.381, $p > 0.05$) did not reveal significant differences.

Between post-graduates (mean= 16.45) and persons with less than 10 years of formal education (mean= 12.43), the attention/ orientation scores differed significantly in phase 1 (|z| = 3.296, $p < 0.05$). This significant difference between post-graduates (mean= 15.82) and persons with less than 10 years of formal education (mean= 13.30) was also observed in phase 2 (|z| = 1.989, $p < 0.05$). Similarly, comparison of scores of graduates (mean= 16.09) and persons with less than 10 years of formal education revealed significant difference in phase 1 (|z| = 4.392, $p < 0.05$). Phase 2 scores also showed significant differences between graduates (mean= 15.91) and persons with less than 10 years of formal education (|z| = 2.929, $p < 0.05$). Phase 1 scores of attention/ orientation subtest did not show significant difference between post-graduates and persons with 10-12 years of formal education (|z| = 1.749, $p > 0.05$), and the same was observed with phase 2 scores of the two groups (|z| = 0.731, $p > 0.05$).

Memory subtest: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show any significant difference (|z| = 0.21, $p > 0.05$). When scores of persons with 10-12 years of formal education (|z| = 0.486, $p > 0.05$), graduates (|z| = 0.464, $p > 0.05$), and post-graduates (|z| = 0.434, $p > 0.05$) were compared between the two phases no significant differences were found.

When the four groups under years of formal education (less than 10 years, 10-12 years, graduate and post-graduate groups) were compared within phase 1 ($H = 23.113$, $p < 0.05$) and phase 2 ($H = 17.838$, $p < 0.05$) of memory subtest, significant differences were observed in both phases. Further, when pair-wise comparisons were done using Mann-Whitney test, the following observations were made. In phase 1, the participants with less than 10 years of education group and the 10-12 years of education group showed no significant differences ($|z| = 1.745$, $p > 0.05$). Even in phase 2 of the memory subtest, these groups, i.e., the less than 10 years of education group and the 10-12 years group showed no significant differences between each other ($|z| = 1.831$, $p > 0.05$). The differences in scores of persons with 10-12 years of education (Mean = 16.60), and graduate (mean = 18.64) groups was significant in phase 1 ($|z| = 3.3.06$, $p < 0.05$). In phase 2 ($|z| = 2.373$, $p < 0.05$) also there was a significant difference differences in scores of persons with 10-12 (Mean = 16.79) years of education, and graduate (mean = 18.61). Comparison of scores of graduates and post-graduates within phase 1 ($|z| = 0.515$, $p > 0.05$) and also in phase 2 ($|z| = 0.472$, $p > 0.05$) did not reveal significant differences. Between post-graduates (mean= 18.73) and persons with less than 10 years of formal education (mean= 15.27), the memory scores differed significantly in phase 1 ($|z| = 2.989$, $p < 0.05$). This significant difference between post-graduates (mean= 18.82) and persons with less than 10 years of formal education (mean= 15.36) was also observed in phase 2 ($|z| = 2.726$, $p < 0.05$). Similarly, comparison of scores of graduates (mean= 18.64) and persons with less than 10 years of formal education (mean =15.27) revealed significant difference in phase 1 ($|z| = 4.136$, $p < 0.05$). Phase 2 scores also showed significant differences between graduates (mean= 15.91) and persons with less than 10 years of formal education ($|z| = 3.675$, $p < 0.05$). Phase 1 scores of memory subtest showed significant difference ($|z| = 2.275$, $p < 0.05$) between post-graduates (mean = 18.73) and persons with 10-12 years of formal education (mean = 16.60). Although there was a significant difference in phase 1, the post graduate group and the persons with 10-12 years of formal education showed no significant difference in phase 2 of the study ($|z| = 1.918$, $p > 0.05$).

Fluency subtest: The participants in the first group, that is those with less than 10 years of education, showed a significant difference between phase 1 and phase 2 ($|z|= 2.349$, $p< 0.05$), when Wilcoxon signed ranks test was done. The second group, which included participants with 10-12 years of education showed no significant difference between phase 1 and phase 2 on this analysis ($|z|= 0.974$, $p > 0.05$). The third group, including persons who had attended university or were graduates also showed no significant difference in phase 1 and phase 2 ($|z|= 0.545$, $p > 0.05$). Scores of participants who were post- graduates were grouped together and analysed, and revealed a significant difference between phase 1 and phase 2 scores ($|z|= 2.126$, $p < 0.05$). Kruskal-Wallis test was done to compare the four categories of education within the two phases. In phase 1 of the fluency subtest, there was a significant difference seen between the scores of participants with less than 10 years of education, 10-12 years of education, those who were graduates and those who were post- graduates ($H= 7.840$, $p< 0.05$). Again, when the analysis was repeated for phase 2 scores of fluency subtest, significant differences were seen between the four categories ($H= 8.346$, $p< 0.05$). Hence further analysis was done for both the phases.

Pair-wise analysis was carried out using Mann-Whitney test. Significant difference was seen between the participants with less than 10 years of education (mean= 5.48) and participants with 10-12 years of education (mean= 6.91) on comparison of phase 1 score ($|z|= 2.203$, $p< 0.05$). Phase 2 scores score also showed significant difference ($|z|= 2.030$, $p< 0.05$) between participants with less than 10 years of education (mean= 6.11) and participants with 10-12 years of education (mean= 7.26). Next, the participants with 10-12 years of education were compared with participants who were graduates, and it was seen that both phase 1 scores ($|z|= 0.397$, $p> 0.05$) and phase 2 scores ($|z|= 0.313$, $p> 0.05$) did not show any significant difference. The next pair analysed was of scores of graduates and post-graduates. Both phase 1 ($|z|= 0.423$, $p> 0.05$) and phase 2 scores ($|z|= 0.975$, $p> 0.05$) did not show a significant difference. Participants with less than 10 years of education (mean= 5.48) compared to the post-graduates (mean= 7.73) showed significant difference in phase 1 of fluency subtest (|z|= 2.050, p< 0.05). Similarly, in phase 2, the post-graduates group (mean= 8.45) performed significantly better than the participants with less than 10 years of education (mean= 6.11) (|z|= 2.371, p< 0.05). Also, when the participants with less than 10 years of education were compared with graduates group, significant difference was observed in phase 1 (|z|= 2.125, p< 0.05). In phase 2, comparison of the same participants in less than 10 years of education group and graduates group showed significant differences again (|z|= 2.047, p< 0.05). Comparison of participants with 10-12 years of education with the post-graduates group showed no significant difference between the two groups in phase 1 (|z|= 0.697, p> 0.05) and phase 2 (|z|= 1.180, p> 0.05).

Language subtest: In persons with less than 10 years of formal education, comparison of scores of the two phases showed a significant difference (|z| = 2.38, p > 0.05). When scores of persons with 10-12 years of formal education (|z| = 1.31, p > 0.05), graduates (|z| = 0.059, p > 0.05), and post-graduates (|z| = 0.707, p > 0.05) were compared between the two phases no significant differences were found. When the four groups under years of formal education (less than 10 years, 10-12 years, graduate and post-graduate groups) were compared within phase 1 (H = 14.055, p < 0.05) a significant difference was noted. In phase 2 (H = 4.444, p > 0.05) of memory subtest, significant differences were not observed in both phases. Further, when pair-wise comparisons were done using Mann-Whitney test for the observations made during phase 1, the following observations were made. In phase 1 of the memory subtest, these groups, i.e., the less than 10 years group and the 10-12 years group showed no significant differences between each other (|z| = -1.668, p > 0.05). The differences in scores of persons with 10-12 (Mean = 20.75) years of education, and graduate (mean = 21.79) groups was significant in phase 1 (|z| = 2.62, p < 0.05). Comparison of scores of graduates and post-graduates within phase 1 ($|z| = 0.338$, $p > 0.05$) did not reveal significant differences. Between post-graduates and persons with less than 10 years of formal education the memory scores did not differ significantly in phase 2 ($|z| = 1.789$, $p < 0.05$). Comparison of scores of graduates (mean= 21.79) and persons with less than 10 years of formal education (mean =19.57) revealed significant difference in phase 1 ($|z| = 3.391$, $p < 0.05$). Phase 1 scores of memory subtest did not show significant difference ($|z| = 0.985$, $p < 0.05$) between post-graduates and persons with 10-12 years of formal education.

Visuo-Spatial skills: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show any significant difference ($|z| = 0.138$, $p > 0.05$). When scores of persons with 10-12 years of formal education ($|z| = 0.922$, $p > 0.05$), graduates ($|z| = 1.308$, $p > 0.05$), and post-graduates ($|z| = 0.108$, $p > 0.05$) were compared between the two phases no significant differences were found.

When the four groups under years of formal education (less than 10 years, 10-12 years, graduate and post-graduate groups) were compared within phase 1, no significant difference was found ($H = 5.535$, $p > 0.05$), whereas in phase 2 significant differences were observed ($H = 15.83$, $p < 0.05$). Phase 1 scores were not analysed further as no significant difference was found in between subject effects of years of education. Further, pair-wise comparisons were done using Mann-Whitney test, as significant difference was seen in phase 2 scores. When phase 2 scores of participants with less than 10 years of education were compared with those participants with 10-12 years of education no significant differences were observed ($|z| = 1.370$, $p > 0.05$). The differences in scores of persons with 10-12 years of education (mean= 12.94), and graduate group (mean= 14.64) showed significant difference in phase 2 ($|z| = 2.391$, $p > 0.05$). Comparison of scores of graduates and post-graduates within phase 2 ($|z| = 0.839$, $p > 0.05$) did not reveal significant differences. Between post-graduates and persons with less than 10 years of formal education, the visuo-spatial scores did not differ significantly in phase 2 ($|z| = 1.757$, $p > 0.05$). Comparison of scores of graduates (mean= 14.64) and persons with less than 10 years of formal education (mean= 12.48) revealed significant difference in phase 2 ($|z| = 4.139$, $p < 0.05$). Phase 2 scores of visuo-spatial subtest did not show significant difference between post-graduates and persons with 10-12 years of formal education ($|z| = 0.83$, $p > 0.05$).

Generally all the participants showed an improvement during the study. In particular the group of participants with less than ten years of formal education showed a considerable improvement in the language and fluency subtest. The post graduates showed an improvement on the fluency subtest.

Participants with less than 10 years of education performed consistently poorer than the other participants in the study. Only minimal differences were observed between the four groups on the language subtest. This is explained by the nature of the tasks and weightage of scores in the language subtest of ACE-R. Maximal weightage of scores was given to the 'naming' task in relation to reading and writing tasks which was possibly the reason for no differences in scores of the categories (less than 10 years, 10-12 years, graduate and post-graduate groups). Apart from the language subtest differences were observed between the groups, wherein the participants with higher education performed considerably better than participants with lower levels of education. These results are in line with the large scale study by Peng, et al (1999) who reported that the number of years of education correlated well with their scores on MMSE. These authors further stated a lower risk of cognitive decline in persons with higher education levels. To support this view, in the Kungsholmen project (Fratiglioni et al., 2007), a higher percentage of dementia was reported in persons with lower education levels. A study in 1993 by Crum, Anthony, Bassett and Folstein found the mean MMSE score was 29 for individuals with at least 9 years of schooling, 26 for those with 5 to 8 years of schooling, and 22 for those with 0 to 4 years of schooling. Thus the best scores were obtained by those with a higher number of years of education. To further explain the effect of education, they reasoned that persons with higher education in turn had higher cognitive stimulation, which led to better performance, as also seen in the present study.

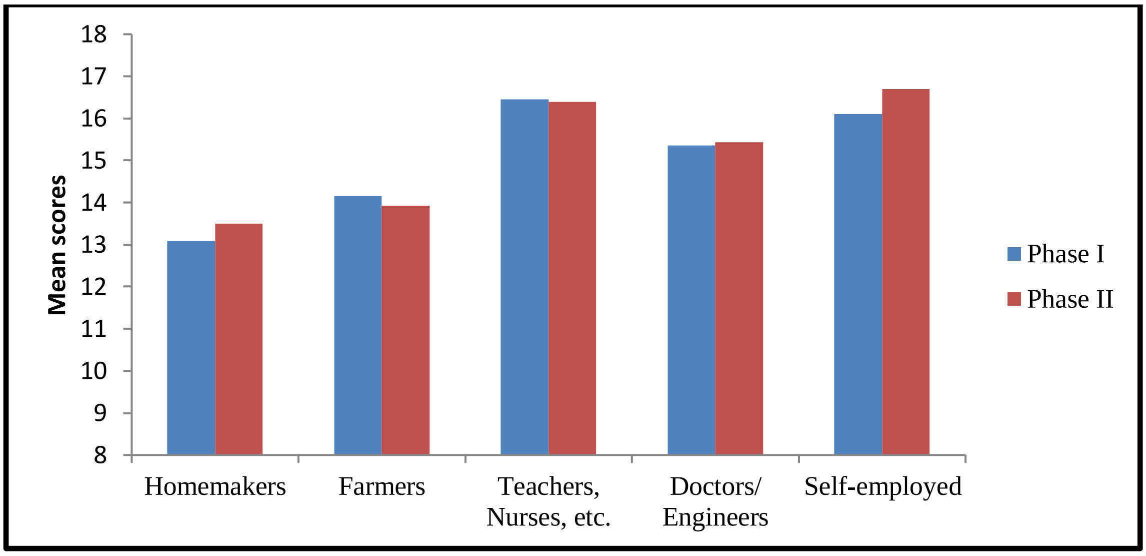
4.1.2.5. OCCUPATION: Analysis of results with occupation and phase as the independent variable.

Table 4.7: *Descriptive statistics for tasks in ACER for Occupation and phase as the independent variable (Homemakers, n= 54; Farmers, n= 25; Teachers, etc, n= 38; Doctors/ Engineers, n= 14; Self-employed, n= 10; N= 141)*

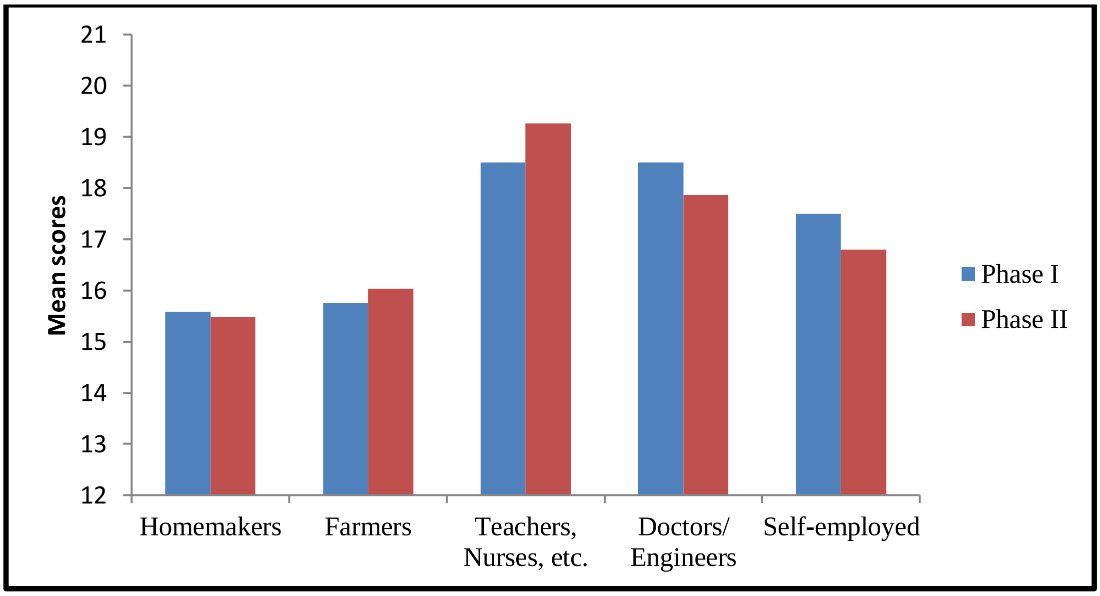
Occupation/ Subtests of ACE-R		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Homemakers	Mean	13.09	13.50	15.59	15.48	5.74	6.15	20.19	20.96	12.39	12.37
	Median	13.50	14.00	16.00	16.00	6.00	6.00	21.00	22.00	13.00	12.50
	SD	3.803	3.860	3.467	4.092	3.211	2.974	2.578	2.555	3.339	2.498
Farmers	Mean	14.16	13.92	15.76	16.04	6.08	6.68	19.96	20.40	12.24	12.20
	Median	16.00	14.00	16.00	17.00	6.00	7.00	20.00	20.00	12.00	13.00
	SD	4.170	3.894	3.908	3.576	2.414	2.462	2.761	2.198	2.818	2.887
Teachers, etc.	Mean	16.45	16.39	18.50	19.26	7.82	8.34	21.58	21.82	14.00	14.32
	Median	18.00	17.00	17.00	19.00	8.00	8.00	22.00	22.00	15.00	15.00
	SD	2.250	1.925	2.368	2.140	3.439	2.386	1.328	1.373	2.438	1.772
D/ E	Mean	15.36	15.43	18.50	17.86	6.57	6.57	21.36	21.29	15.00	14.71
	Median	17.00	17.00	19.50	19.50	6.50	6.50	21.50	21.00	16.00	16.00
	SD	4.031	3.897	3.107	3.549	3.777	3.589	1.646	1.637	1.797	1.899
Self-emp	Mean	16.10	16.70	17.50	16.80	7.80	8.50	20.60	21.70	14.40	14.70
	Median	17.00	18.00	19.00	18.50	7.00	8.00	21.00	22.00	15.00	15.50
	SD	2.998	3.129	4.601	4.237	3.155	3.064	2.547	1.829	1.506	2.541

Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-

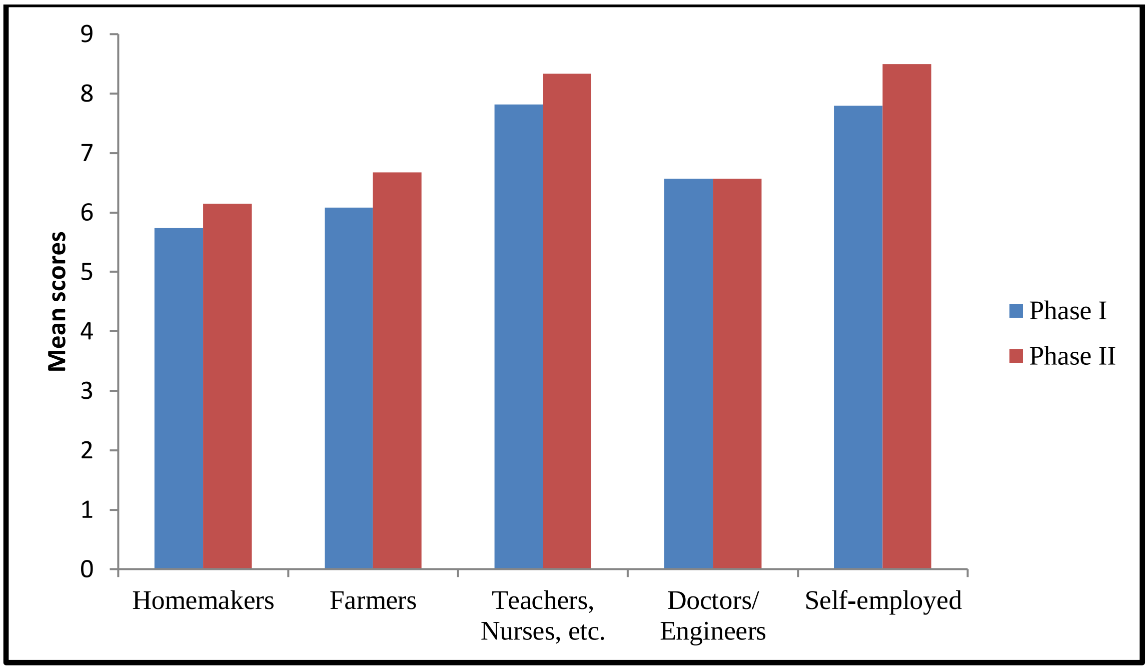
R administered after 3 months of initial testing; Homemakers= participants who were homemakers; Teachers, etc.= Professionals as teachers, bank employees or nurses; D/E= doctors or engineers; Self- emp = self-employed individuals; SD= standard deviation



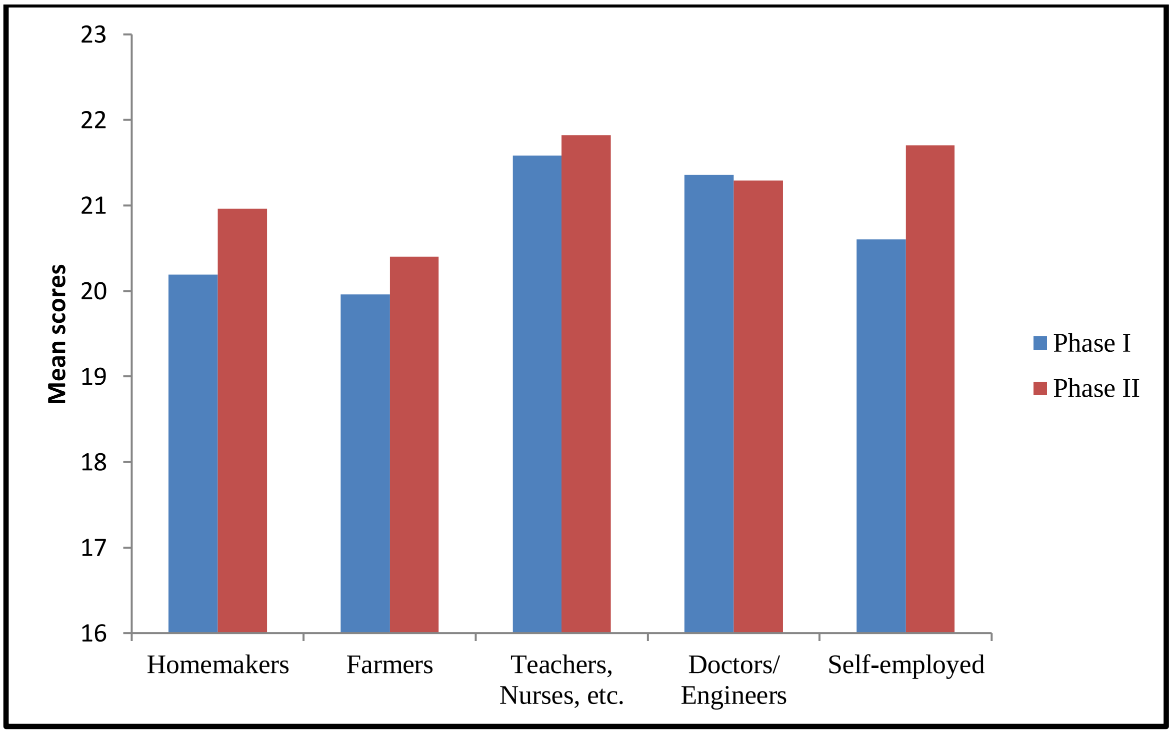
Graph 4.23: *Mean scores of A/O subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



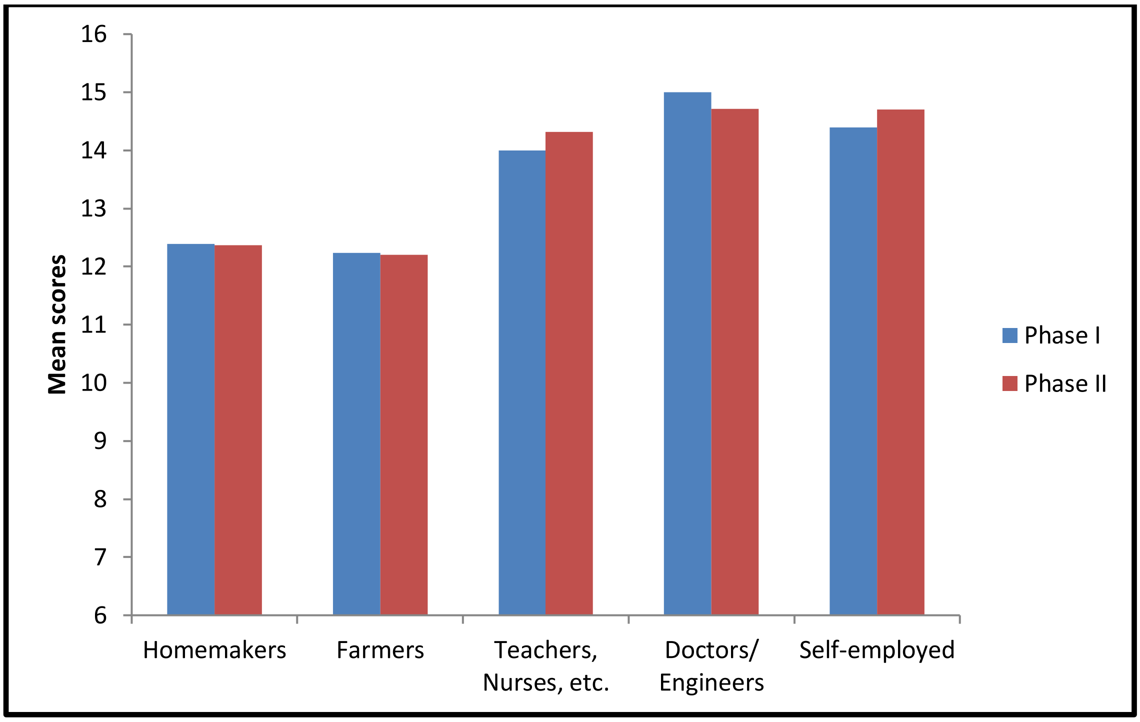
Graph 4.24: *Mean scores of Memory subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.25: *Mean scores of Fluency subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.26: *Mean scores of Language subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.27: *Mean scores of Visuo-spatial skills subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*

Attention/ orientation subtest: The participants were grouped into five categories based on their occupation which were homemakers, farmers, professionals as teachers, bank employees and nurses, doctors or engineers and self-employed individuals. Homemakers and persons with no job during their lifetime constituted the first group. This group did not show any significant differences between the two phases ($|z| = 1.251$, $p > 0.05$). The second group of persons in farming and agriculture too did not show any significant differences ($|z| = 0.066$, $p > 0.05$). Professionals as teachers, bank employees and nurses, did not show significant differences between the two phases ($|z| = 0.952$, $p > 0.05$). The participants who were doctors or engineers by profession also did not show any significant difference between the two phases ($|z| = 0.952$, $p > 0.05$). The scores of attention/ orientation subtest did not differ significantly between the two phases for the self-employed individuals ($|z| = 1.890$, $p > 0.05$).

There was a significant difference in the performance of these categories on the attention/ orientation subtest within phase 1 ($H = 23.570$, $p < 0.05$) and phase 2 ($H = 18.363$, $p < 0.05$) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons. The homemakers (mean= 13.09) as a group were compared with the self-employed individuals (mean= 16.10), and a significant difference was observed in phase 1 ($|z| = 2.474$, $p < 0.05$). Analysis of phase 2 ($|z| = 2.646$, $p < 0.05$) results also showed a significant difference between homemakers (mean= 13.50) and self-employed individuals (mean= 16.70). Comparison of scores of homemakers and doctors/ engineers indicated the difference to be significant in phase 1 ($|z| = 2.290$, $p < 0.05$), though the difference was not significant in phase 2 of the attention/ orientation subtest ($|z| = 1.787$, $p > 0.05$). Homemakers when compared to professionals as teachers, bank employees and nurses (mean= 16.45), showed significant difference in phase 1 of the subtest ($|z| = 4.522$, $p < 0.05$), and the same was seen in phase 2 ($|z| = 3.615$, $p < 0.05$) between homemakers and these professionals (mean= 16.39). Comparison of the participants who worked as farmers (mean= 14.16) with the doctors/engineers (mean= 15.36) showed no significant difference in performance on attention/orientation tasks in phase 1 ($|z| = 1.061$, $p > 0.05$). When the performance of the same farmers (mean= 13.92) was again compared with the performance of doctors/engineers (mean = 15.43) during phase 2 of the study again no significant difference was observed ($|z| = 1.251$, $p > 0.05$). A similar comparison between the farmers (mean = 14.16) and the self employed individuals (mean = 16.10) showed no significant differences in phase 1 ($|z| = 1.301$, $p > 0.05$). During phase 2 of the study however a significant difference ($|z| = 2.121$, $p < 0.05$) was observed between the categories of farmers (mean = 13.92) and self employed individuals (mean = 16.70). Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals, no significant differences were observed in phase 1 ($|z| = 0.649$, $p > 0.05$) as well as phase 2 (|z|

= 1.386, $p > 0.05$). Homemakers when compared to farmers showed no significant different in phase 1 ($|z| = 1.390$, $p > 0.05$) and phase 2 ($|z| = 0.414$, $p > 0.05$). Professionals as teachers, bank employees and nurses performed better when compared to farmers within their scores of phase 1 ($|z| = 2.384$, $p < 0.05$) and phase 2 ($|z| = 2.407$, $p < 0.05$). Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase 1 ($|z| = 0.911$, $p > 0.05$) and phase 2 ($|z| = 0.182$, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase 1 ($|z| = 0.212$, $p > 0.05$) and phase 2 ($|z| = 1.280$, $p > 0.05$).

Memory subtest: Homemakers and persons with no job during their lifetime constituted the first group. This group did not show any significant differences between the two phases ($|z| = 0.123$, $p > 0.05$). The second group of persons in farming and agriculture too did not show any significant differences ($|z| = 0.34$, $p > 0.05$). Professionals as teachers, bank employees and nurses, showed significant differences ($|z| = 2.673$, $p < 0.05$) between phase 1 (mean = 18.50) and phase 2 (mean = 19.26). The participants who were doctors or engineers by profession also did not show any significant difference between the two phases ($|z| = 1.128$, $p > 0.05$). The scores of Memory subtest did not differ significantly between the two phases for the self-employed individuals ($|z| = 0.616$, $p > 0.05$).

There was a significant difference in the performance of these categories on the Memory subtest within phase 1 ($H = 24.825$, $p < 0.05$) and phase 2 ($H = 27.020$, $p < 0.05$) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons. The homemakers (mean= 15.59) as a group were compared with the self-employed individuals (mean= 17.50), and a significant difference was observed in phase 1 ($|z| = 2.358$, $p < 0.05$). Analysis of phase 2 results however showed no significant difference ($|z| = 1.106$, $p < 0.05$) between the homemakers and self-employed individuals. Comparison of scores of homemakers (mean = 15.59)and doctors/ engineers (mean = 18.50) indicated the difference to be significant in phase 1 ($|z|$ = 2.965, $p < 0.05$), this difference between the scores of homemakers (mean = 15.48)and doctors/ engineers (mean = 17.86) was significant ($|z|$ = 2.066, $p > 0.05$). in phase 2 also. Homemakers (mean = 15.59) when compared to professionals as teachers, bank employees and nurses (mean= 18.50), showed significant difference in phase 1 of the subtest ($|z|$ = 4.245, $p < 0.05$), and the same was seen in phase 2 ($|z|$ = 4.744, $p < 0.05$) between homemakers and these professionals (mean= 19.26). Comparison of the participants who worked as farmer with the doctors/engineers showed no significant difference in performance on memory tasks in phase 1 ($|z|$ = 1.653, $p > 0.05$). When the performance of the same farmer was again compared with the performance of doctors/engineers during phase 2 of the study again no significant difference was observed ($|z|$ = 0.756, $p > 0.05$). A similar comparison between the farmers and the self employed individuals showed no significant differences in phase 1 ($|z|$ = 1.653, $p > 0.05$). During phase 2 of the study also a significant difference ($|z|$ = 0.756, $p < 0.05$) was not observed between the categories of farmers and self employed individuals. Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals, no significant differences were observed in phase 1 ($|z|$ = -0.283, $p > 0.05$).However during phase 2 there was a significant difference ($|z|$ = 2.106, $p > 0.05$) between the professionals as teachers, bank employees and nurses (mean = 18.50) with the self employed individuals (mean = 16.80). Homemakers when compared to farmers showed no significant different in phase 1 ($|z|$ = 0.308, $p > 0.05$) and phase 2 ($|z|$ = 0.386, $p > 0.05$). Professionals as teachers, bank employees and nurses performed better when compared to farmers within their scores of phase 1 ($|z|$ = 2.916, $p < 0.05$) and phase 2 ($|z|$ = 3.826, $p < 0.05$). Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase 1 ($|z|$ = 0.555, $p > 0.05$) and phase 2 ($|z|$ = -

1.303, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase 1 ($|z| = 0.6$, $p > 0.05$) and phase 2 ($|z| = 0.754$, $p > 0.05$).

Fluency subtest: Wilcoxon sign-ranks test was done to compare within the categories of occupations between the two phases. Within homemakers ($|z|= 1.369$, $p> 0.05$), farmers ($|z|= 1.437$, $p> 0.05$), professionals as teachers, bank employees ($|z|= 1.118$, $p> 0.05$), and doctors/ engineers ($|z|= 0.734$, $p> 0.05$), it was observed that there was no significant difference between phase 1 and phase 2. Only within the category of self-employed participants, significant difference was seen between phase 1 and phase 2 ($|z|= 2.646$, $p < 0.05$).

Comparison of the five categories of occupation was done using Kruskal-Wallis test. Both phase 1 ($H= 10.289$, $p < 0.05$) and phase 2 ($H= 15.805$, $p < 0.05$) showed significant differences between the categories. Next, Mann-Whitney test was done to analyse pair-wise differences. Comparison of homemakers and farmers on phase 1 ($|z|= 0.578$, $p> 0.05$) and phase 2 ($|z|= 0.928$, $p> 0.05$) of fluency subtest showed there was no significant difference between the two groups. When homemakers (mean= 5.74) were compared to professionals as teachers (mean= 7.82), significant difference was seen in phase 1 ($|z|= 2.814$, $p < 0.05$). Similarly, there was significant difference between the homemakers (mean= 6.15) and professionals as teachers (mean= 8.34) in phase 2 ($|z|= 3.586$, $p < 0.05$). Performance of farmers (mean= 6.08) compared to professionals as teachers (mean= 7.82) showed significant difference in phase 1 ($|z|= 2.076$, $p < 0.05$). There was a significant difference between farmers (mean= 6.68) and teachers/ bank employees (mean= 8.34) even on phase 2 ($|z|= 2.494$, $p < 0.05$). Comparison of teachers/ bank employees and doctors/ engineers showed no significant difference in phase 1 ($|z|= 1.140$, $p> 0.05$) and in phase 2 ($|z|= 1.644$, $p> 0.05$). Performance of doctors/ engineers in phase 1 was compared with performance of self-employed participants in phase 1 ($|z|= 0.794$, $p> 0.05$) and phase 2 ($|z|= 1.329$, $p> 0.05$). No significant difference was seen. Homemakers' performance when compared to self-employed individuals showed no significant difference in phase 1 ($|z|= 1.857$, $p> 0.05$), but showed a significant difference in phase 2 ($|z|= 2.193$, $p < 0.05$), with self-employed individuals (mean= 8.50) performing better than the homemakers (mean= 6.15). Next, scores secured by doctors/ engineers were compared to scores of homemakers. No significant differences were seen in phase 1 ($|z|= 0.662$, $p> 0.05$) and phase 2 ($|z|= 0.183$, $p> 0.05$). Similarly between doctors/ engineers and farmers, no significant differences were seen in phase 1 ($|z|= 0.251$, $p> 0.05$) and phase 2 ($|z|= 0.236$, $p> 0.05$). Next, participants who were farmers and participants who were self-employed were compared on their scores of fluency. No significant difference was seen in phase 1 ($|z|= 1.568$, $p> 0.05$) and in phase 2 ($|z|= 1.673$, $p> 0.05$). Finally, professionals as teachers, nurses, etc., were compared to the self-employed participants, and it was noticed that there is no significant difference in both phase 1 ($|z|= 0.000$, $p> 0.05$) and phase 2 ($|z|= 0.193$, $p> 0.05$) between these categories.

Language subtest: Homemakers and persons with no job during their lifetime constituted the first group. This group did not show any significant differences between the two phases ($|z| = 1.949$, $p > 0.05$). The second group of persons in farming and agriculture too did not show any significant differences ($|z| = 1.15$, $p > 0.05$). Professionals as teachers, bank employees and nurses, showed no significant differences ($|z| = 0.736$, $p > 0.05$) between the phases. The participants who were doctors or engineers by profession also did not show any significant difference between the two phases ($|z| = 0.526$, $p > 0.05$). The scores of language subtest did not differ significantly between the two phases for the self-employed individuals ($|z| = 1.801$, $p > 0.05$).

There was no significant difference in the performance of these categories on the language subtest within phase 1 ($H = 9.011$, $p < 0.05$) and phase 2 ($H = 7.968$, $p < 0.05$) on the Kruskal-Wallis test. Since no significant differences was observed between the five categories of occupation no further analysis was carried out on the same.

Visuo-Spatial skills: Wilcoxon signed ranks test was done. Homemakers did not show any significant differences between the two phases ($|z| = 0.203$, $p > 0.05$). The second group of persons in farming and agriculture too did not show any significant differences ($|z| = 0.358$, $p > 0.05$). Professionals as teachers, bank employees and nurses, did not show significant differences between the two phases ($|z| = 0.891$, $p > 0.05$). The participants who were doctors or engineers by profession also did not show any significant difference between the two phases ($|z| = 1.414$, $p > 0.05$). The scores of visuo-spatial subtest did not differ significantly between the two phases for the self-employed individuals ($|z| = 0.551$, $p > 0.05$).

There was a significant difference in the performance of these categories on the visuo-spatial subtest within phase 1 ($H = 15.222$, $p < 0.05$) and phase 2 ($H = 25.948$, $p < 0.05$) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons.

The visuo-spatial skills of homemakers (mean= 12.37) were compared with the self-employed individuals (mean= 14.70), and a significant difference was observed in phase 2 scores ($|z| = 2.526$, $p < 0.05$), whereas in phase 1, this pair did not show a significant difference ($|z| = 1.469$, $p > 0.05$). Comparison of scores of homemakers (mean= 12.39) and doctors/ engineers (mean= 15.00) indicated the difference to be significant in phase 1 ($|z| = 2.702$, $p < 0.05$). The difference in phase 2 between homemakers (mean= 12.37) and doctors/ engineers (mean= 14.71) was also found to be significant ($|z| = 3.316$, $p > 0.05$).

Homemakers when compared to professionals as teachers, bank employees and nurses (mean= 14.00) in phase 1, showed significant difference in the visuo-spatial subtest ($|z| = 1.981$, $p < 0.05$), and the same was seen in phase 2 ($|z| = 3.880$, $p < 0.05$) between homemakers and these professionals (mean= 14.32). Comparison of the participants who worked as farmers (mean= 12.24) with the doctors/engineers (mean= 15.00) showed significant difference in performance on visuo-spatial tasks in phase 1 ($|z| = 3.165$, $p < 0.05$). When the performance of the same farmers (mean= 12.20) was again compared with the performance of doctors/engineers (mean = 14.71) during phase 2 of the study again significant difference was observed ($|z| = 2.788$, $p < 0.05$). Similarly, a comparison between the farmers (mean = 12.24) and the self employed individuals (mean = 14.40) showed significant difference in phase 1 ($|z| = 2.011$, $p < 0.05$). During phase 2 of the study, visuo-spatial skills of farmers (mean = 12.20) and self-employed individuals (mean = 14.70) again showed a significant difference ($|z| = 2.213$, $p < 0.05$). Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals, no significant differences were observed in phase 1 ($|z| = 0.117$, $p > 0.05$) as well as phase 2 ($|z| = 0.588$, $p > 0.05$). Homemakers when compared to farmers showed no significant different in phase 1 ($|z| = 0.458$, $p > 0.05$) and phase 2 ($|z| = 0.191$, $p > 0.05$). Professionals as teachers, bank employees and nurses performed better when compared to farmers within their scores of phase 1 ($|z| = 2.414$, $p < 0.05$) and phase 2 ($|z| = 2.969$, $p < 0.05$). Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase 1 ($|z| = 1.908$, $p > 0.05$) and phase 2 ($|z| = 1.031$, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase 1 ($|z| = 1.675$, $p > 0.05$) and phase 2 ($|z| = 0.125$, $p > 0.05$).

Within the categories of occupations, slight variations are present in the scores of phase II from phase I. Notably, a significant improvement was seen in the teachers, bank employees, etc, and the self-employed participants in the memory and fluency subtests respectively. A clear difference in the performance of each of the categories of occupation was observed in the results of ACE-R. Homemakers were found to perform poorer than farmers, who in turn performed poorer than self-employed participants and doctors/ engineers. Professionals as teachers, bank employees and nurses were observed to consistently perform best on the tasks in ACE-R. These variations in scores are in support with the findings in literature that persons whose work demanded more mental effort than manual effort, showed an increased stability of cognitive functions throughout their lifetime (Huadong et.al., 2003). Salthouse (2006) used the term 'preserved differentiation' to further explain this idea that persons with more complex occupations demonstrated better performance on cognitive tests. This hypothesis was also supported by authors Finkel, Andel, Gatz and Pedersen (2009), and stated that persons in occupation requiring greater mental effort performed better on verbal, spatial and speed tasks. Nevertheless there is literature support stating a weak but direct correlation between physical activity and cognitive performance on cognitive tests (Psaltopoulou et. al., 2008). The professionals as teachers, bank employees and nurses might have had an ideal balance of mental effort and physical activity in their work and thus demonstrating a better performance than other occupational categories.

Although clear differences were seen in the performance of the various occupation on the subtests of ACE-R, on the language subtest these differences were not evident. As has been mentioned earlier in this section, the confrontation naming task in the language subtest of ACE-R received more weightage than the language comprehension, reading and writing tasks. Owing to the task simplicity, all participants performed similarly well on the naming test, and in turn no group differences were observed on the language subtest.

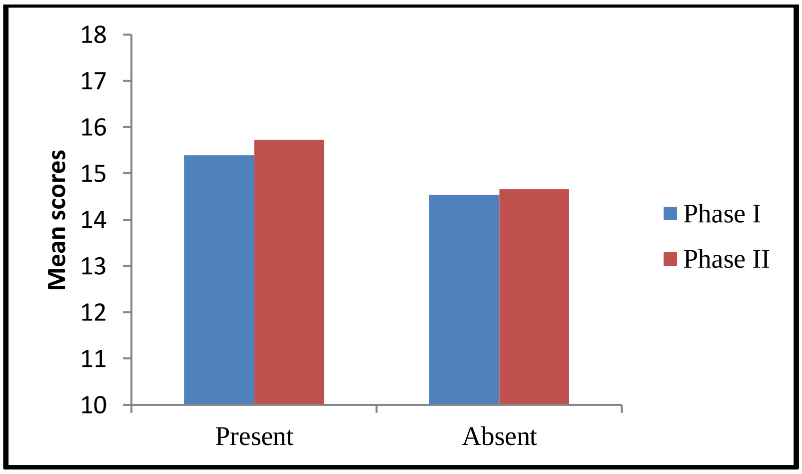
4.1.3. Analysis of cognitive communication skills with reference to co-existing medical conditions.

4.1.3.1. CARDIAC ISSUES: Analysis of results with cardiac issues and phase as the independent variable.

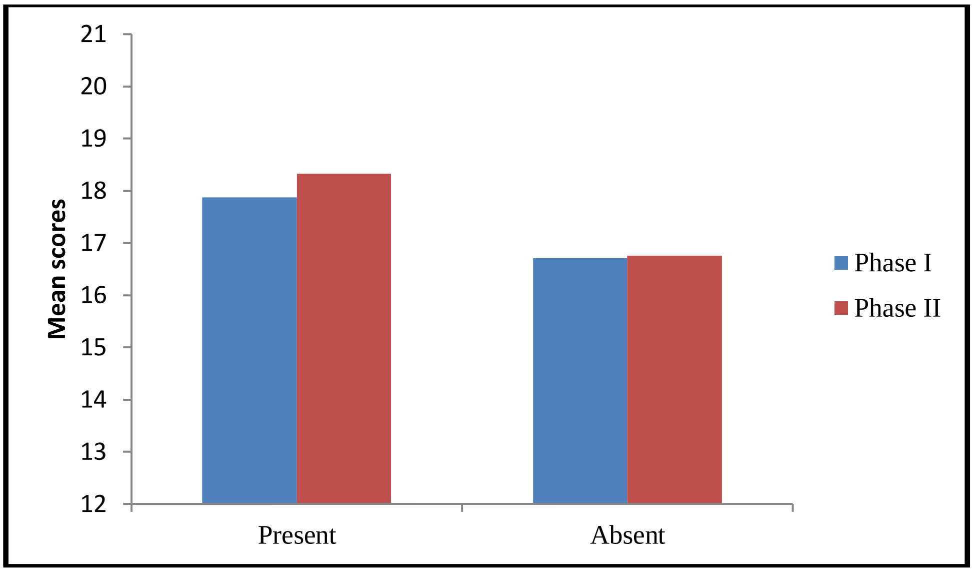
Table 4.8: *Descriptive statistics for subtests of ACER for Cardiac issues and phase as the independent variable (cardiac issues present, n= 15; cardiac issues absent, n=126; N= 141)*

Cardiac issues		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	15.40	15.73	17.87	18.33	8.60	9.13	21.20	21.53	13.80	14.00
	Median	17.00	17.00	18.00	20.00	10.00	10.00	22.00	22.00	15.00	15.00
	SD	3.334	2.712	2.973	3.331	2.971	2.232	1.699	1.767	2.366	2.563
Absent	Mean	14.53	14.66	16.71	16.76	6.35	6.79	20.60	21.13	13.13	13.17
	Median	16.00	16.00	18.00	17.50	6.00	7.00	21.00	22.00	14.00	14.00
	SD	3.779	3.695	3.629	3.850	3.255	2.924	2.387	2.166	2.996	2.552

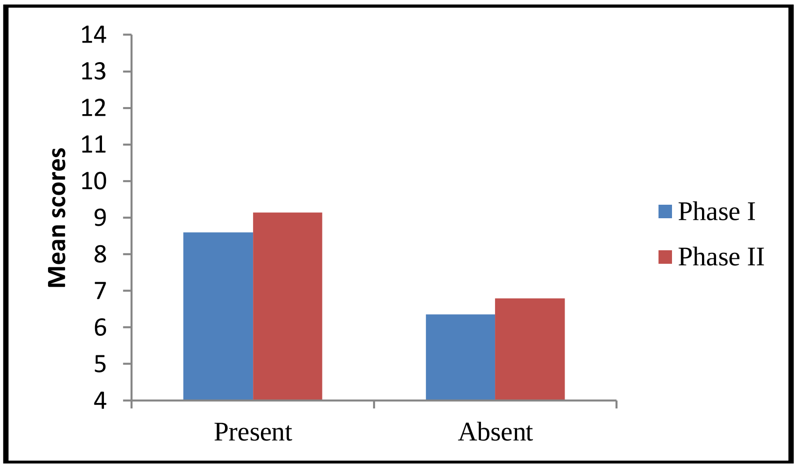
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; SD= standard deviation



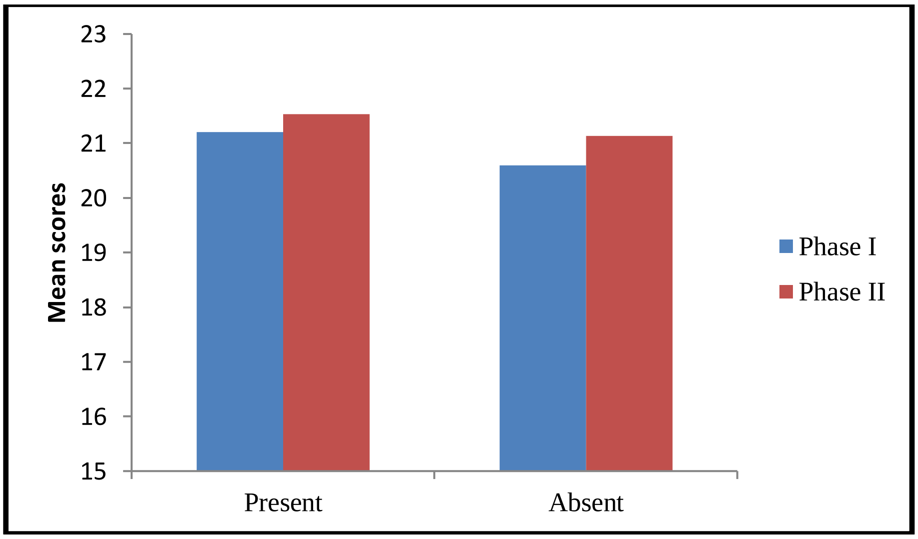
Graph 4.28: *Mean scores of A/O subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



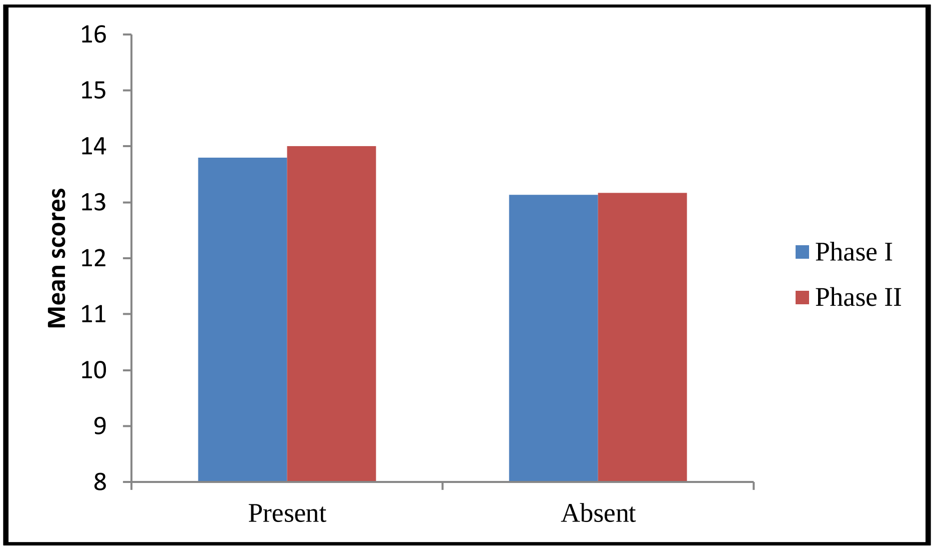
Graph 4.29: *Mean scores of Memory subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



Graph 4.30: *Mean scores of Fluency subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



Graph 4.31: *Mean scores of Language subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



Graph 4.32: *Mean scores of Visuo-spatial skills subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*

Attention/ orientation subtest: The participants who reported to have cardiac issues were grouped into a category and were compared on their scores for attention/orientation between the two phases of the study. This analysis was done using the Wilcoxon signed ranks test and no significant results ($|z| = 0.434$, $p > 0.05$) were obtained. A similar analysis to compare the participants with no cardiac issues also showed no significant differences ($|z| = 1.039$, $p > 0.05$) between the two phases.

The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase 1 ($|z| = 0.752$, $p > 0.05$) and during phase 2 ($|z| = 0.916$, $p > 0.05$) no significant differences were observed between the two categories.

Memory subtest: The participants who reported to have cardiac issues were grouped into a category and were compared on their scores for memory between the two phases of the study. This analysis was done using the Wilcoxon signed ranks test and no significant results ($|z| = 0.975$, $p > 0.05$) were obtained. A similar analysis to compare the participants with no cardiac issues also showed no significant differences ($|z| = 0.45$, $p > 0.05$) between the two phases.

The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase 1 ($|z|$ = 0.979, $p > 0.05$) and during phase 2 ($|z|$ = 1.454, $p > 0.05$) no significant differences were observed between the two categories.

Fluency subtest: When Wilcoxon signed ranks test was done to analyze the within subject effects in participants with and without cardiac issues, it was observed that participants with cardiac issues showed no significant difference between phase 1 and phase 2 ($|z|$= 1.513, $p > 0.05$). In those participants whom there was no cardiac issue, showed a significant difference from phase 1 to phase 2 ($|z|$= 2.124, $p < 0.05$).

The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems within both the phases. During phase 1 ($|z|$ = 2.387, $p < 0.05$) there was a significant difference between participants with cardiac issues (mean= 8.60) and those without cardiac issues (mean= 6.35). Even during phase 2 ($|z|$ = 2.895, $p < 0.05$) a significant difference was observed between the participants with cardiac issues (mean= 9.13) and those without (mean= 6.79).

Language subtest: The participants who reported to have cardiac issues were grouped into a category and were compared on their scores for memory between the two phases of the study. This analysis was done using the Wilcoxon signed ranks test and no significant results ($|z|$ = 0.571, $p > 0.05$) were obtained. A similar analysis to compare the participants with no cardiac issues showed significant differences ($|z|$ = 2.43, $p < 0.05$) between the two phases.

The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase 1 ($|z|$ = 0.683, $p > 0.05$) and during phase 2 ($|z|$ = 0.803, $p > 0.05$) no significant differences were observed between the two categories.

Visuo-Spatial subtest: The participants who reported to have cardiac issues were grouped into a category and were compared on their scores for visuo-spatial skills between the two phases of the study. Wilcoxon signed ranks test was used for analysis. No significant differences ($|z| = 0.159$, $p > 0.05$) were obtained within persons with cardiac issues. A similar analysis to compare the participants with no cardiac issues also showed no significant differences ($|z| = 0.082$, $p > 0.05$) between the two phases.

The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase 1 ($|z| = 0.564$, $p > 0.05$) and during phase 2 ($|z| = 1.388$, $p > 0.05$) no significant differences were observed between the two categories.

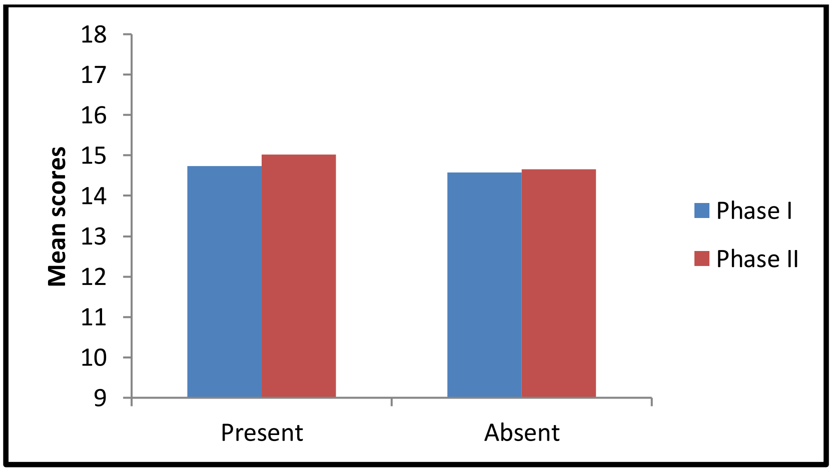
On careful examination of the results it was evident that participants with cardiac issues were able to just maintain their performance in all subtests of ACE-R on repeated serial assessment after three months. The participants with no cardiac issues however showed an improvement in the score for the language related subtests of fluency and language and maintained their performance in cognitively loaded subtests. No differences in performance of participants with and without cardiac issues present were observed on the ACE-R subtests. A study done by Elliott et. al. (2010) examined pre-surgical cognitive function in candidates for coronary artery bypass graft surgery (CABGS) and demonstrated reductions in attention, verbal fluency, and memory when compared with healthy elderly. The participants in our study however had undergone various cardiac related surgeries in the past and seem to show no long term effects on their cognitive abilities in the present. This may due to several reasons. Successful recovery from cardiac issues could have resulted in performance of the participants with cardiac issues to be on par with those having no cardiac issues. Secondly, the participants had limited knowledge about specific cardiac issues/surgeries that they had undergone. Details regarding cardiac issues were more ambiguous than when compared to other health concerns such as diabetes or hypertension wherein the participants were sure about specificities such as type, presence or absence. Thirdly, cardiac issues are by nature broad in its severity and type and hence require a more detailed approach to elicit its effects on cognitive-linguistic performance.

4.1.3.2. DIABETES: Analysis of results with diabetes and phase as the independent variable.

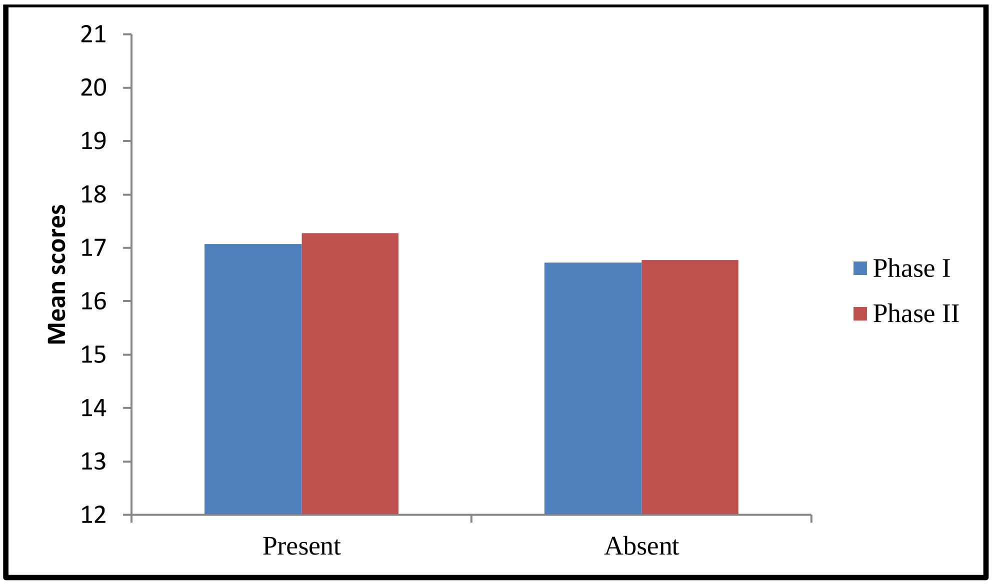
Table 4.9: *Descriptive statistics for subtest of ACER for Diabetes and phase as the independent variable (*Diabetes *present, n= 44;* Diabetes *absent, n=97; N= 141)*

Diabetes		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	14.73	15.02	17.07	17.27	7.09	7.73	20.52	21.02	13.61	13.30
	Median	16.00	16.00	18.00	19.00	7.00	8.00	21.00	22.00	15.00	14.00
	SD	3.967	3.527	3.467	3.812	3.198	2.697	2.454	2.367	2.847	2.368
Absent	Mean	14.58	14.66	16.72	16.77	6.36	6.73	20.73	21.25	13.01	13.25
	Median	16.00	16.00	16.00	18.00	6.00	6.00	21.00	22.00	14.00	14.00
	SD	3.642	3.660	3.634	3.831	3.323	3.009	2.275	2.016	2.970	2.650

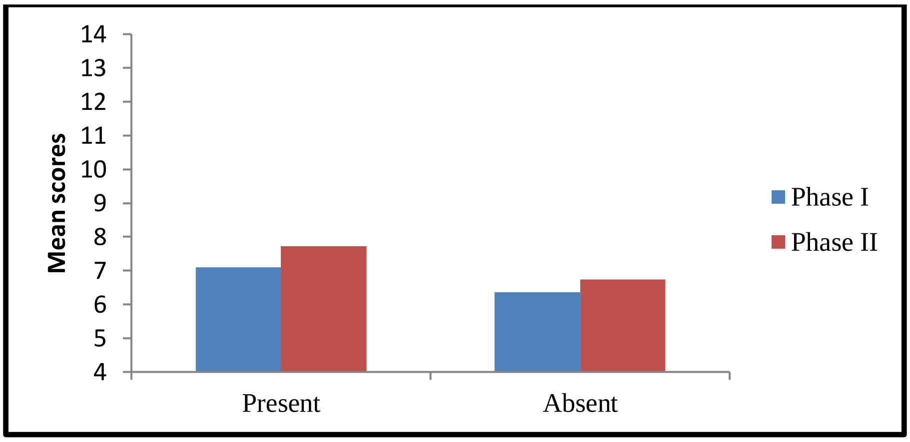
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; SD= standard deviation



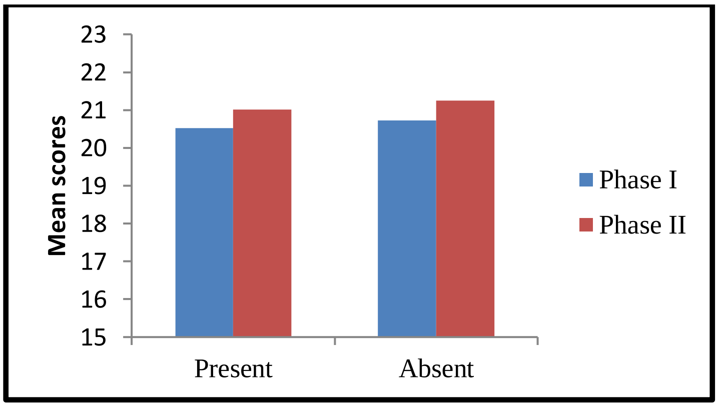
Graph 4.33: *Mean scores of A/O subtest between the phases for participants who had diabetes and those who did not have diabetes*



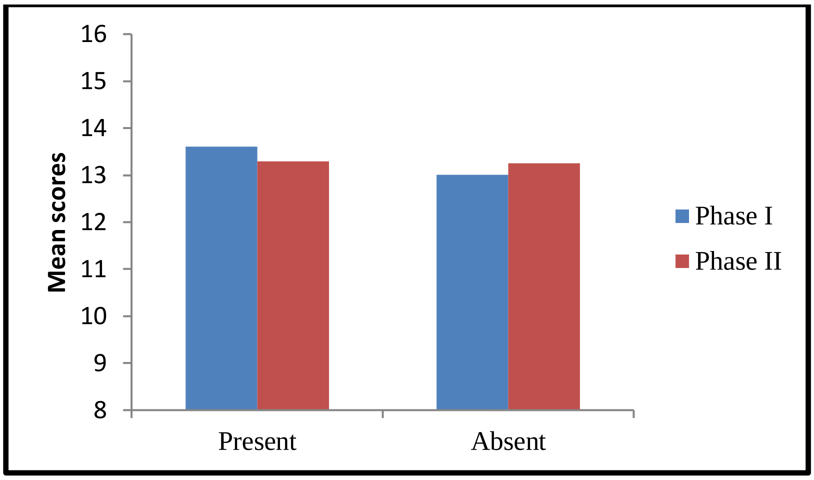
Graph 4.34: *Mean scores of Memory subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.35: *Mean scores of Fluency subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.36: *Mean scores of Language subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.37: *Mean scores of Visuo-spatial skills subtest between the phases for participants who had diabetes and those who did not have diabetes*

Attention/ orientation subtest: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase 2 and no significant difference (|z| = 0.622, p > 0.05) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences (|z| = 1.017, p > 0.05). In phase 1 comparison of persons with and without diabetes showed no significant differences (|z| = 0.518, p > 0.05). Comparison of these two categories for performance on phase 2 (|z|= 0.46, p > 0.05) of the study also showed no significant differences.

Memory subtest: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase 2 and no significant difference (|z| = 0.812, p > 0.05) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences (|z| =0.284, p > 0.05). In phase 1 comparison of persons with and without diabetes showed no significant differences (|z| = 0.558, p > 0.05). Comparison of these two categories for performance on phase 2 (|z|= 0.746, p > 0.05) of the study also showed no significant differences.

Fluency subtest: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase 2 and no significant difference ($|z| = 1.862$, $p > 0.05$) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences ($|z| = 1.668$, $p > 0.05$). In the first phase, comparison of persons with and without diabetes showed no significant difference ($|z| = 1.202$, $p > 0.05$). Comparison of these two categories for performance on phase 2 of the study also showed no significant differences ($|z| = 1.812$, $p > 0.05$).

Language subtest: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase 2 and no significant difference ($|z| = 1.29$, $p > 0.05$) was observed. However on comparison of scores of the participants with no diabetes during the two phases a significant difference was observed ($|z| = 2.08$, $p > 0.05$). In phase 1 comparison of persons with and without diabetes showed no significant differences ($|z| = 0.585$, $p > 0.05$). Comparison of these two categories for performance on phase 2 ($|z| = 0.23$, $p > 0.05$) of the study also showed no significant differences.

Visuo-Spatial skills: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase 2 and no significant difference ($|z| = 1.350$, $p > 0.05$) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences ($|z| = 1.136$, $p > 0.05$). In phase 1 comparison of persons with and without diabetes showed no significant differences ($|z| = 0.969$, $p > 0.05$). Comparison of these two categories for performance on phase 2 ($|z| = 0.126$, $p > 0.05$) of the study also showed no significant differences.

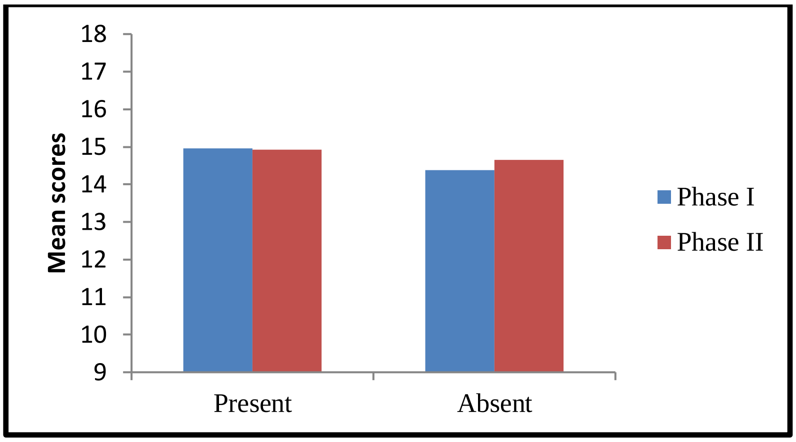
In our study both participants with and without diabetes were able maintain their performance levels on all subtests of ACE-R except the language subtest wherein participants without diabetes improved their scores. Also no evident cognitive differences were observed between persons with diabetes and those without diabetes. A study done by Spauwen et. al. (2013) gives us evidence that the period of having diabetes is an important factor since it was proved that persons with diabetes since only a short duration did not show any conclusive difference in their cognitive performances compared to those without diabetes. Psaltopoulou et. al. (2008) also found the performance of persons with diabetes to be only very slightly inferior to a control group of elderly persons.

4.1.3.3. HYPER/ HYPOTENSION: Analysis of results with blood pressure issues and phase as the independent variable.

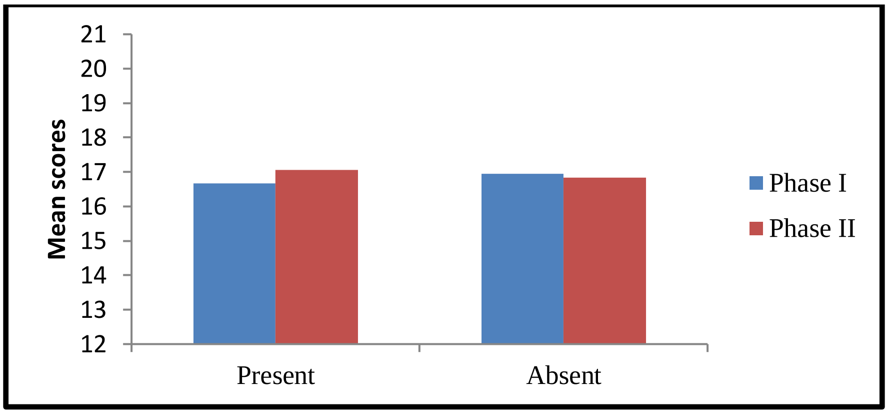
Table 4.10: *Descriptive statistics for subtest of Attention/ orientation subtest in ACER for Blood pressure issues (Blood pressure issues present, n= 60; Blood pressure issues absent, n=81; N= 141)*

Blood pressure issues		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	14.95	14.93	16.67	17.05	6.33	6.98	20.55	21.15	13.37	13.35
	Median	16.00	16.00	18.00	17.50	6.00	7.00	21.00	22.00	14.50	14.00
	SD	3.422	3.414	3.462	3.802	3.208	2.613	2.012	2.106	2.786	2.392
Absent	Mean	14.38	14.65	16.95	16.84	6.78	7.09	20.75	21.20	13.07	13.20
	Median	16.00	16.00	18.00	18.00	7.00	7.00	21.00	22.00	14.00	14.00
	SD	3.951	3.766	3.670	3.852	3.358	3.179	2.542	2.153	3.053	2.685

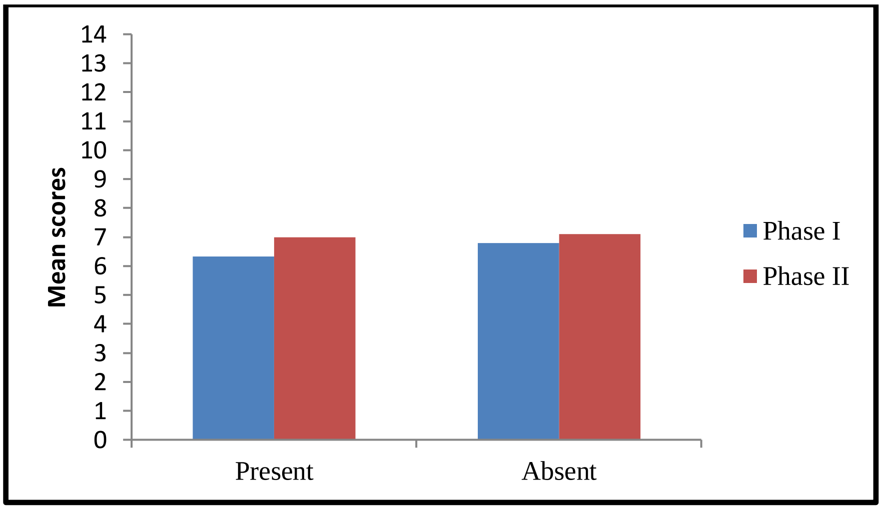
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; SD= standard deviation



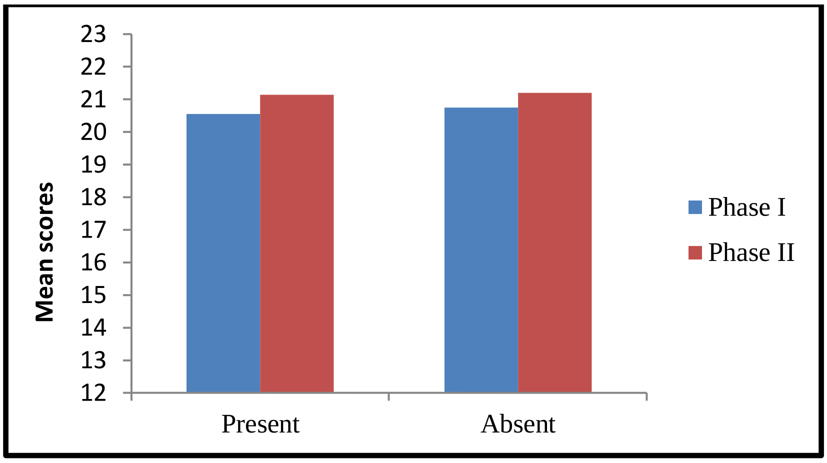
Graph 4.38: *Mean scores of A/O subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



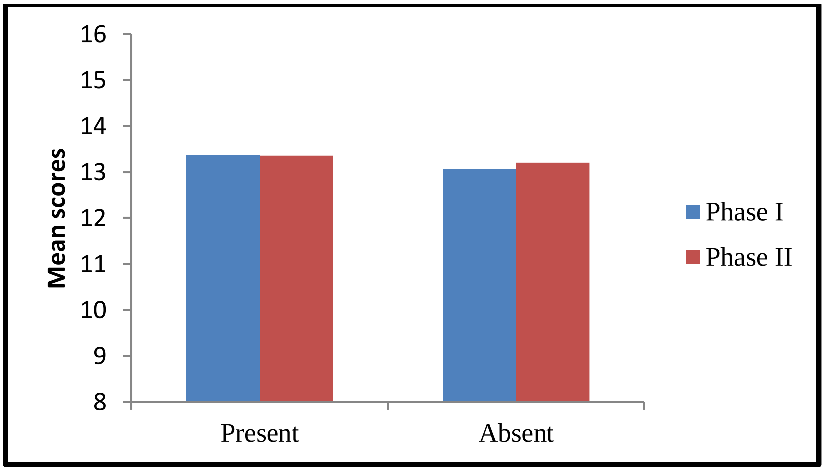
Graph 4.39: *Mean scores of Memory subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



Graph 4.40: *Mean scores of Fluency subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



Graph 4.41: *Mean scores of Language subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



Graph 4.42: *Mean scores of Visuo-spatial skills subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*

Attention/ orientation subtest: Participants who reported to have blood pressure issues were compared for their scores on attention/orientation during phase 1 and during phase 2, as observed through the Wilcoxon signed ranks test no significant differences ($|z|= 0.118$, $p > 0.05$) were observed during the two phases. A similar analysis of the participants with no blood pressure issues also showed no significant differences ($|z|= 1.507$, $p > 0.05$) between phase 1 and phase 2. When the participants with and without blood pressure issues during phase 1 were compared using the Mann-Whitney test no significant differences ($|z|= 0.556$, p

> 0.05) were observed. During phase 2 of the study also no significant differences were observed between the two groups (|z|= 0.138, p > 0.05).

Memory subtest: Participants with blood pressure issues were compared for their scores on Memory/orientation during phase 1 and during phase 2, as observed through the Wilcoxon signed ranks test no significant differences (|z|= 1.518, p > 0.05) were observed during the two phases. A similar analysis of the participants with no blood pressure issues also showed no significant differences (|z|= 0.399, p > 0.05) between phase 1 and phase 2. When the participants with and without blood pressure issues during phase 1 were compared using the Mann-Whitney test no significant differences (|z|= 0.659, p > 0.05) were observed. During phase 2 of the study also no significant differences were observed between the two groups (|z|= 0.353, p > 0.05).

Fluency subtest: Participants who reported to have blood pressure issues were compared for their scores on fluency subtest during phase 1 and during phase 2. As observed through the Wilcoxon signed ranks test, a significant difference (|z|= 2.319, p < 0.05) was observed between the two phases. In participants with no blood pressure issues, significant difference between phase 1 and phase 2 was not observed (|z|= 1.118, p > 0.05). When the participants with and without blood pressure issues during phase 1 were compared using the Mann-Whitney test no significant differences (|z|= 0.806, p > 0.05) was observed. Also during phase 2 of the study, no significant difference was observed between the two groups (|z|= 0.187, p > 0.05).

Language subtest: Participants who reported to have blood pressure issues were compared for their scores on language during phase 1 and during phase 2, as observed through the Wilcoxon signed ranks test no significant differences (|z|= 1.907, p > 0.05) were observed during the two phases. A similar analysis of the participants with no blood pressure issues also showed no significant differences ($|z|= 1.523$, $p > 0.05$) between phase 1 and phase 2. When the participants with and without blood pressure issues during phase 1 were compared using the Mann-Whitney test no significant differences ($|z|= 1.237$, $p > 0.05$) were observed. During phase 2 of the study also no significant differences were observed between the two groups ($|z|= 0.571$, $p > 0.05$).

Visuo-Spatial skills: As observed through the Wilcoxon signed ranks test, the participants who reported to have blood pressure issues showed no significant differences between phase 1 and phase 2, ($|z|= 0.187$, $p > 0.05$). A similar analysis of the participants with no blood pressure issues also showed no significant differences ($|z| = 0.307$, $p > 0.05$) between phase 1 and phase 2. When the participants with and without blood pressure issues during phase 1 were compared using the Mann-Whitney test no significant differences ($|z|= 0.436$, $p > 0.05$) were observed. During phase 2 of the study also no significant differences were observed between the two groups ($|z|= 0.192$, $p > 0.05$).

In effect our results showed no significant difference in the performance of participants with and without hyper/hypotension. Previous research done to study the effect of hyper/hypotension on cognition by Petrovich, et. al. (2000) found long-standing hypertension to be associated with more numbers of senile plaques, a lower brain weight, and large numbers of neuro-fibrillary tangles all indicators of reduced cognitive performance and possible dementia. In our study, although a considerable difference was not observed, a slight difference was seen differentiating the participants with and without hyper/hypotension. The participants without hyper/hypotension performed better on verbal fluency and language subtests of ACE-R, than those participants with hyper/hypotension.

On the whole, the presence of hyper/hypotension did not stand out as a key factor that affected cognitive functions of the participants in our study. These results are in line with the earlier studies that report absence of any relation between cognitive functions and hyper/hypotension (Scherr, Hebert, Smith & Evans, 1991; Psaltopoulou et. al., 2008; Desmond, Tatemichi, Paik & Stern, 1993; Hebert, Scherr, Bennett, Bienias, Wilson, Morris & Evans, 2004).

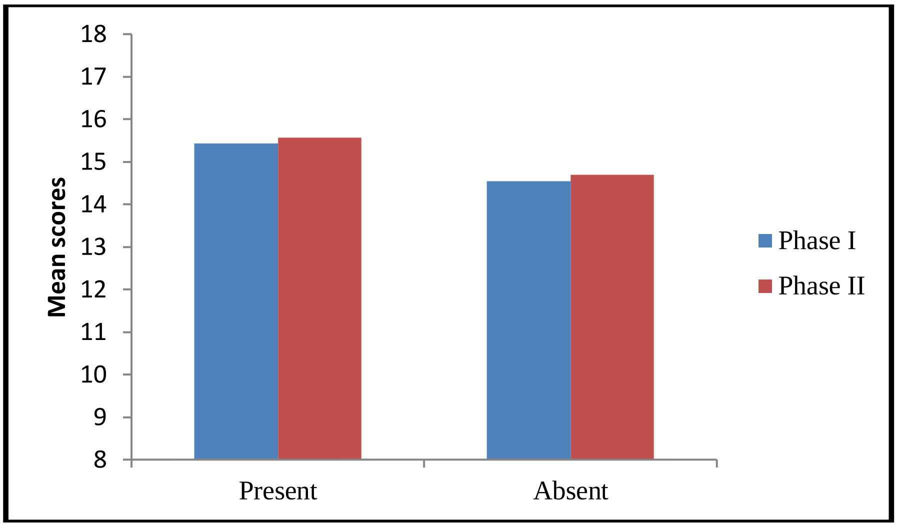
4.1.4. Analysis of cognitive communication skills with reference to habits.

4.1.4.1. SMOKING: Analysis of results with smoking habits and phase as the independent variable.

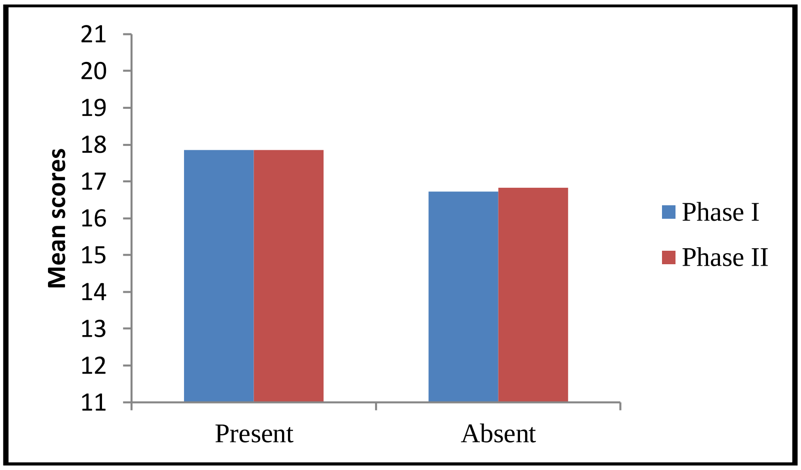
Table 4.11.: *Descriptive statistics for subtests of ACER with phase and Smoking habits as independent variables (Present, n= 14; Absent, n=127; N= 141)*

Smoking habits		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	15.43	15.57	17.86	17.86	6.64	7.29	20.64	21.50	13.93	14.29
	Median	17.50	17.50	19.00	19.50	7.00	7.00	20.50	21.50	15.00	14.50
	SD	4.108	3.936	3.183	3.800	3.500	2.701	1.946	1.092	2.336	1.590
Absent	Mean	14.54	14.69	16.72	16.83	6.58	7.02	20.67	21.14	13.12	13.15
	Median	16.00	16.00	18.00	17.00	6.00	7.00	21.00	22.00	14.00	14.00
	SD	3.696	3.578	3.608	3.822	3.282	2.976	2.371	2.210	2.991	2.622

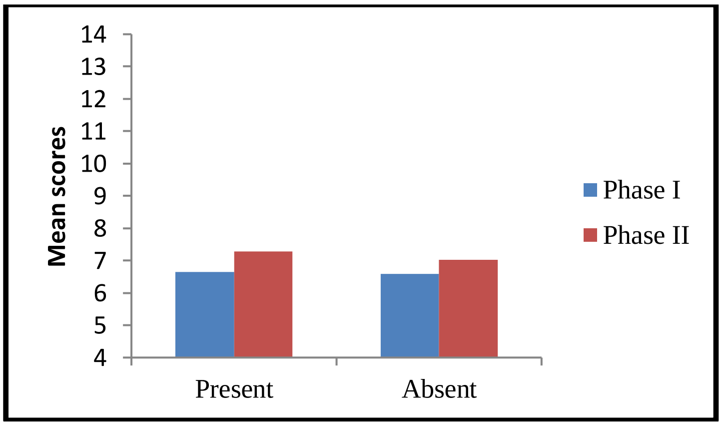
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; Present = participants who were smokers; absent = participants who had no smoking habits; SD= standard deviation



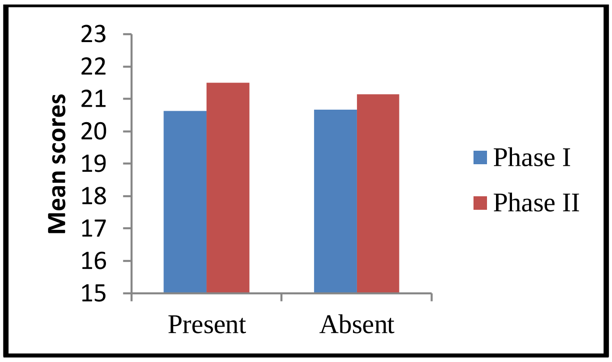
Graph 4.43: *Mean scores of A/O subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



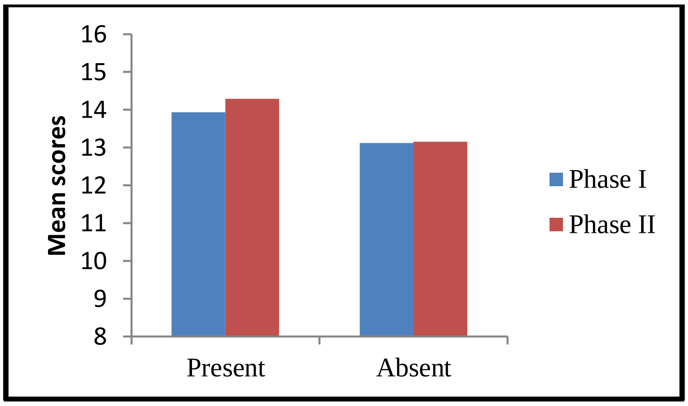
Graph 4.44: *Mean scores of Memory subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.45: *Mean scores of Fluency subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.46: *Mean scores of Language subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.47: *Mean scores of Visuo-spatial skills subtest between the phases for participants who had smoking habits and those who did not have smoking habits*

Attention/ orientation subtest: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase 1 and phase 2 of the stud. This was analysed using the Wilcoxon signed ranks test. No significant difference was observed for the smokers ($|z|= 0.952$, $p > 0.05$) as well as the non smokers ($|z|= 0.941$, $p > 0.05$). Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase 1 ($|z|= 1.326$, $p > 0.05$) as well phase 2 ($|z|= 1.285$, $p > 0.05$) of the study.

Memory subtest: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase 1 and phase 2 of the stud. This was analysed using the Wilcoxon signed ranks test. No significant difference was observed for the smokers (|z|= 0.709, $p > 0.05$) as well as the non smokers (|z|= 0.529, $p > 0.05$). Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase 1 (|z|= 1.27, $p > 0.05$) as well phase 2 (|z|= 1.107, $p > 0.05$) of the study.

Fluency subtest: Participants who reported of smoking habits and the non smokers were analysed for any differences in performance between phase 1 and phase 2 of the fluency subtest. No significant difference was observed for the smokers (|z|= 1.196, $p > 0.05$). Although in non-smokers, a significant difference was seen between phase 1 and 2 (|z|= 2.144, $p < 0.05$). Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase 1 (|z|= 0.055, $p > 0.05$) as well phase 2 (|z|= 0.201, $p > 0.05$) of the fluency subtest.

Language subtest: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase 1 and phase 2 of the stud. This was analysed using the Wilcoxon signed ranks test. No significant difference was observed for the smokers (|z|= 1.368, $p > 0.05$). The non smokers however showed a significant difference (|z|= 2.125, $p > 0.05$) in performance during the two phases of the study. Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase 1 (|z|= 0.399, $p > 0.05$) as well phase 2 (|z|= 0.053, $p > 0.05$) of the study.

Visuo-Spatial skills: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase 1 and phase 2 of the study. This was analysed using the Wilcoxon sign rank test. No significant difference was observed for the smokers ($|z|= 0.318$, $p > 0.05$) as well as the non smokers ($|z|= 0.056$, $p > 0.05$). Mann-Whitney test was done to examine if there was any difference in performance on visuo-spatial subtest, for the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase 1 ($|z|= 0.609$, $p > 0.05$) as well phase 2 ($|z|= 1.361$, $p > 0.05$) of the study.

The participants with a history of smoking habits and the non-smokers performed similarly on all the cognitive linguistic tasks of ACE-R. On observation of the results of subtests of ACE-R, the participants with a history of smoking habits did not show an improvement or decline in their performance during the 3 month period of the study. The findings in the study by Psaltopoulou, et. al. (2008) are in support with the findings in the present study, wherein they found no significant association between smoking habits and MMSE scores. On the language based tasks, the non-smokers showed considerable improvement in their scores on the fluency and language subtests.

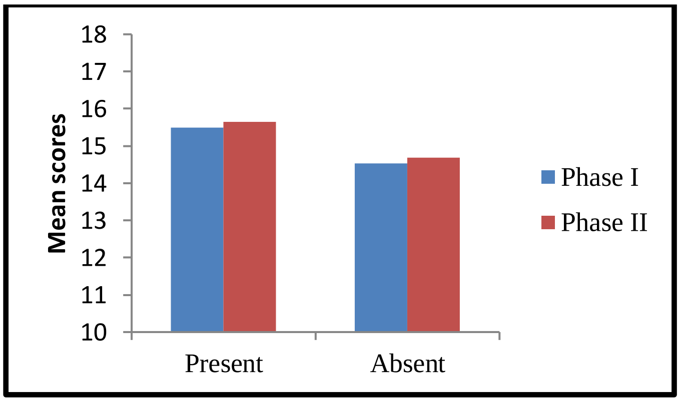
Although there a large number of studies reported with findings of a significant correlation between smoking habits and cognitive decline, our findings do not corroborate with these studies. A majority of these studies have reported their findings on active smokers. Whereas in our study, it is to be noted that the participants who were considered in the group of smokers are not currently active smokers. Hence this could possibly account for no evident differences in cognitive linguistic scores between the smokers and the non smokers. This inference in our study has been supported by the results of the study by Huadong et. al. (2003) wherein the prevalence of cognitive impairment in participants who never smoked was 5.3 percent. In those participants who were past smokers, the prevalence was 4.5 percent and, in those who were active smokers, it was 11.8 percent. On a careful analysis of the results it was observed that 92% of the participants with a past history of smoking were also multilinguals or bilinguals. 56% of participants with habits of smoking were in occupations which required a greater mental effort. These demographic advantages in the group of participants with habits of smoking could account for their performance being on par with the group of non smokers.

4.1.4.2. ALCOHOL CONSUMPTION: Analysis of results with alcoholism and phase as the independent variable.

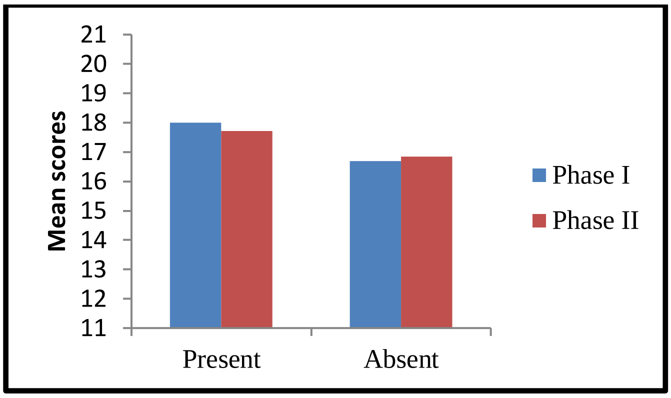
Table 4.12.: *Descriptive statistics for subtests of ACER with phase and Alcohol habits as independent variables (Present, n= 14; Absent, n=127; N= 141)*

Alcohol habits		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	15.50	15.64	18.00	17.71	6.86	7.14	20.79	21.50	14.29	14.64
	Median	17.50	18.00	19.00	19.50	7.00	7.00	21.00	21.50	15.00	15.00
	SD	4.128	3.973	3.282	3.970	3.613	3.085	1.888	1.092	2.431	1.692
Absent	Mean	14.53	14.68	16.70	16.84	6.56	7.03	20.65	21.14	13.08	13.11
	Median	16.00	16.00	18.00	18.00	6.00	7.00	21.00	22.00	14.00	14.00
	SD	3.692	3.572	3.593	3.808	3.268	2.938	2.375	2.210	2.970	2.595

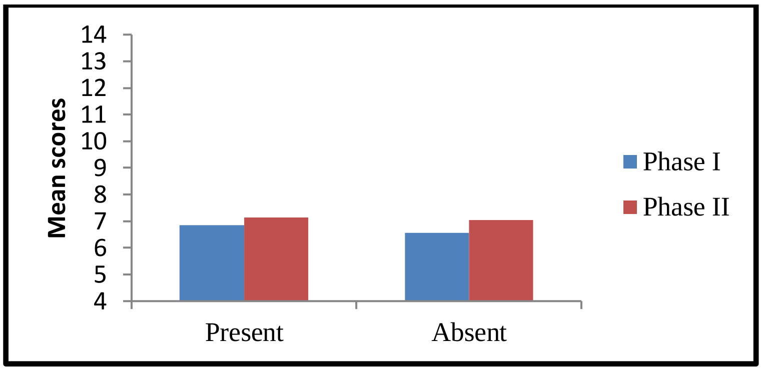
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; Present = participants who consumed alcohol; Absent = participants who did not consume alcohol; SD= standard deviation



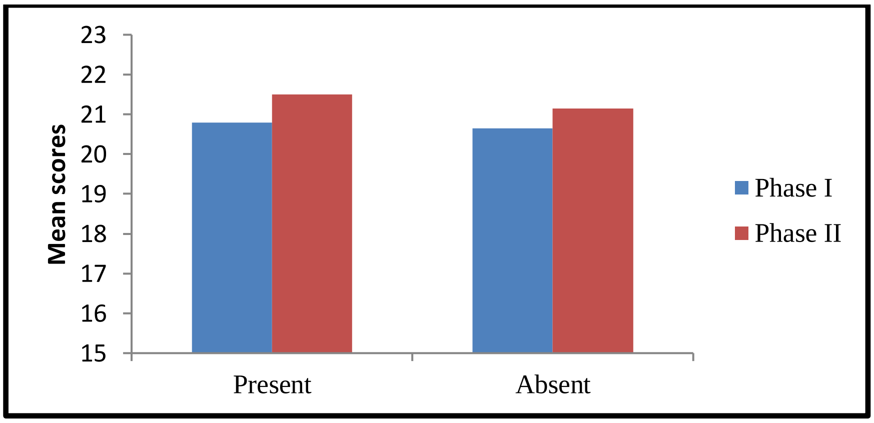
Graph 4.48: *Mean scores of A/O subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



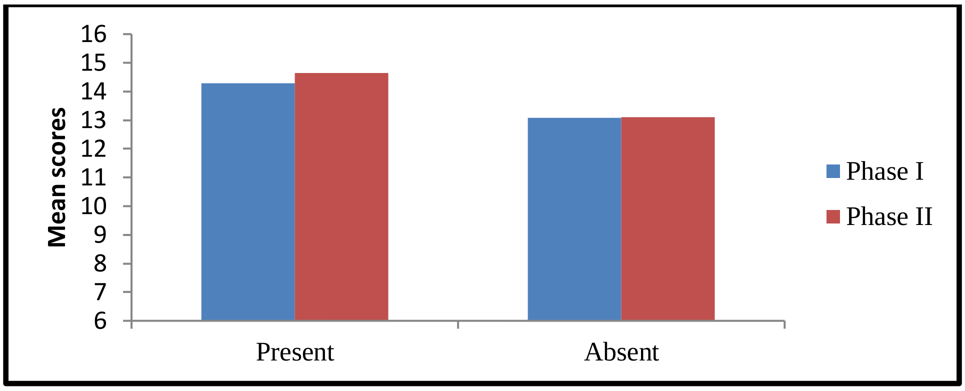
Graph 4.49: *Mean scores of Memory subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.50: *Mean scores of Fluency subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.51: *Mean scores of Language subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.52: *Mean scores of Visuo-spatial subtest between the phases for participants who had drinking habits and those who did not have drinking habits*

Attention/ orientation subtest: When the performance of persons who reported to consume alcohol were compared for their performance, no significant difference ($|z|= 0.952$, $p > 0.05$) was observed during the two phases of the study. Participants who did not consume alcohol also showed no significant differences ($|z|= 0.941$, $p > 0.05$) between the two phases of the study. No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 ($|z|= 1.456$, $p > 0.05$) and during phase 2 ($|z|= 1.503$, $p > 0.05$).

Memory subtest: Performance of persons who reported to consume alcohol were compared for their performance, no significant difference ($|z|= 0.224$, $p > 0.05$) was observed during the two phases of the study. Participants who did not consume alcohol also showed no significant differences ($|z|= 0.637$, $p > 0.05$) between the two phases of the study. No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 ($|z|= 1.492$, $p > 0.05$) and during phase 2 ($|z|= 1.107$, $p > 0.05$).

Fluency subtest: When the performance of persons who reported to consume alcohol was compared between phase 1 and 2, no significant difference was observed ($|z|= 0.719$, $p > 0.05$). Participants who did not consume alcohol showed a significant difference between phase 1 and phase 2 ($|z|= 2.297$, $p < 0.05$). No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 ($|z|= 0.318$, $p > 0.05$) and during phase 2 ($|z|= 0.114$, $p > 0.05$).

Language subtest: When the performance of persons who reported to consume alcohol were compared for their performance, no significant difference ($|z|= 1.262$, $p > 0.05$) was observed during the two phases of the study. Participants who did not consume alcohol however showed significant differences ($|z|= 2.17$, $p > 0.05$) between the two phases of the study. No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 ($|z| = 0.126$, $p > 0.05$) and during phase 2 ($|z|= 0.053$, $p > 0.05$).

Visuo-Spatial skills: When the performance of persons who reported to consume alcohol were compared for their performance, no significant difference ($|z|= 0.359$, $p > 0.05$) was observed during the two phases of the study. Participants who did not consume alcohol also showed no significant differences ($|z|= 0.061$, $p > 0.05$) between the two phases of the study. No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 ($|z|= 1.441$, $p > 0.05$). During phase 2 there was a significant difference between those who consumed alcohol and those who did not ($|z|= 2.206$, $p < 0.05$).

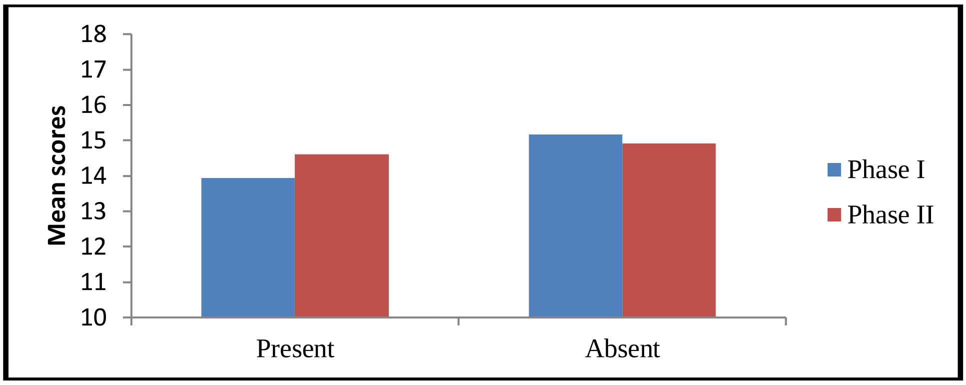
The participants with a history of alcohol consumption showed no differences in their cognitive linguistic performance through the period of the study. Also when this group was compared with the group of participants who abstained from alcohol consumption no difference was found on the subtests of attention/orientation, memory, fluency and language. On visuo-spatial subtest in phase II, our results indicated a better performance by the consumers of alcohol. Here, it is important to mention that 57 percent of the non-alcoholics were either homemakers or farmers, and as seen observed earlier on the subtests of ACE-R, homemakers and farmers consistently performed poorer than the doctors/ engineers, professionals as teachers, etc., and self-employed participants. It is significant to note that the non consumers of alcohol were able to show an improvement in their scores on the fluency and language subtests unlike those who consumed alcohol.

4.1.5. Analysis of results with participants' self report of cognitive-communication issues and phase as the independent variable.

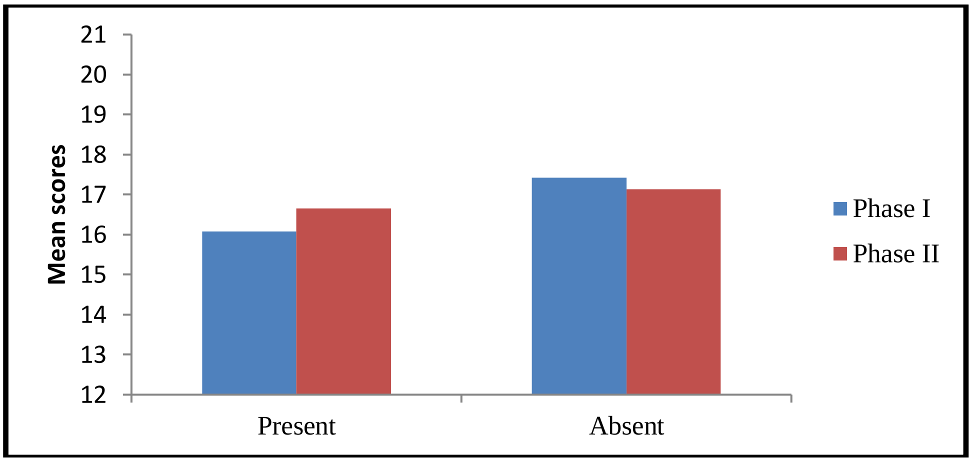
Table 4.13: *Descriptive statistics for subtests of ACER with phase and Cognitive-communicative issues in first phase as independent variables (Present, n= 62; Absent, n=79; N= 141)*

Cognitive-communicative issues		**Attention/ orientation subtest**		**Memory subtest**		**Fluency subtest**		**Language subtest**		**Visuo-Spatial skills**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	13.94	14.60	16.08	16.66	5.98	6.63	20.34	21.18	12.79	12.97
	Median	16.00	16.00	16.00	17.00	6.00	7.00	21.00	22.00	14.00	13.00
	SD	4.254	3.717	3.540	3.841	3.277	2.859	2.698	2.021	2.959	2.636
Absent	Mean	15.16	14.91	17.42	17.14	7.06	7.37	20.92	21.18	13.52	13.49
	Median	16.00	16.00	18.00	18.00	7.00	7.00	21.00	22.00	14.00	14.00
	SD	3.192	3.542	3.510	3.812	3.244	2.984	1.966	2.217	2.895	2.485

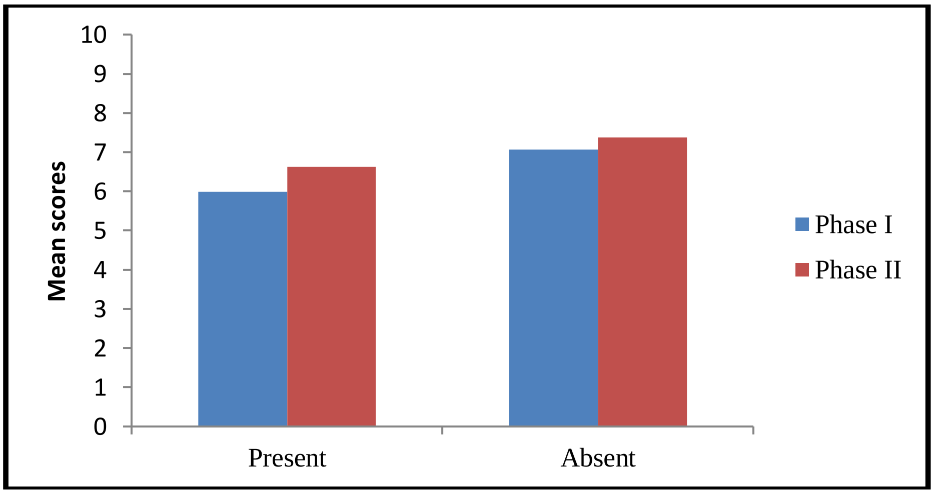
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of ACE-R administered at the beginning of the study; Phase II= subtests of ACE-R administered after 3 months of initial testing; Present = participants who had cognitive-communicative issues; Absent = participants who had no cognitive-communicative issues; SD= standard deviation



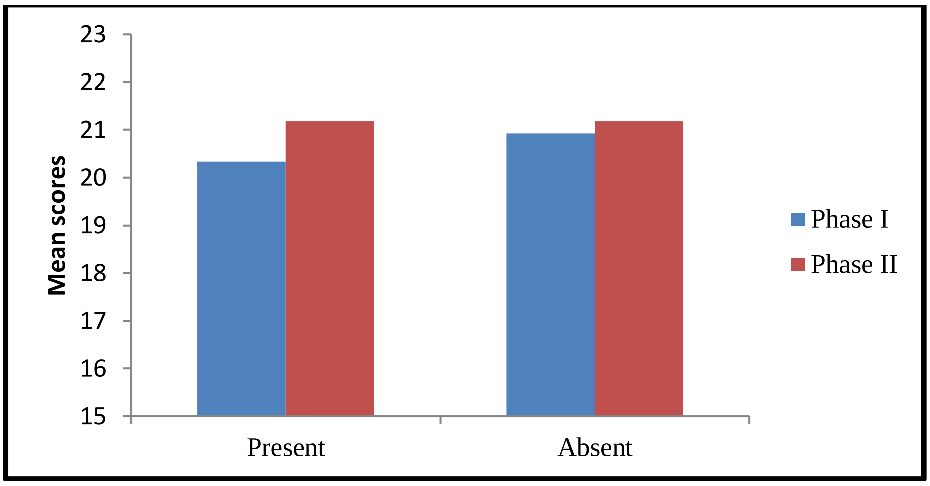
Graph 4.53: *Mean scores of A/O subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



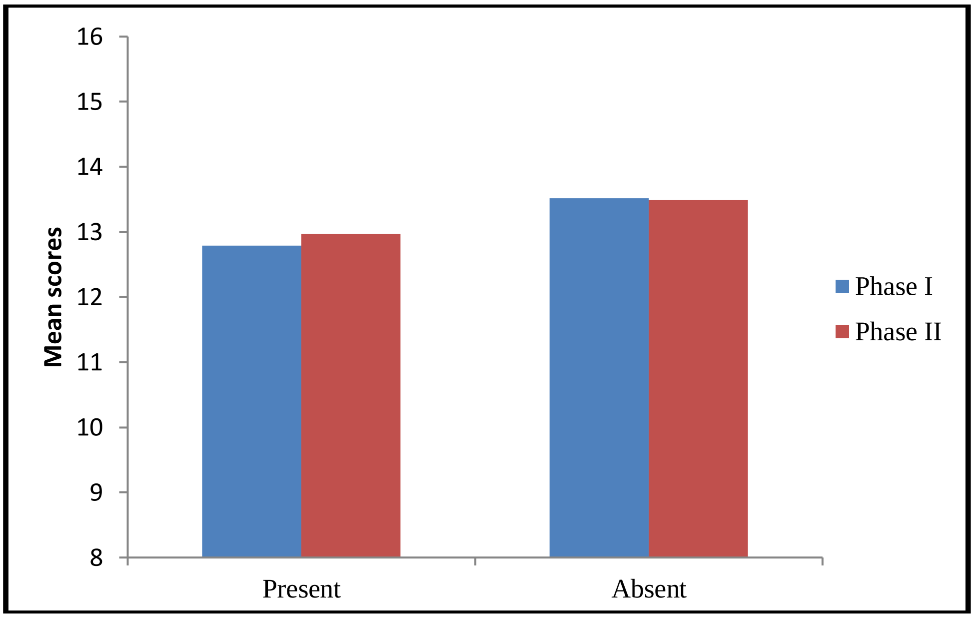
Graph 4.54: *Mean scores of Memory subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.55: *Mean scores of Fluency subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.56: *Mean scores of Language subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.57: *Mean scores of Visuo-spatial subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*

Attention/ orientation subtest: There was no significant difference ($|z|= 1.813$, $p > 0.05$) in the performance of the participants who reported to have cognitive-communicative issues in first phase when compared for their scores during the two phases of the study. Similarly no significant differences ($|z|= 0.188$, $p > 0.05$) were observed for the participants who reported to having no issues during the two phases of the study. On comparing the performance of participants who reported to have cognitive-communicative issues during the first phase of the study and those who reported to have no issues no significant differences ($|z| = 1.386$, $p > 0.05$) was observed during phase 1. During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z| = 0.413$, $p > 0.05$) was observed.

Memory subtest: There was no significant difference ($|z| = 1.758$, $p > 0.05$) in the performance of the participants who reported to have Cognitive-communicative issues when compared for their scores during the two phases of the study. Similarly no significant differences ($|z| = 0.67$, $p > 0.05$) were observed for the participants who reported to having no cognitive-communicative issues during the two phases of the study. On comparing the performance of participants who reported to have memory issues during the first phase of the study and those who reported to have no issues no significant differences ($|z| = 2.694$, $p > 0.05$) was observed during phase 1. During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z| = 0.887$, $p > 0.05$) was observed.

Fluency subtest: A significant difference was seen in the performance of the participants who reported to have cognitive-communicative issues ($|z| = 2.398$, $p < 0.05$) when their scores during the two phases of fluency subtest were compared. No significant difference between the performance on the two phases was observed for the participants who reported no cognitive-communicative issues in the first phase of the study ($|z| = 1.088$, $p > 0.05$). Comparing the performance of participants who reported to have issues in cognitive-communication abilities during the first phase of the study (mean= 5.98) with those who did not report any issues (mean= 7.06), a significant difference was noticed ($|z| = 2.035$, $p < 0.05$) was observed during phase 1. In phase 2 of the fluency subtest, the same categories were examined for any differences in performances and no significant differences was observed ($|z|= 1.564$, $p > 0.05$).

Language subtest: There was a significant difference ($|z|= 2.587$, $p < 0.05$) in the performance of the participants who reported to have issues in cognitive-communicative abilities when compared for their scores during the two phases of the study. No significant differences ($|z|= 0.915$, $p > 0.05$) were observed for the participants who reported to having no cognitive-communicative issues during the two phases of the study. On comparing the performance of participants who reported to have cognitive-communicative issues during the first phase of the study and those who reported to have no issues no significant differences ($|z|= 0.882$, $p > 0.05$) was observed during phase 1. During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z|= 0.212$, $p > 0.05$) was observed.

Visuo-Spatial skills: There was no significant difference ($|z|= 0.441$, $p > 0.05$) in the performance of the participants who reported to have memory issues when compared for their scores during the two phases of the study. Similarly no significant differences ($|z|= 0.317$, $p > 0.05$) were observed for the participants who reported to having no memory issues during the two phases of the study. On comparing the performance of participants who reported to have memory issues during the first phase of the study and those who reported to have no memory issues no significant differences ($|z|= 1.660$, $p > 0.05$) was observed during phase 1. During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z|= 1.110$, $p > 0.05$) was observed.

To summarize the results of the group reported to have memory issues during the period of the study it was found that there were differences in the performance of participants, with a better performance by those without memory issues on the memory and fluency subtests. The common cognitive-communicative difficulties reported were recalling names of unfamiliar persons, misplacing common objects such as keys, and forgetting to take their pills. In the study by the authors Vanderhill, Hultsch, Hunter and Strauss (2010) questions were asked regarding self-perceived cognitive linguistic issues and they found evidence linking cognitive decline and self-reports. On the language and fluency subtests of the present study, all participants showed an improvement over the period of the study. Although the participants with cognitive linguistic issues showed an improvement in their performance, these findings are in parallel with the findings of Lim et. al. (2013).

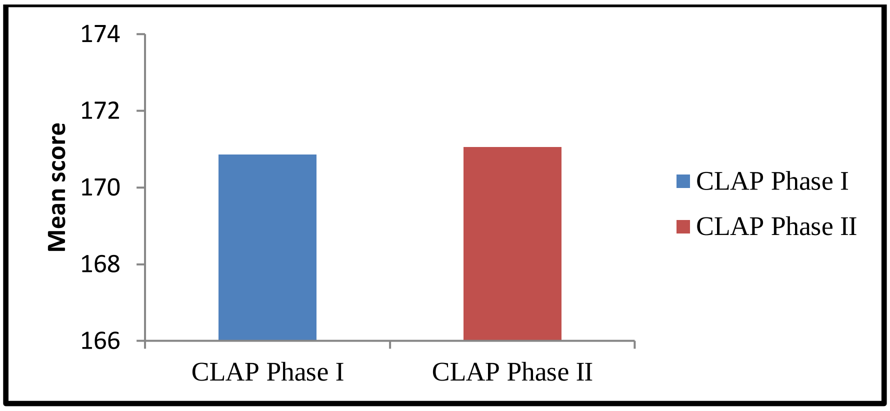
4.2. Results of Cognitive Linguistic Assessment Protocol

Cognitive Linguistic Assessment Protocol (CLAP) in Kannada has four subtests which are Attention, Perception, Discrimination (APD, visual and auditory), Memory, Problem Solving, and Organisation. The test was administered in phase I of the study and then re-administered during the second phase with the interval of three months between the two phases on the same group of participants. The overall difference in performance of the participants on CLAP during phase I and phase II was analysed using Wilcoxons signed-ranks test. No significant difference was observed ($|z| = 0.275$, $p > 0.05$) in the performances between phase I and phase II of CLAP.

Table 4.14: *Descriptive statistics for CLAP*

Test	N	Mean	Median	SD
CLAP phase I	141	170.87	172.00	19.499
CLAP phase II	141	171.06	172.00	16.226

Note: N= total number of participants within the category; SD= standard deviation



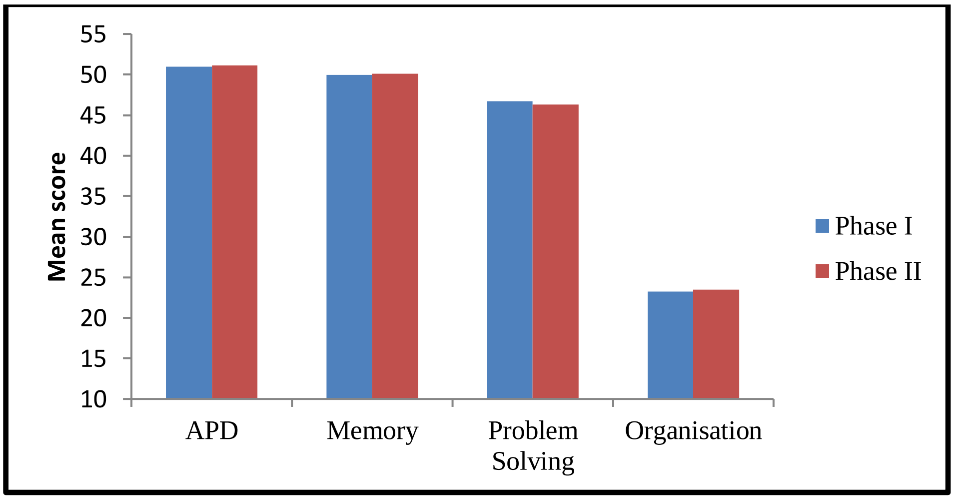
Graph 4.58: *Mean of the total scores on CLAP during each phase of the study*

4.2.1. Analysis of phase difference within each subtest of CLAP.

Table 4.15: *Descriptive statistics for subtests of CLAP (N=141)*

Subtests of CLAP	APD		Memory		Problem solving		Organisation	
	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Mean	50.95	51.11	49.97	50.15	46.70	46.33	23.25	23.46
Median	54.00	53.00	51.00	50.00	47.00	47.00	23.00	23.00
SD	6.728	5.277	3.781	3.187	6.541	4.974	7.680	7.174

Note: N= total number of participants within the category; SD= standard deviation; APD= attention, perception, discrimination subtest of CLAP



Graph 4.59: *Mean of total scores on each subtest of CLAP during the two phases*

APD: Scores of the participants on the APD subtest of CLAP was obtained during both phase I and phase II of the study. The scores of phase I and phase II were compared using Wilcoxon signed ranks test, and it was seen that no significant difference was present from phase I to phase II ($|z| = 0.031$, $p > 0.05$).

Memory: In the subtest of memory the overall difference between the phases was examined using the Wilcoxon signed ranks test. No significant difference was observed in the overall score comparison of phase I and phase II ($|z| = 0.051$, $p > 0.05$).

Problem solving: In the subtest of language the overall difference between the phases was examined. A significant difference was not observed in the overall score comparison of phase I and phase II ($|z| =0.856$, $p > 0.05$).

Organisation: A significant difference was not observed in the overall score comparison of phase I and phase II ($|z| = 0.148$, $p > 0.05$) of the organisation subtest.

The overall difference between the phases was examined using the Wilcoxon signed ranks test. A significant difference was not observed in the overall score comparison of phase I and phase II. Scores of the participants on the attention perception discrimination subtest of CLAP obtained during both phase I and phase II of the study were compared using Wilcoxon signed ranks test. It was seen that there were no significant difference ($|z| = 0.031$, $p > 0.05$) from phase I to phase II for APD. Memory ($|z| = 0.051$, $p > 0.05$), *Problem solving* ($|z| =0.856$, $p > 0.05$) and *Organisation skills* ($|z| = 0.148$, $p > 0.05$). On all the cognitive-linguistic subtests of CLAP i.e., attention-perception-discrimination, memory, problem solving and organisation no differences were observed on testing at the second phase compared to the baseline assessment done at the first phase. This suggests that the practice effect of stimuli used in CLAP was absent. This can be attributed to several probable reasons.

Although CLAP tapped cognitive skills under the domains such as attention and memory like ACE-R, there were variety of stimuli used which were more confusing. Hence the carry over effect for the period of three months (from phase I to phase II) would have been absent. Considering age as a strong effect on cognition the working memory storage to retain these stimuli will be more taxing. Hence the practice effect was not observed for CLAP.

On the CLAP test an individual can obtain a maximum score of 240. Participants in the present study had mean scores of 170.87 in phase I and a mean score of 171.06 in phase II and the difference in overall scores between the two phases was not significant. Although due to practise effects the participants improved their performance on the ACE-R test it was found that the CLAP test was more resistant to any practise effects. Practice effects occur when previous exposure to a particular test stimuli and procedure causes improved performance on repeat assessment (Collie, Maruff, Darby & McStephen, 2003). In this way, only a small but not significant improvement of scores was picked up during phase II of CLAP test. A shorter interval between the two phases may have given more chance for practise effects to show an improvement in scores. This type of shorter time interval between serial assessments was used in the study by Bartels, Wegrzyn, Wiedl, Ackermann and Ehrenreich (2010) who elicited practise effects to be evident on high frequency serial testing which showed highly significant score increased over time (baseline, week 2-3, week 6, week 9 and month 3) in the vast majority of tests. While a longer time interval than only three months between phase I and phase II could have resulted in the effects of natural cognitive decline to take place. Since the time interval between phase I and phase II was of only three months, chances of visible cognitive decline was minimal. Lim et al., (2013) studied the cognitive performance of three groups of participants i.e., normal healthy elderly, amnesic mild cognitive impairment and a group of participants with Alzheimer 's disease using the CogState software. Findings of this study showed stable cognitive performance of all the three groups when their scores were compared between baseline and after a three month period. It is important to note that this study used a phase interval of three months viz. similar to the study design. Thus considering these factors it is justified that there was neither an improvement nor a decline in CLAP scores of the participants of this study. The study involved participants with a wide range of demographic variables such as level of education, occupation and number of languages known. Since the above results of the CLAP test involves the scores of a wide range of participants in total a large standard deviation is present. It is noted that overall significant difference cannot be obtained for two consecutive testing within three months of interval in between. Although this interval is sufficient to detect some changes in few parameters which are discussed further.

Further, McCaffrey et. al. (1992) suggested that practice effects operate equally across all domains of cognition. While a study by Basso et. al. (1999) elicited practice effects on tests that required complex cognitive load while similar practice effects were absent in cognitively simpler tests such as the Wisconsin Card Sorting Test (Kongs et. al., 2000) and Stroop Test.

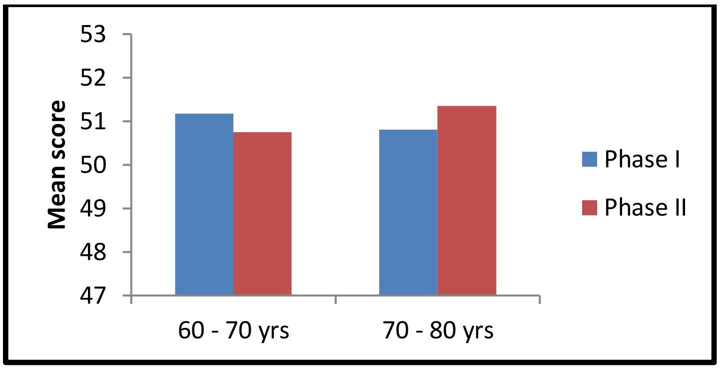
4.2.2. Analysis of cognitive communication skills with reference to demographic variables.

4.2.2.1. AGE: Analysis of results with age and phase as the independent variable.

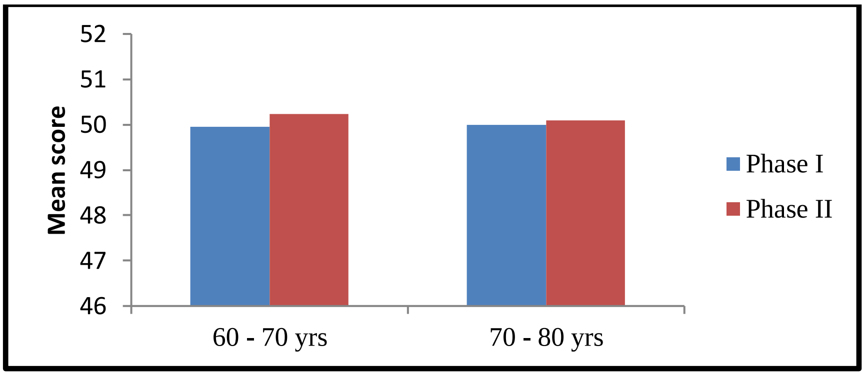
Table 4.16: *Descriptive statistics for subtests of CLAP for age groups and phase as the independent variable (60-70 yrs, n= 55; 70-80 yrs, n=86; N= 141)*

Age group/ Subtests of CLAP		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
60-70 yrs	Mean	51.18	50.75	49.95	50.24	46.36	46.22	22.96	22.22
	Median	53.00	52.00	51.00	51.00	47.00	46.00	23.00	22.00
	SD	6.222	5.327	3.739	3.232	6.369	5.163	7.260	6.688
70-80 yrs	Mean	50.80	51.35	49.99	50.09	46.91	46.41	23.43	24.26
	Median	54.00	53.00	51.00	50.00	47.00	47.00	23.00	24.00
	SD	7.064	5.262	3.830	3.176	6.677	4.878	7.974	7.397

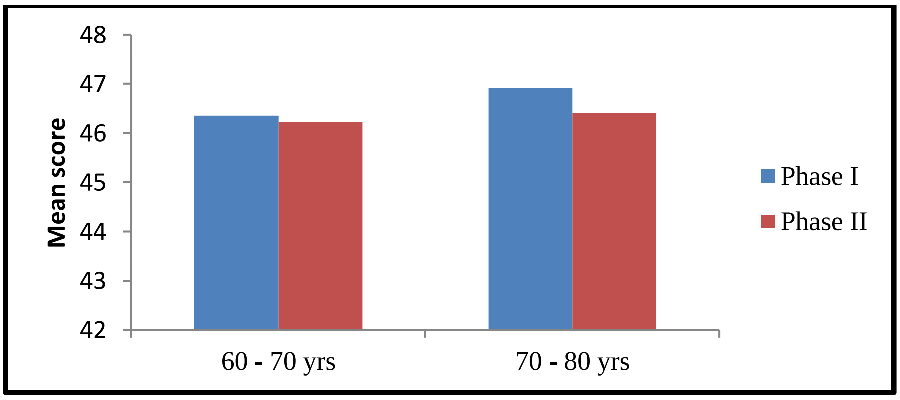
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; 60-70 yrs= participants in the age range of 60-70 years; 70-80 yrs= participants in the age range of 70-80 years; SD= standard deviation



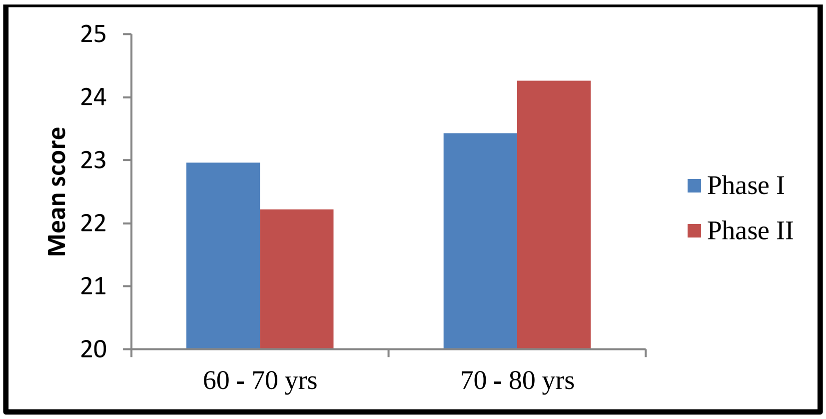
Graph 4.60: *Mean scores of APD subtest between the phases for 60-70 and 70-80 year old participants*



Graph 4.61: *Mean scores of Memory subtest between the phases for 60-70 and 70-80 year old participants*



Graph 4.62: *Mean scores of Problem solving subtest between the phases for 60-70 and 70-80 year old participants*



Graph 4.63: *Mean scores of organisation subtest between the phases for 60-70 and 70-80 year old participants*

APD: Statistical tests using Wilcoxon Sign ranks was done to analyse any differences from phase I to phase II, within the two age groups. In the 60-70 year old adults, no significant difference was observed ($|z| = 0.789$, $p > 0.05$) and similarly in 70-80 years no significant was seen ($|z| = 0.589$, $p > 0.05$). when the 60- 70 year olds and the 70-80 year olds were compared using the Mann-Whitney test within phase I ($|z| = 0.051$, $p > 0.05$) and phase II ($|z| = 0.714$, $p > 0.05$), the results did not show any significant difference in both phases.

Memory: Within the age group of 60-70 year olds, the difference between phase I and phase II was not significant ($|z| = 0.246$, $p > 0.05$). Similarly, within the 70-80 year old participants, no significant difference between phases was observed ($|z| = 0.037$, $p > 0.05$). Analysis of scores of Memory subtest in phase I revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.157$, $p > 0.05$). no significant difference between 60-70 and 70-80 year old participants was found for scores of memory of phase II ($|z| = 0.575$, $p > 0.05$).

Problem solving: 60-70 year old participants showed no significant difference between phase I and phase II ($|z| = 0.745$, $p > 0.05$). Also, within the 70-80 year old participants, no significant difference was observed between phase I and phase II ($|z| = 0.610$, $p > 0.05$). Analysis of scores of problem solving subtest in phase I revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.366$, $p > 0.05$). Even in problem solving scores of phase II, significant difference were not found between 60-70 and 70-80 year old participants ($|z| = 0.233$, $p > 0.05$).

Organisation: The participants in the lower range, i.e., 60-70 year olds, showed no difference between phase I and phase II ($|z| = 0.776$, $p > 0.05$). Also, within the 70-80 year old participants, no significant difference between phase I and phase II was observed ($|z| = 0.863$, $p > 0.05$). Analysis of scores of the subtest of organisation in phase I revealed no significant difference between 60-70 and 70-80 year old participants ($|z| = 0.265$, $p > 0.05$). Even in scores of phase II, no significant difference in the performance of participants was found ($|z| = 1.513$, $p > 0.05$).

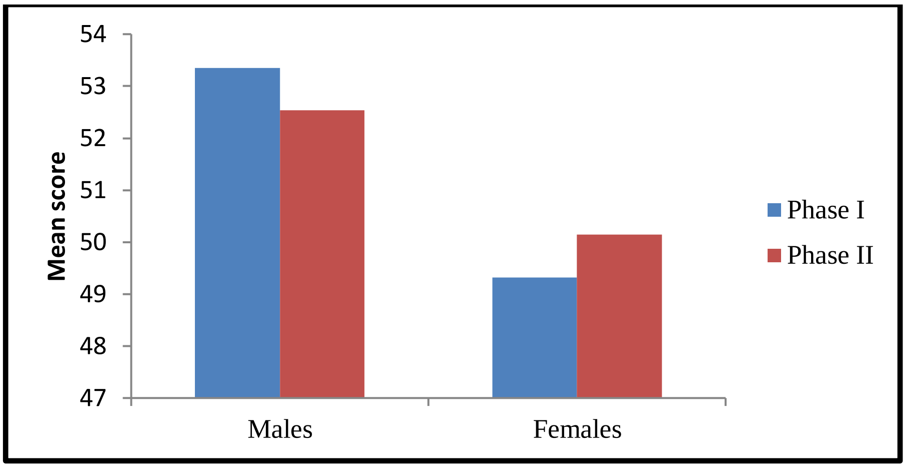
The performance of the two age groups was found to be similar on all the cognitive subtests of CLAP. Also participants in both the age groups were able to maintain their performance on all the subtests of CLAP throughout the two phases of the study. Research literature indicates that as age progresses an inevitable decline in cognitive abilities is inevitable. A study of cognitive status of the elderly population in rural areas of India done by Goswami, Reddaiah, Kapoor, Singh, Dey, Dwivedi and Kumar (2006) showed that in the age group of 60-70 years 26.3 percent of elderly had measurable cognitive decline when tested using MMSE. This percentage increased to 48.3 in the 70+ years group. In contrary to these findings in the present study it is found that no differences existed in cognitive performance of the groups with 60-70 year versus the 70-80 year. On further analysis of the demographic details of these groups it was found that the 70-80 year group comprised of a majority of multilinguals which was not the case with the 60-70 year aged group wherein the monolinguals formed the majority. As such, any expected cognitive decline in 70-80 year olds may have been warded off by the advantage of being multilingual. Thus the difference in cognitive performance of these age groups was not apparent. This finding is in line with the work done by Kavé, Eyal, Shorek, Cohen-Mansfield (2008) who showed that cognitive test scores were related to the number of languages spoken irrespective of the influence of other demographic details, such as age, gender or education.

4.2.2.2. GENDER: Analysis of results with gender and phase as the independent variable.

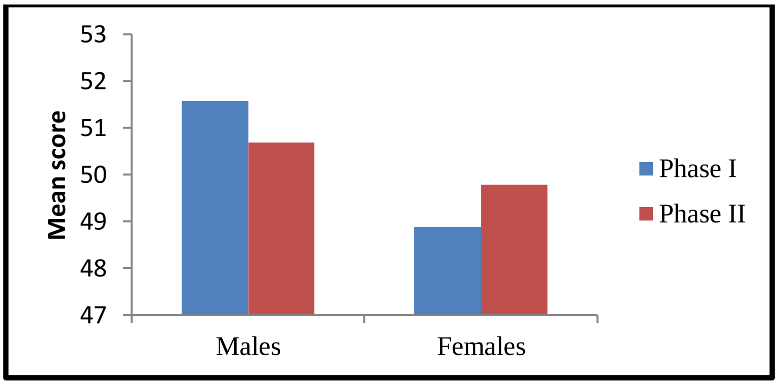
Table 4.17: *Descriptive statistics for subtests of CLAP for gender and phase as the independent variable (males, n= 57; females, n= 84; N= 141)*

Gender/ Subtests of CLAP		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
M	Mean	53.35	52.54	51.58	50.68	48.37	47.37	26.25	25.26
	Median	55.00	53.00	52.00	51.00	49.00	47.00	25.00	24.00
	SD	5.163	4.476	3.111	3.230	5.882	5.424	7.927	7.463
F	Mean	49.32	50.14	48.88	49.79	45.56	45.63	21.21	22.24
	Median	52.00	51.50	49.00	50.00	46.00	46.00	20.00	23.00
	SD	7.191	5.576	3.823	3.124	6.753	4.544	6.837	6.744

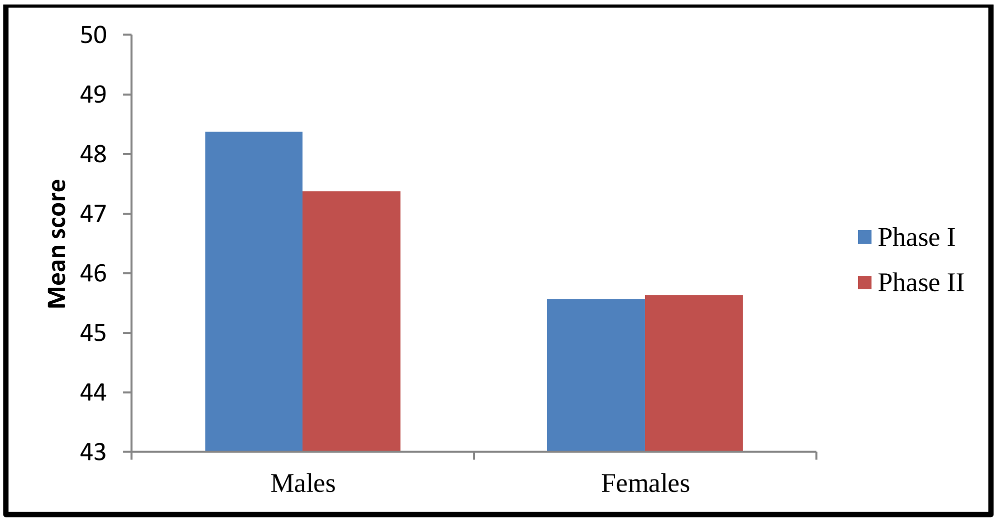
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; M= male participants; F= female participants; SD= standard deviation



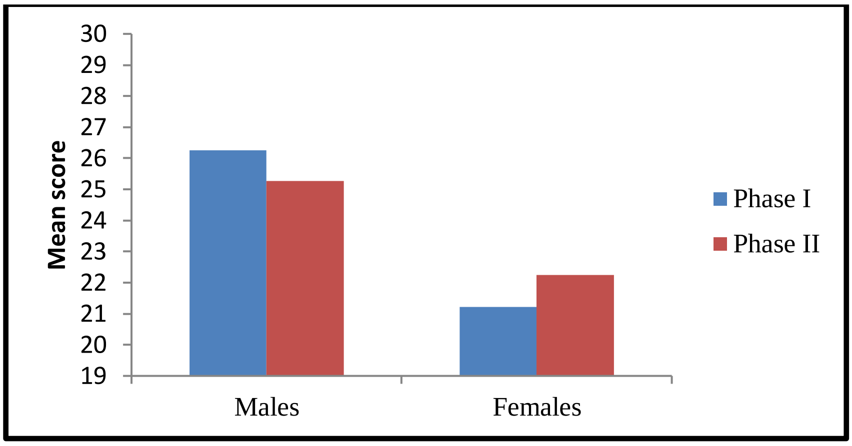
Graph 4.64: *Mean scores of APD subtest between the phases for males and females*



Graph 4.65: *Mean scores of Memory subtest between the phases for males and females*



Graph 4.66: *Mean scores of Problem solving subtest between the phases for males and females*



Graph 4.67: *Mean scores of Organisation subtest between the phases for males and females*

APD: The performance of males, when compared between phase I and phase II did not show a significant difference ($|z| = 1.765$, $p > 0.05$). Performance of female participants also showed no significant difference from phase I to phase II ($|z| = 1.175$, $p > 0.05$). On Mann-Whitney test, performance of males (mean= 53.35) when compared to females (mean= 49.32) within phase I showed a significant difference indicating males performing higher than females. Similarly in phase II, males (mean= 52.54) performed significantly better than the females (mean= 50.14) ($|z| = 2.492$, $p < 0.05$).

Memory: Performance of males on comparison of scores in Memory subtest between phase I and phase II differed significantly ($|z| = 2.648$, $p < 0.05$) with a better performance during phase I testing. Although, the performance of the females did not differ significantly ($|z| = 1.856$, $p > 0.05$) between the two phases. Within the phase I ($|z| = 4.320$, $p < 0.05$) significant difference was observed between males (mean= 51.58) and females (mean= 48.88) in their performance on Memory subtest. Within phase II ($|z| = 1.452$, $p > 0.05$) no significant difference was observed between the males and females.

Problem solving: Performance of males on comparison of scores in problem solving subtest between phase I and phase II did not differ significantly ($|z| = 1.518$, $p > 0.05$). The performance of the females also did not differ significantly ($|z| = 0.14$, $p < 0.05$) between the two phases. Within the phase I ($|z| = 2.408$, $p < 0.05$) significant difference was observed between males (mean= 45.56) and females (mean= 48.37) in their performances with females achieving better scores when compared to males on the problem solving subtest. However within the phase II ($|z| = 1.859$, $p > 0.05$) a significant difference was not observed between the males and females.

Organisation: Performance of males on comparison of scores in the organisation subtest between phase I and phase II did not differ significantly ($|z| = 1.438$, $p > 0.05$). The performance of the females also did not differ significantly ($|z| = 1.180$, $p > 0.05$) between the two phases. Within the phase I ($|z| = 3.942$, $p < 0.05$) significant difference was observed between males (mean= 26.25) and females (mean= 21.21) in their performance indicating the higher had of males as compared to females with resoect to organization skills. Within the phase II ($|z| = 2.137$, $p < 0.05$) also a significant difference was observed between the males (mean = 25.26) and females (females = 21.21).

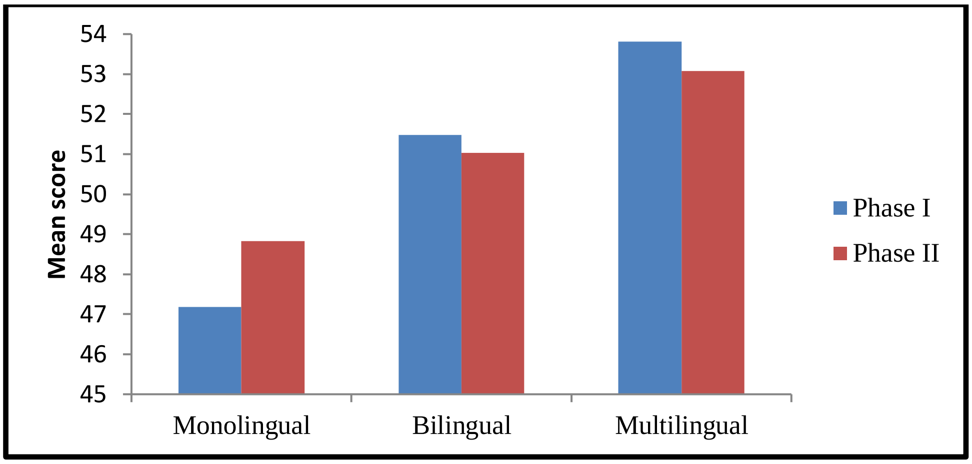
To summarize the performance of the males and females in the study on the CLAP test a clear and overall better performance by the males in the study is evident. The findings in the present study are in agreement with a study by Roselli et. al. (2000) where the males clearly outperformed the females when the educational level was low. This is specifically true for participants where 75 percent of the females were from the lower educational level group. Overall varying and contradictory results regarding gender differences in cognitive performance has been reported by a number of authors. Ranging from the females performing drastically better than the males on total MMSE scores (Jones & Gallo, 2002) to no gender differences in populations with equal educational status (Roselli et.al., 2000). Performance of the females has generally shown to be better on tasks of memory and males have performed better on visuo-spatial tasks. Specifically, women outperformed men on tests of psychomotor speed and verbal learning and memory, whereas men performed better than women on tasks of visuoconstruction and visual perception in a study conducted by Munro et al, 2012. In another study by Goswami et al., 2006 on screening, 12.2 per cent of the males and 23.7 per cent of the females were found to have cognitive defect and the gender difference was statistically significant ($p<0.001$).

4.2.2.3. Analysis of results of CLAP with respect to number of languages known and phases being the independent variables.

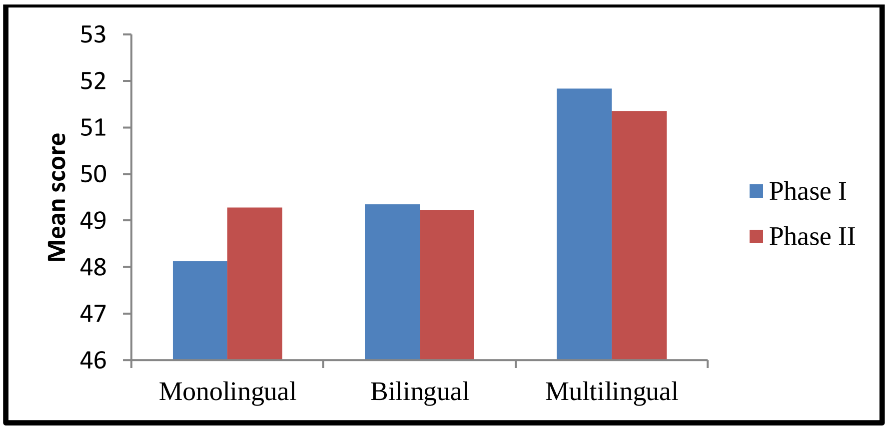
Table 4.18: *Descriptive statistics for subtests of CLAP for number of languages known and phase as the independent variable (monolinguals, n= 50; bilinguals, n= 31; multilinguals, n= 60; N= 141)*

Number of languages known/ Subtests of CLAP		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Mono	Mean	47.18	48.82	48.12	49.28	45.04	44.68	19.98	20.40
	Median	46.50	49.00	48.50	49.50	45.00	45.00	20.00	19.50
	SD	7.210	5.583	4.236	3.182	6.596	4.410	5.666	4.481
Bi	Mean	51.48	51.03	49.35	49.23	45.35	46.06	23.06	22.84
	Median	52.00	52.00	50.00	49.00	46.00	46.00	22.00	21.00
	SD	5.662	4.736	3.072	2.860	6.243	4.024	6.542	6.170
Multi	Mean	53.82	53.07	51.83	51.35	48.77	47.85	26.07	26.33
	Median	55.00	54.00	52.00	51.00	49.00	47.00	25.00	25.00
	SD	5.232	4.521	2.757	2.996	6.160	5.443	8.626	8.340

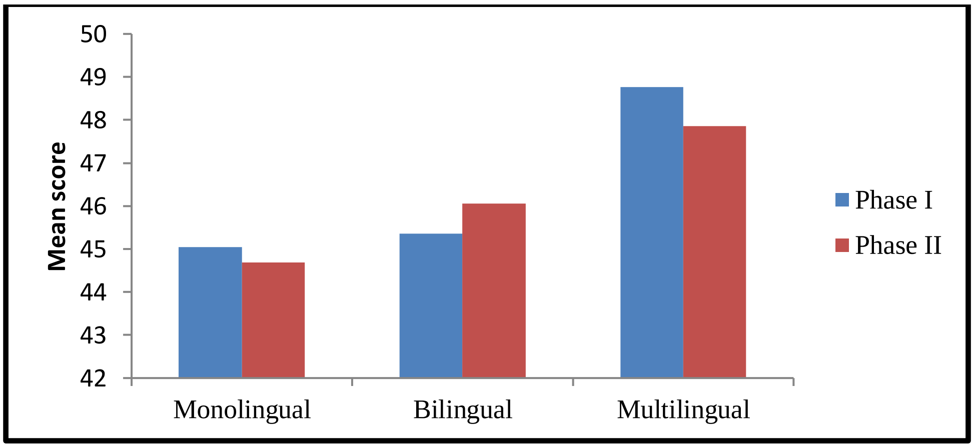
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; Mono= participants who were monolinguals; Bi= participants who were bilinguals; Multi= participants who were multilinguals; SD= standard deviation



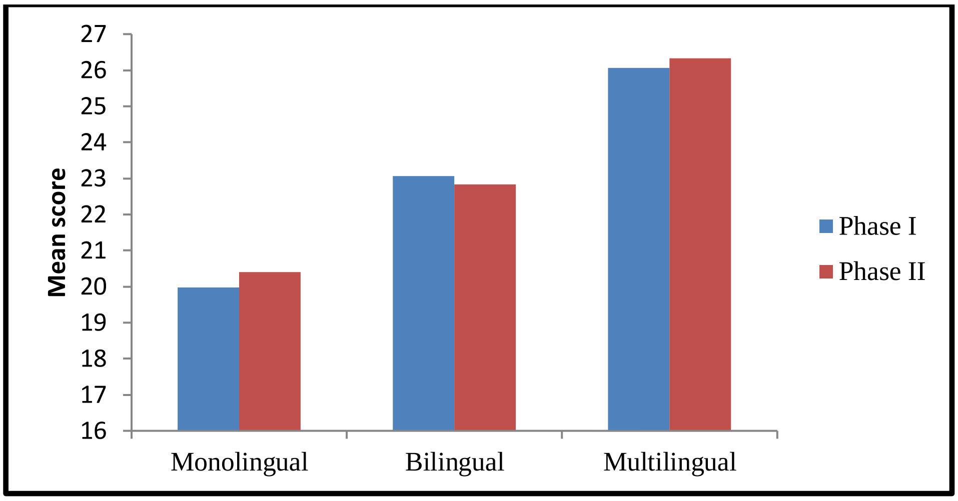
Graph 4.68: *Mean scores of APD subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.69: *Mean scores of Memory subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.70: *Mean scores of Problem solving subtest between the phases for monolinguals, bilinguals and multilinguals participants*



Graph 4.71: *Mean scores of Organisation subtest between the phases for monolinguals, bilinguals and multilinguals participants*

APD: *There was no* significant difference between phase I and phase II for Monolinguals ($|z| = 1.810$, $p > 0.05$), bilinguals ($|z| = 0.227$, $p > 0.05$) and the multilinguals ($|z| = 1.537$, $p > 0.05$) in the study for the APD subtest. Kruskal-Wallis test was done for the comparison of the three categories of the participants for the number of languages known. The results revealed that within phase I significant difference was seen between the three categories ($H= 26.573$, $p < 0.05$). Also within phase II of the APD subtest, comparison of scores of the three groups showed a significant difference ($H= 16.623$, $p < 0.05$). Further, Mann-Whitney test for pair-wise comparisons was done for the category pairs in phase I and phase II. In phase I of the APD subtest, monolinguals (mean= 47.18) and bilinguals (mean= 51.48) were compared, and a significant difference was seen between the groups ($|z| = 2.637$, $p < 0.05$). Whereas on comparison of phase II scores of monolinguals and bilinguals, significant difference was not observed ($|z| = 1.730$, $p > 0.05$). Further, performance of bilinguals (mean= 51.48) and multilinguals (mean= 53.82) on APD subtest were compared, and a significant difference was seen in phase I ($|z| = 2.108$, $p < 0.05$). Again in phase II of APD subtest, performance of bilinguals (mean= 51.03) and multilinguals (mean= 53.07) showed a significant difference ($|z| = 2.140$, $p < 0.05$). Finally, comparison of scores of monolinguals (mean= 47.18) and multilinguals (mean= 53.82) in phase I showed a significant difference ($|z| = 5.026$, $p < 0.05$). Also in phase II multilinguals (mean= 53.07) were found to perform significantly better than the monolinguals (mean= 48.82) ($|z| = 3.920$, $p < 0.05$).

Memory: When the performance of the participants were compared between phase I and phase II no significant difference was found for ($|z| = 1.649$, $p > 0.05$), bilinguals ($|z| = 0.626$, $p > 0.05$) and multilinguals ($|z| = 1.402$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was observed between the three groups in both phase I ($H = 25.960$, $p < 0.05$) and phase II ($H = 15.067$, $p < 0.05$). Pair-wise comparisons were done using Mann-Whitney test since a significant difference was observed between the three groups. Monolinguals and bilinguals did not show a significant difference in both phase I ($|z| = 1.194$, $p > 0.05$) and in phase II ($|z| = 0.215$, $p > 0.05$). A significant difference was observed between the bilinguals (mean= 49.35) and multilinguals (mean= 51.83) in phase I ($|z| = 3.543$, $p < 0.05$), and also the difference was significant in phase II ($|z| = 3.193$, $p > 0.05$) between the bilinguals (mean= 49.23) and multilinguals (mean= 51.35). When the monolinguals (mean= 48.12) were compared with the multilinguals (mean= 51.83), a significant difference was observed in phase I ($|z| = 4.685$, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 49.28) and multilinguals (mean= 51.35) were seen in phase II ($|z| = 3.288$, $p < 0.05$).

Problem solving: When the performance of monolinguals were compared between phase I and phase II, differences were found to be not significant ($|z| = 0.334$, $p > 0.05$). In bilinguals, the difference between phase I and phase II was also found to be not significant ($|z| = 0.53$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 1.252$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was observed between the three groups in both phase I ($H = 11.182$, $p < 0.05$) and phase II ($H = 8.291$, $p < 0.05$). Pair-wise comparisons were done using Mann-Whitney test since a significant difference was observed between the three groups. Monolinguals and bilinguals showed no significant difference in both phase I ($|z| = 0.35$, $p > 0.05$) and phase II ($|z| = 1.551$, $p > 0.05$). A significant difference was observed between the bilinguals (mean = 45.35) and multilinguals (mean = 48.77) in phase I ($|z| = 2.398$, $p < 0.05$), but the difference was not significant in phase II ($|z| = 1.222$, $p > 0.05$). When the monolinguals (mean= 45.04) were compared with the multilinguals (mean= 48.77), a significant difference was observed in phase I ($|z| = 3.075$, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 48.77) and multilinguals (mean= 47.85) were seen in phase II ($|z| = 2.766$, $p < 0.05$).

Organisation: When the performance of monolinguals were compared between phase I and phase II, differences were found to be not significant ($|z| = 0.462$, $p > 0.05$). In bilinguals, the difference between phase I and phase II was also found to be not significant ($|z| = 0.412$, $p > 0.05$). Between phase differences in multilinguals were also not significant ($|z| = 0.138$, $p > 0.05$). For the purpose of analysing within phase effects in monolingual, bilingual, and multilingual participants, the Kruskal-Wallis test was done. A significant difference was observed between the three groups in both phase I ($H = 14.028$, $p < 0.05$) and phase II ($H = 16.615$, $p < 0.05$). Pair-wise comparisons were done using Mann-Whitney test since a significant difference was observed between the three groups. Monolinguals and bilinguals showed no significant difference in both phase I ($|z| = 1.704$, $p > 0.05$) and phase II ($|z| = 1.701$, $p > 0.05$). Significant difference was not observed between the bilinguals and multilinguals in phase I ($|z| = 1.581$, $p > 0.05$), and the difference was not significant in phase II as well ($|z| = 1.951$, $p > 0.05$). When the monolinguals (mean= 19.98) were compared with the multilinguals (mean= 26.07), a significant difference was observed in phase I ($|z| = 3.706$, $p < 0.05$), and a similar significant difference between the monolinguals (mean= 13.46) and multilinguals (mean= 15.80) were seen in phase II ($|z| = 3.999$, $p < 0.05$).

The performance of all the language groups i.e., monolinguals, bilinguals and multilinguals did not differ throughout the study. However a clear and significant finding among all the elderly participants of the study is that the multilingual elders have shown a clear advantage on all the cognitive domains of attention-perception-discrimination, memory, problem solving and organisation. This finding is in line with the work done by Kavé et. al. (2008) analyses which showed cognitive test scores were related to the number of languages spoken irrespective of the influence of other demographic details, such as age, gender or education. Bialystok, et. al. (2004) also reported bilinguals performed better than monolinguals on cognitive tasks. They explained that bilinguals utilised more effective processing and this aided in overcoming any age related cognitive decline as opposed to monolinguals. The monolinguals and the bilinguals have performed equally on all subtests of CLAP. The multilinguals again show an advantage over the bilinguals on the attention-perception-discrimination and memory subtests.

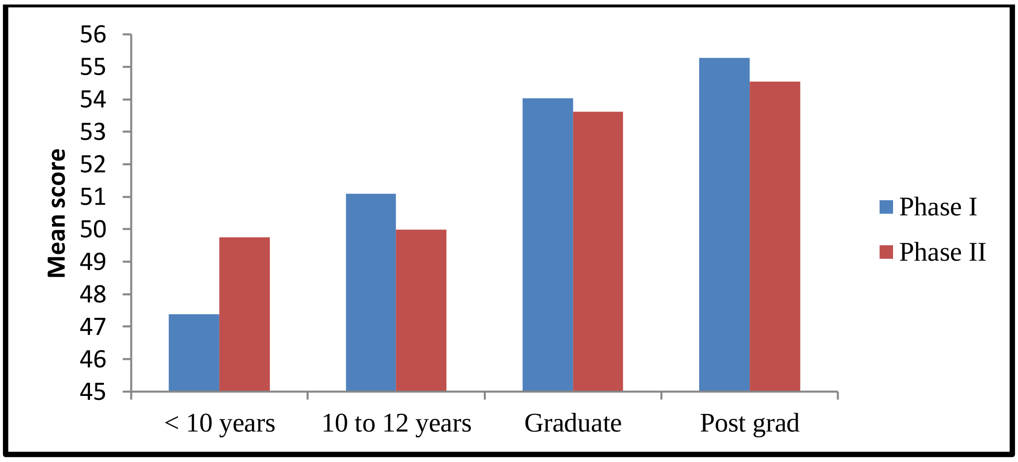
4.2.2.4. EDUCATION: Analysis of results of CLAP with respect to education and phase as the independent variables.

Table 4.19: *Descriptive statistics for subtest of CLAP for years of Education and phase as the independent variable (<10 yrs, n= 44; 10-12 yrs, n= 53; Graduates, n= 33; Post-graduates, n= 11; N= 141)*

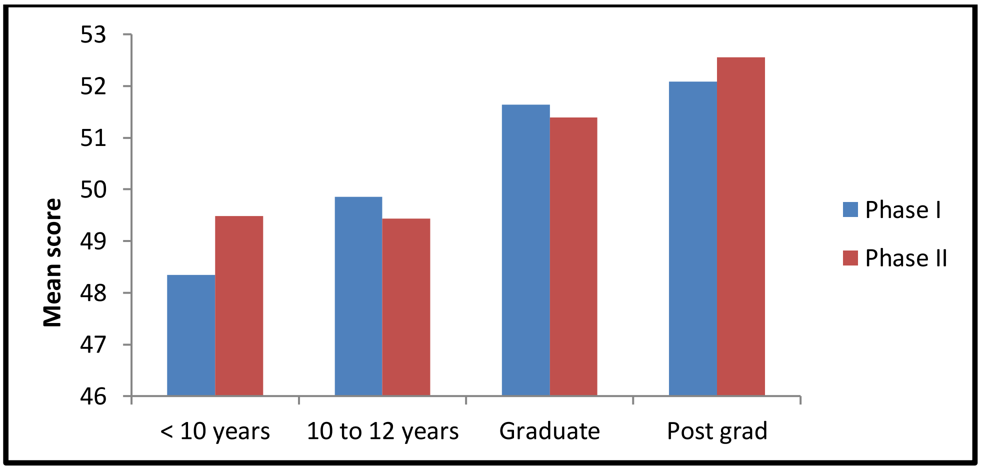
Years of Education/ Subtests of ACE-R		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
< 10 yrs	Mean	47.39	49.75	48.34	49.48	45.30	45.43	20.45	20.86
	Median	47.50	49.50	48.50	50.00	45.00	46.00	20.50	20.00
	SD	7.412	4.881	3.748	2.984	7.073	4.717	5.994	5.411
10-12 yrs	Mean	51.09	49.98	49.85	49.43	46.36	45.13	22.66	22.43
	Median	53.00	52.00	50.00	49.00	47.00	45.00	22.00	22.00
	SD	6.068	5.826	3.629	3.360	5.838	3.813	7.411	7.515

Grad.	Mean	54.03	53.61	51.64	51.39	48.21	48.30	27.73	26.88
	Median	55.00	55.00	52.00	52.00	49.00	48.00	26.00	26.00
	SD	5.440	4.160	3.516	2.726	6.932	6.013	8.722	6.963
Post-grad.	Mean	55.27	54.55	52.09	52.55	49.36	49.82	23.82	28.55
	Median	55.00	54.00	52.00	53.00	51.00	50.00	23.00	28.00
	SD	1.849	2.659	2.427	2.296	5.316	4.687	6.290	6.593

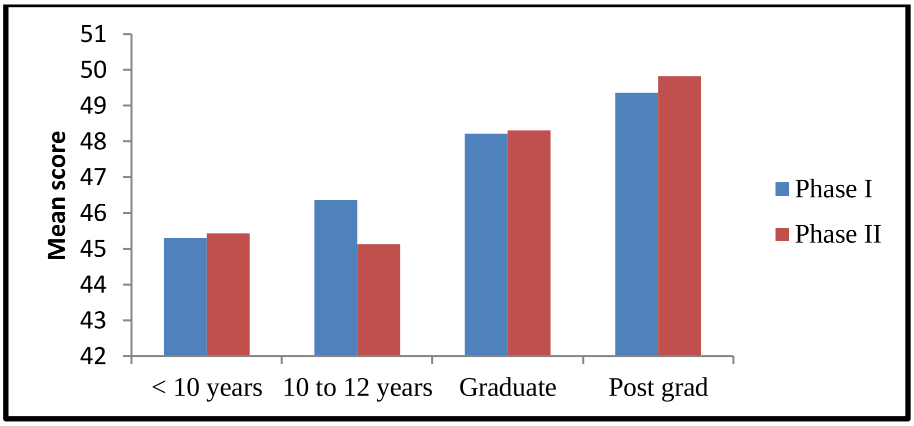
Note: n= number of participants within the category; N= total number of participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; <10 yrs= participants with less than 10 years of formal education; 10-12 yrs= participants with 10-12 years of formal education; Grad.= participants who had attended university; Post-grad.= participants with higher educational qualifications; SD= standard deviation



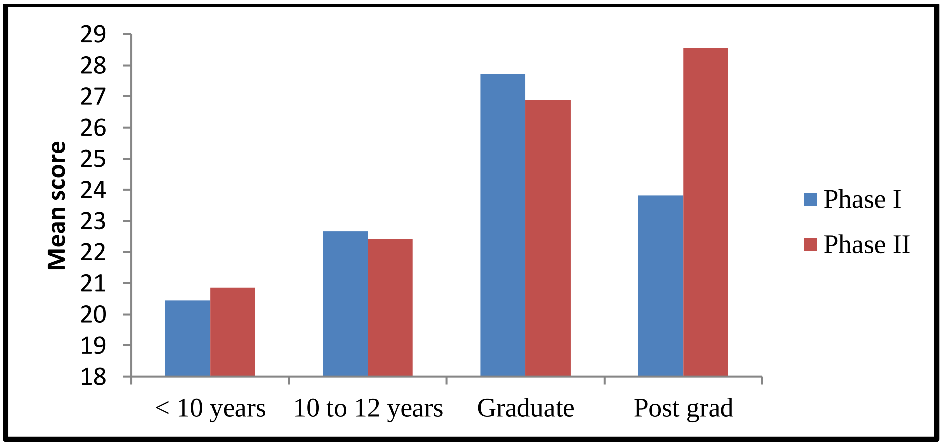
Graph 4.72: *Mean scores of APD subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.73: *Mean scores of Memory subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.74: *Mean scores of Problem solving subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*



Graph 4.75: *Mean scores of Organisation subtest between the phases for participants with less than 10 years of education, 10-12 years of formal education, participants who were graduates and those who were post-graduates*

APD: When Wilcoxon signed ranks test was done the participants in the first group, that is less than 10 years of education, showed a significant difference between phase I and phase II ($|z|= 2.549$, $p < 0.05$),. The second group, which included participants with 10-12 years of education showed no significant difference between phase I and phase II on this analysis ($|z|= 1.450$, $p > 0.05$). The third group, including persons who had attended university or were graduates also showed no significant difference in phase I and phase II ($|z|= 1.062$, $p > 0.05$).

Scores of participants who were post- graduates were grouped together and analysed, and revealed no significant difference between phase I and phase II ($|z|= 0.629$, $p > 0.05$).

Kruskal-Wallis test was done to compare the four categories of education within the two phases. In phase I of the APD subtest, there was a significant difference seen between the scores of participants with less than 10 years of education, 10-12 years of education, those who were graduates and those who were post- graduates ($H= 24.305$, $p < 0.05$). Again, when the analysis was repeated for phase II scores of APD subtest, significant differences were seen between the four categories ($H= 16.86$, $p < 0.05$). Hence further analysis was done for both the phases. Pair-wise analysis was carried out using Mann-Whitney test. Significant difference was seen between the participants with < 10 years of education (mean= 47.39) and participants with 10-12 years of education (mean= 51.09) on comparison of phase I score ($|z| = 2.487$, $p < 0.05$). Comparison of the same pair for phase II scores showed no significant difference ($|z| = 0.494$, $p > 0.05$). Further, the participants with 10-12 years of education (mean= 51.09) were compared with participants who were graduates (mean= 54.03) in phase I and scores showed significant difference between these categories ($|z| = 2.797$, $p < 0.05$). Even in phase II, comparison of performance of participants with 10-12 years of education (mean= 49.98) were compared with participants who were graduates (mean= 53.61) showed a significant difference ($|z| = 2.882$, $p < 0.05$). The next pair analysed was of scores of graduates and post-graduates. Both phase I ($|z| = 0.164$, $p> 0.05$) and phase II scores ($|z| = 0.287$, $p> 0.05$) did not show a significant difference. Participants with less than 10 years of education (mean= 47.39) were compared with the post-graduates (mean= 55.27) and showed significant difference in phase I of APD subtest ($|z| = 3.277$, $p < 0.05$). Similarly, in phase II, the post-graduates group (mean= 54.55) performed significantly better than the participants with less than 10 years of education (mean= 49.75) ($|z| = 2.881$, $p < 0.05$). Also, when the participants with less than 10 years of education were compared with graduates group, significant difference was observed in phase I ($|z| = 4.037$, $p < 0.05$). In phase II, comparison of the same participants in the group of less than 10 years of education and graduates showed significant differences ($|z| = 3.321$, $p < 0.05$). Comparison of participants with 10-12 years of education with the group of post-graduates showed a significant difference between the two groups in phase I ($|z| = 2.247$, $p> 0.05$) and phase II ($|z| = 2.242$, $p> 0.05$), with the post-graduates performing better than the other category.

Memory: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show any significant difference ($|z| = 1.654$, $p > 0.05$). Between the two phases no significant differences were found for persons with 10-12 years of formal education ($|z| = 0.960$, $p > 0.05$), graduate ($|z| = 1.202$, $p > 0.05$), and post-graduate level ($|z| = 0.315$, $p > 0.05$) were compared. When the four groups under years of formal education (<10 years, 10-12 years, graduate and post-graduate groups) were compared within phase I ($H = 21.43$, $p < 0.05$) and phase II ($H = 15.732$, $p < 0.05$) of memory subtest, significant differences were observed in both the phases. Further, when pair-wise comparisons were done using Mann-Whitney test, the following observations were made.

In phase I, the group of participants with less than 10 years (mean= 48.34) and the 10-12 years of education (mean= 49.85) showed a significant difference ($|z| = 2.080$, $p < 0.05$). In phase II of the memory subtest, these groups, did not show any significant difference between each other ($|z| = 0.011$, $p > 0.05$). The differences in scores of persons with 10-12 years of education (Mean = 49.85), and graduate (mean = 51.64) was significant in phase I ($|z| = 2.606$, $p < 0.05$). In phase II ($|z| = 2.681$, $p < 0.05$) also there was a significant difference in scores of persons with 10-12 years of education (Mean = 49.43), and graduate (mean =

51.39). Comparison of scores of graduates and post-graduates within phase I ($|z| = 0.068$, $p > 0.05$) and also in phase II ($|z| = 1.093$, $p > 0.05$) did not reveal significant differences. Between post-graduates (mean= 52.09) and persons with less than 10 years of formal education (mean= 48.34), the memory scores differed significantly in phase I ($|z| = 3.046$, $p < 0.05$). This significant difference between post-graduates (mean= 52.55) and persons with <10 years of formal education (mean= 49.48) was also observed in phase II ($|z| = 2.876$, $p < 0.05$). Similarly, comparison of scores of graduates (mean= 51.64) and persons with less than 10 years of formal education (mean =48.34) revealed significant difference in phase I ($|z| = 4.049$, $p < 0.05$). Phase II scores also showed significant differences between graduates (mean= 51.39) and persons with less than 10 years of formal education ($|z| = 2.727$, $p < 0.05$). Phase I scores of memory subtest showed no significant difference ($|z| = 1.914$, $p > 0.05$) between post-graduates and persons with 10-12 years of formal education. Although there was no significant difference in phase I, in phase II, the post graduate group (mean= 52.55) and the persons with 10-12 years of formal education (mean= 49.48) showed significant difference ($|z| = 2.818$, $p > 0.05$).

Problem solving: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show a significant difference ($|z| = 0.272$, $p > 0.05$). When the scores of persons with 10-12 years of formal education was analysed a significant difference ($|z| = 2.201$, $p > 0.05$) was found between the performance during the two phases of the study. The graduates, were compared between the two phases and no significant differences ($|z| = 0.248$, $p > 0.05$) were found. In the group of post graduates also a significant difference ($|z| = 0.658$, $p > 0.05$) was not found between the two phases. When the four groups under years of formal education (<10 years, 10-12 years, graduate and post-graduate groups) were compared within phase I ($H = 5.896$, $p < 0.05$) and phase II ($H = 13.015$, p <

0.05) of organisation subtest, significant differences were observed in only in phase II. Hence pair-wise comparisons were done using Mann-Whitney test for the observations made during phase II. In phase II, the less than 10 years group (mean =45.43) and the group of participants with10-12 years (mean = 45.13) showed no significant differences ($|z| = 0.608$, $p < 0.05$). The differences in scores of persons with 10-12 years of education (mean = 45.13), and graduates (mean = 48.30) was found to be significant ($|z| = 2.591$, $p > 0.05$) in phase II. Comparison of scores of graduates and post-graduates within phase II did not reveal significant differences ($|z| = 0.693$, $p > 0.05$). Between post-graduates (mean= 49.82) and persons with less than 10 years of formal education (mean= 45.43), the problem solving scores differed significantly in phase II ($|z| = 2.433$, $p < 0.05$). Comparison of scores of graduates (mean= 48.30) and persons with less than 10 years of formal education (mean = 45.43) revealed significant difference in phase II ($|z| = 2.085$, $p < 0.05$). Phase II scores of organisation subtest showed significant difference ($|z| = 2.886$, $p < 0.05$) between post-graduates and persons with 10-12 years of formal education.

Organisation: In persons with less than 10 years of formal education, comparison of scores of the two phases did not show a significant difference ($|z| = 0.144$, $p > 0.05$). When scores of persons with 10-12 years of formal education ($|z| = 0.303$, $p > 0.05$) and graduates ($|z| = 0.794$, $p > 0.05$), were compared between the two phases no significant differences were found. In the group of post graduates a significant difference ($|z| = 0.707$, $p > 0.05$) was found between the two phases.

When the four groups under years of formal education (<10 years, 10-12 years, graduate and post-graduate groups) were compared within phase I ($H = 24.305$, $p < 0.05$) and phase II ($H = 16.86$, $p < 0.05$) of organisation subtest, significant differences were observed in both phases. Further, when pair-wise comparisons were done using Mann-Whitney test, the following observations were made. In phase I, the participants in the group of less than 10 years of education (mean= 20.45) and the 10-12 years (mean= 20.86) showed significant differences ($|z| = 2.487$, $p < 0.05$). Although in phase II of organisation subtest, these groups, did not show a significant differences between each other ($|z| = 0.494$, $p > 0.05$). The differences in scores of persons with 10-12 years of education (mean = 22.66), and graduate groups (mean = 27.73) was found to be significant in phase I ($|z| = 2.797$, $p < 0.05$). In phase II a significant difference ($|z| = 2.882$, $p < 0.05$) was found to be present between 10-12 years of education (mean = 22.43) and graduate groups (mean = 26.88). Comparison of scores of graduates and post-graduates within phase I ($|z| = 1.194$, $p > 0.05$) and also in phase II ($|z| = 1.069$, $p > 0.05$) did not reveal significant differences. Between post-graduates (mean= 23.82) and persons with less than 10 years of formal education (mean= 20.45), the organisation scores differed significantly in phase I ($|z| = 3.277$, $p < 0.05$). This significant difference between post-graduates (mean= 28.55) and persons with less than 10 years of formal education (mean= 20.86) was also observed in phase II ($|z| = 1.989$, $p < 0.05$). Similarly, comparison of scores of graduates (mean= 16.09) and persons with less than 10 years of formal education revealed significant difference in phase I ($|z| = 4.392$, $p < 0.05$). Phase II scores also showed significant differences between graduates (mean= 15.91) and persons with less than 10 years of formal education ($|z| = 2.881$, $p < 0.05$). Scores of organisation subtest in Phase I showed significant difference ($|z| = 2.247$, $p < 0.05$) between post-graduates (mean = 23.82) and persons with 10-12 years of formal education (mean = 22.66). No significant difference was observed with phase II scores of the two groups ($|z| = 0.731$, $p > 0.05$).

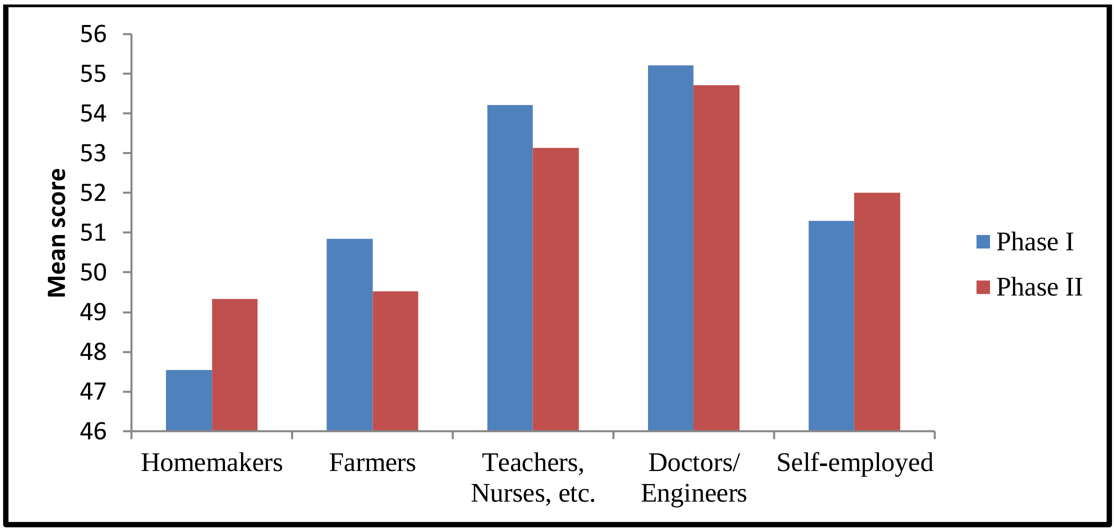
On analysis of scores of the participants based on number of years of education, there is clear evidence of the role of education in relation to cognitive performance. The groups with a higher level of education have shown a clear superior performance over those with lower levels of education. This is in consonance with other cognitive studies which have utilised tests that are not biased to persons who are literate. More years of education were associated with better performance on tasks which tested memory, attention and cognitive speed (Zahodne, Stern & Manly, 2014).

4.2.2.5. Analysis of results with respect to occupation and phases as the independent variables.

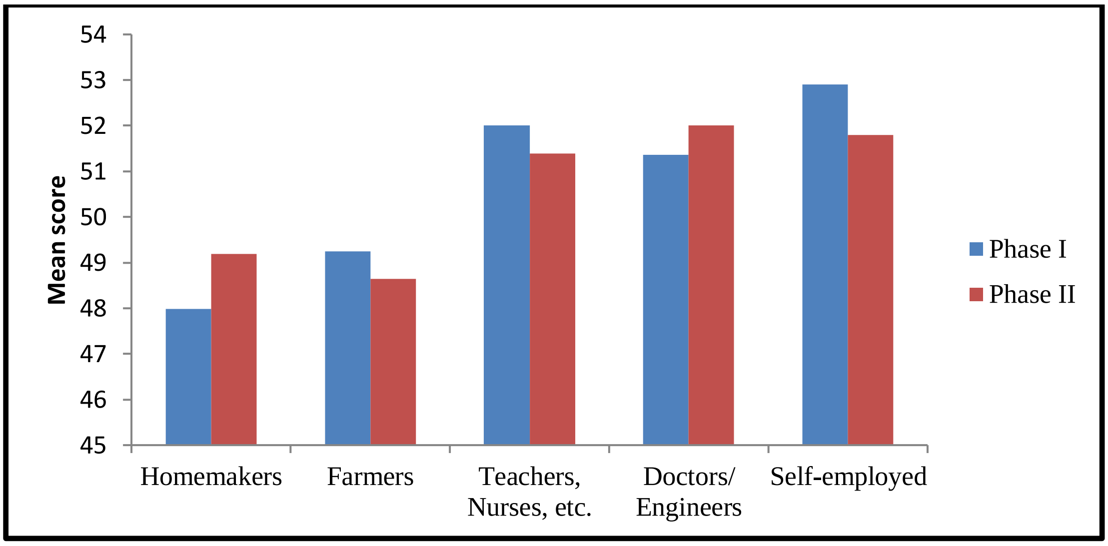
Table 4.20: *Descriptive statistics for subtests of CLAP for Occupation and phase as the independent variable (Homemakers, n= 54; Farmers, n= 25; Teachers, etc, n= 38; Doctors/ Engineers, n= 14; Self-employed, n= 10; N= 141)*

Occupation/ Subtests of CLAP		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Homemakers	Mean	47.54	49.33	47.98	49.19	43.89	44.89	20.89	20.57
	Median	49.00	49.50	48.00	50.00	44.00	45.00	20.00	19.00
	SD	7.218	5.522	3.657	3.109	6.494	4.390	6.389	6.014
Farmers	Mean	50.84	49.52	49.24	48.64	47.12	45.28	20.92	21.72
	Median	53.00	50.00	51.00	48.00	47.00	45.00	20.00	20.00
	SD	5.998	5.292	3.767	2.722	5.495	4.373	7.449	6.687
Teachers, etc.	Mean	54.21	53.13	52.00	51.39	49.13	48.74	25.63	26.42
	Median	55.00	54.00	52.00	52.00	49.50	49.00	25.00	26.00
	SD	4.319	4.186	2.118	2.521	5.527	4.415	6.528	6.680
D/ E	Mean	55.21	54.71	51.36	52.00	48.14	48.93	25.14	26.71
	Median	56.00	54.50	52.00	52.00	51.50	49.00	23.50	23.00
	SD	5.191	3.361	3.795	3.162	7.764	6.844	8.565	7.859
Self-emp	Mean	51.30	52.00	52.90	51.80	49.50	44.00	30.10	27.60
	Median	54.50	54.00	54.00	53.00	50.50	44.50	25.00	25.00
	SD	6.516	5.121	3.381	3.736	6.258	4.000	10.857	8.044

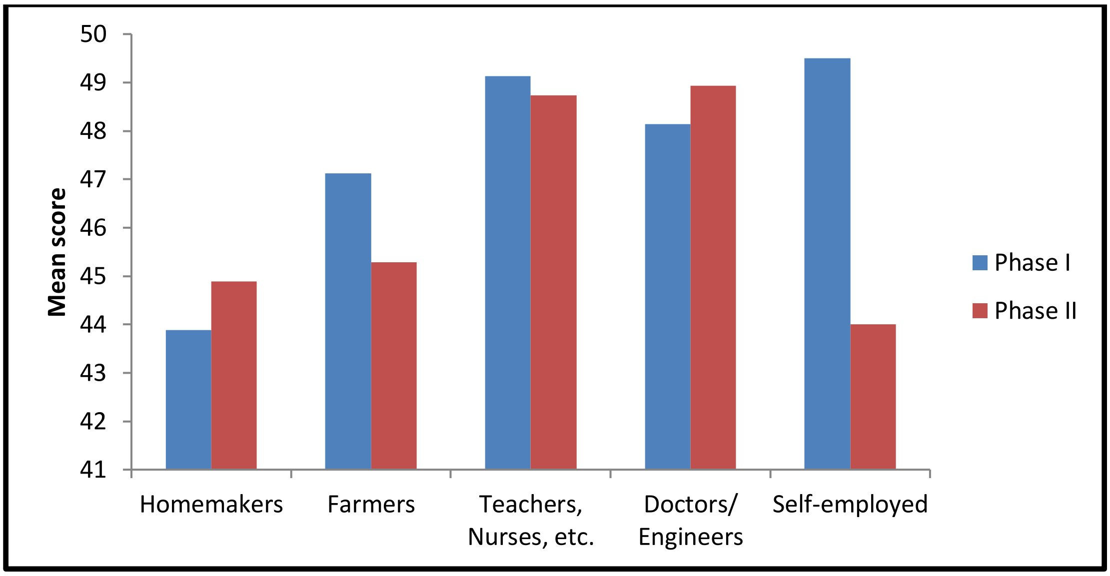
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; Homemakers= participants who were homemakers; Teachers, etc.= Professionals as teachers, bank employees or nurses; D/E= doctors or engineers; Self- emp = self-employed individuals; SD= standard deviation



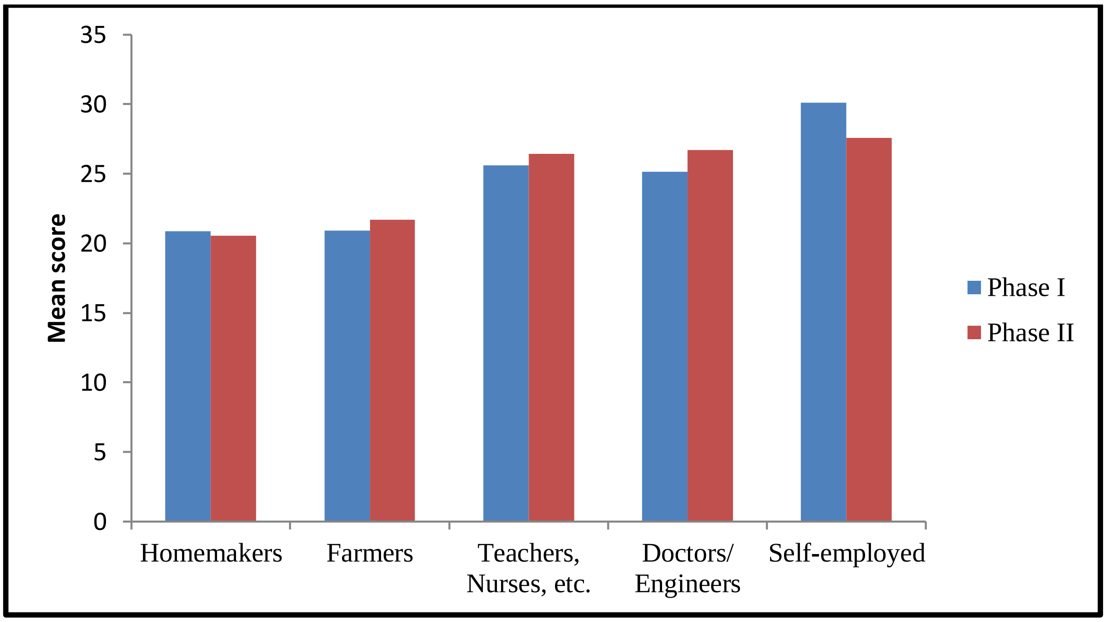
Graph 4.76: *Mean scores of APD subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.77: *Mean scores of Memory subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.78: *Mean scores of Problem solving subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals*



Graph 4.79: *Mean scores of Organisation subtest between the phases for participants who were homemakers, farmers, professionals as teachers, bank employees or nurses, doctors/ engineers or self-employed individuals.*

APD: Wilcoxon signed-ranks test was done to compare within the categories of occupations between the two phases. Within homemakers ($|z| = 2.080$, $p < 0.05$) significant difference was present between the two phases with an improvement in scores during phase II. Performance of farmers ($|z| = 1.307$, $p > 0.05$) did not show significant difference between phase I and II. Professionals as teachers, bank employees ($|z| = 2.043$, $p < 0.05$) performed significantly different in phase II (mean = 53.13) compared to phase I (mean = 54.21). Performance of doctors/ engineers ($|z| = 0.792$, $p > 0.05$), and self-employed participants ($|z| = 0.597$, $p > 0.05$), did not differ significantly between phase I and phase II.

Kruskal-Wallis test was used to compare the categories of occupation. Both phase I ($H= 31.569$, $p < 0.05$) and phase II ($H= 20.455$, $p < 0.05$) showed significant differences between the categories. Further, pair-wise differences were analyzed using Mann-Whitney test. Comparison of homemakers and farmers on phase I ($|z| = 1.394$, $p > 0.05$) and phase II ($|z| = 0.293$, $p > 0.05$) of APD subtest showed there was no significant difference between the two groups. When homemakers (mean= 47.54) were compared to professionals such as teachers (mean= 54.21), significant difference was seen in phase I ($|z| = 4.720$, $p < 0.05$). Similarly, there was significant difference between the homemakers (mean= 49.33) and professionals as teachers (mean= 53.13) in phase II ($|z| = 3.299$, $p < 0.05$) with a better performance by the professionals as teachers. Performance of farmers (mean= 50.84) compared to professionals as teachers (mean= 54.21) showed significant difference in phase I ($|z| = 2.165$, $p < 0.05$). There was a significant difference between farmers (mean= 49.52) and teachers/ bank employees (mean= 53.13) even on phase II ($|z| = 2.748$, $p < 0.05$). Comparison of teachers/ bank employees and doctors/ engineers showed no significant difference in phase I ($|z| = 1.194$, $p > 0.05$) and in phase II ($|z| = 1.069$, $p > 0.05$). Performance of doctors/ engineers in phase I (mean= 55.21) was compared with performance of self-employed participants in phase I (mean= 51.30) and a significant difference was seen ($|z| = 2.419$, $p < 0.05$) with a better performance by the group of doctors/engineers. Whereas in phase II no significant difference was seen ($|z| = 0.980$, $p > 0.05$). Homemakers' performance when compared to self- employed individuals showed no significant difference in phase I ($|z| = 1.742$, $p > 0.05$), and in phase II ($|z| = 1.567$, $p > 0.05$). Further, scores obtained by doctors/ engineers were compared to scores of homemakers. A significant difference was seen in phase I ($|z| = 3.904$, $p < 0.05$) and phase II ($|z| = 3.263$, $p < 0.05$), with the former category performing better in the APD subtest. Similarly between doctors/ engineers and farmers, significant differences were seen in phase I ($|z| = 2.320$, $p < 0.05$) and phase II ($|z| = 2.994$, $p < 0.05$). Succeeding, participants who were farmers and participants who were self-employed were compared on their scores of APD. No significant difference was seen in phase I ($|z| = 0.000$, $p > 0.05$) and in phase II ($|z| = 1.410$, $p > 0.05$). Finally, professionals as teachers, nurses, etc., were compared to the self-employed participants, and it was noticed that there is no significant difference in both phase I ($|z| = 1.640$, $p > 0.05$) and phase II ($|z| = 0.357$, $p > 0.05$) between these categories.

Memory: The participants were grouped into five categories based on their occupation which were homemakers, farmers, professionals as teachers, bank employees and nurses, doctors or engineers and self-employed individuals. The scores of Memory subtest in CLAP did not differ significantly between the two phases for Homemakers ($|z| = 1.925$, $p > 0.05$), farming and agriculture ($|z| = 1.238$, $p > 0.05$), professionals as teachers, bank employees and nurses, ($|z| = 1.462$, $p > 0.05$), doctors or engineers by profession also did not show any significant difference between the two phases ($|z| = 0.593$, $p > 0.05$) and the self-employed individuals ($|z| = 1.556$, $p > 0.05$).

There was a significant difference in the performance of these categories on the Memory subtest within phase I ($H = 36.625$, $p < 0.05$) and phase II ($H = 24.145$, $p < 0.05$) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons. The homemakers (mean= 47.98) as a group were compared with the self-employed individuals (mean= 52.90), and a significant difference was observed in phase I ($|z| = 3.505$, $p < 0.05$). Analysis of phase II results also showed significant difference ($|z| = 2.410$, $p < 0.05$) between the homemakers (mean= 49.19) and self-employed individuals (mean= 51.80). Comparison of scores of homemakers (mean = 47.98) and doctors/ engineers (mean = 51.36) indicated the difference to be significant in phase I ($|z| = 3.075$, $p < 0.05$), this difference between the scores of homemakers (mean = 49.19) and doctors/ engineers (mean = 52.00) was significant ($|z| = 2.624$, $p > 0.05$) in phase II also. Homemakers (mean = 47.98) when compared to professionals as teachers, bank employees and nurses (mean= 52.00), showed significant difference in phase I of the subtest ($|z| = 5.273$, $p < 0.05$), and the same was seen in phase II ($|z| = 3.287$, $p < 0.05$) between homemakers and these professionals (mean= 51.39).

Comparison of the participants who worked as farmer with the doctors/engineers showed no significant difference in performance on memory tasks in phase I ($|z| = 1.741$, $p > 0.05$). When the performance of the same farmer was again compared with the performance of doctors/engineers during phase II of the study significant difference was observed ($|z| = 3.000$, $p < 0.05$). Similarly on comparison of the farmers (mean = 49.24) and the self employed individuals (mean = 52.90), significant differences in phase I ($|z| = 2.656$, $p < 0.05$) and phase II of the study also a significant difference ($|z| = 2.422$, $p < 0.05$) was observed between the categories of farmers (mean = 48.64) and self employed individuals (mean = 51.80). Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals showed no significant differences in phase I ($|z| = 1.510$, $p > 0.05$). Even during phase II there was no significant difference ($|z| = 0.907$, $p > 0.05$) between the two categories. Homemakers when compared to farmers showed no significant difference in phase I ($|z| = 1.408$, $p > 0.05$) and phase II ($|z| = 1.055$, $p > 0.05$).

Professionals as teachers, bank employees and nurses performed significantly better when compared to farmers within their scores of phase I ($|z| = 2.876$, $p < 0.05$) and in the phase II ($|z| = 3.692$, $p < 0.05$) of the memory subtest. Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase I ($|z| = 0.188$, $p > 0.05$) and phase II ($|z| = 0.768$, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase I ($|z| = 1.178$, $p > 0.05$) and phase II ($|z| = 0.059$, $p > 0.05$).

Problem solving: The participants were grouped into five categories based on their occupation. Homemakers and persons with no job during their lifetime constituted the first group. This group did not show any significant differences between the two phases ($|z| = 1.545$, $p > 0.05$). Persons involved in farming and agriculture showed a significant differences ($|z| = 2.166$, $p < 0.05$). Professionals as teachers, bank employees and nurses, showed no significant differences ($|z| = 0.978$, $p > 0.05$) between the phases. The participants who were doctors or engineers by profession did not show any significant difference between the two phases ($|z| = 0.629$, $p > 0.05$). The scores of language subtest differed significantly between the two phases for the self-employed individuals ($|z| = 2.654$, $p > 0.05$). There was a significant difference in the performance of these categories on the attention/ orientation subtest within phase I ($H = 18.611$, $p < 0.05$) and phase II ($H = 20.89$, $p < 0.05$) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons. The homemakers (mean= 43.89) as a group were compared with the self-employed individuals (mean= 49.50), and a significant difference was observed in phase I ($|z| = 2.241$, $p < 0.05$). Analysis of phase II ($|z| = 0.566$, $p > 0.05$) results however did not show a significant difference between homemakers and self-employed individuals. Comparison of scores of homemakers and doctors/ engineers (mean = 48.93) indicated the difference to be significant in phase II ($|z| = 1.972$, $p < 0.05$), and in phase I of the problem solving subtest ($|z| = 2.141$, $p < 0.05$). Homemakers when compared to professionals as teachers, bank employees and nurses (mean= 49.13), showed significant difference in phase I of the subtest ($|z| = 3.867$, $p < 0.05$), and the same was seen in phase II ($|z| = 4.018$, $p < 0.05$) between homemakers and these professionals (mean= 48.74). Comparison of the participants who worked as farmers (mean= 47.12) with the doctors/engineers (mean= 48.14) showed no significant difference in performance on problem solving subtest in phase I ($|z| = 0.998$, $p > 0.05$). When the performance of the farmers (mean= 47.12) was compared with the performance of doctors/engineers (mean = 48.14) during phase II of the study no significant difference was observed ($|z| = 1.647$, $p > 0.05$). A similar comparison between the farmers and the self employed individuals showed no significant differences in phase I ($|z| = 0.916$, $p > 0.05$) and phase II ($|z| = 0.734$, $p > 0.05$). Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals, no significant differences were observed in phase I ($|z| = 0.203$, $p > 0.05$). However there was a significant difference ($|z| = 2.87$, $p > 0.05$) between the professionals as teachers, bank employees and nurses (mean = 48.74) and the self employed individuals (mean = 44.00) in phase II. Performance of Homemakers (mean = 43.89) when compared to farmers (mean = 47.12) showed a significant different in phase I ($|z| = 2.297$, $p < 0.05$) but not in phase II ($|z| = 0.206$, $p > 0.05$). Professionals as teachers, bank employees and nurses performed better when compared to farmers within their scores of phase II ($|z| = 3.055$, $p < 0.05$) although in phase I ($|z| = 1.478$, $p < 0.05$) no significant difference was observed. Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase I ($|z| = 0.093$, $p > 0.05$) and phase II ($|z| = 0.093$, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase I ($|z| = 0.47$, $p > 0.05$) and phase II ($|z| = 1.791$, $p > 0.05$).

Organisation: When the people were compared within the group between the phase I and phase II there was no significant difference between Homemakers and persons (|z| = 0.535, p > 0.05), farming and agriculture (|z| = 0.374, p > 0.05). Professionals as teachers, bank employees and (|z| = 0.719, p > 0.05), doctors or engineers by profession (|z| = 0.665, p > 0.05), and the self-employed individuals (|z| = 1.278, p > 0.05).

There was a significant difference in the performance of these categories on the organisation subtest within phase I (H = 16.875, p < 0.05) and phase II (H = 22.84, p < 0.05) on the Kruskal-Wallis test. Since there was a significant difference between the categories, Mann-Whitney test was performed for pair-wise comparisons. The homemakers (mean= 20.89) as a group were compared with the self-employed individuals (mean= 30.10), and a significant difference was observed in phase I (|z| = 2.613, p < 0.05). Analysis of phase II (|z| = 2.459, p < 0.05) results also showed a significant difference between homemakers (mean= 20.57) and self-employed individuals (mean= 27.60). Comparison of scores of homemakers and doctors/ engineers (mean = 26.7) indicated the difference to be significant in phase II (|z| = 2.504, p < 0.05), though the difference was not significant in phase I of the attention/ orientation subtest (|z| = 1.634, p > 0.05). Homemakers when compared to professionals as teachers, bank employees and nurses (mean= 16.45), showed significant difference in phase I (|z| = 3.325, p < 0.05), and in phase II (|z| = 3.988, p < 0.05). Comparison of the participants who worked as farmers (mean= 14.16) with the doctors/engineers (mean= 15.36) showed no significant difference in performance on attention/orientation tasks in phase I (|z| = 1.422, p > 0.05). When the performance of the same farmers (mean= 21.72) was again compared with the performance of doctors/engineers (mean = 21.72) during phase II of the study a significant difference was observed (|z| = 2.027, p < 0.05). A similar comparison between the farmers (mean = 20.92) and the self employed individuals (mean = 30.10) showed a significant differences in phase I (|z| = 2.159, p < 0.05). During phase II of the study also a significant difference ($|z| = 2.180$, $p < 0.05$) was observed between the categories of farmers (mean = 21.72) and self employed individuals (mean = 27.60). Comparing the category of professionals as teachers, bank employees and nurses with the self employed individuals, no significant differences were observed in phase I ($|z| = 1.005$, $p > 0.05$) as well as phase II ($|z| = 0.026$, $p > 0.05$). Homemakers when compared to farmers showed no significant different in phase I ($|z| = 0.201$, $p > 0.05$) and phase II ($|z| = 0.476$, $p > 0.05$). Professionals as teachers, bank employees and nurses performed better when compared to farmers within their scores of phase I ($|z| = 2.498$, $p < 0.05$) and phase II ($|z| = 3.022$, $p < 0.05$). Between professionals (teachers, bank employees, etc.), and doctors/ engineers, no significant difference was observed within phase I ($|z| = 0.538$, $p > 0.05$) and phase II ($|z| = 0.186$, $p > 0.05$). Comparing doctors/ engineers with individuals who were self-employed, there was no significant difference in both phase I ($|z| = 1.292$, $p > 0.05$) and phase II ($|z| = 0.443$, $p > 0.05$).

Overall, professionals (teachers, nurses, etc.) and doctor/ engineers performed significantly better than homemakers and farmers on all the subtests of CLAP. In the study by Huadong et al., (2003), 35.4 percent of participants who were homemakers had cognitive impairment, as compared to those participants in the administration and technology sectors where only around 10 percent of the participants showed a cognitive impairment. Also, the self-employed participants performed considerably better than homemakers and farmers on memory, problem solving and organisation subtests of CLAP. A similar pattern of performance was also observed in the scores of ACE-R. As understood earlier, the difference in mental effort required for each of the occupation could possibly be a factor determining the cognitive performance on these tests (Huadong et al., 2003; Salthouse, 2006; Finkel et. al., 2009). It is also important to note that of the categories which consistently performed better, 100 percent of the doctors/ engineers and 61 percent of the professionals (teachers, nurses, etc.) had attended university level.

On observation of the descriptive data the scores on performance on both phases of the study did not show a noticeable variation. Exceptions were scores of homemakers, who showed an improvement on Phase II of APD subtest implying that this could have been an effect of practice after the phase I test. On the other hand, in phase II of the APD subtest, professionals (teachers, nurses, etc.) showed a decline in their performance. On the problem solving subtest, farmers and self-employed persons showed a decline in their performance during phase II of the study. Finkel et. al. (2009) reported that in individuals with occupations requiring greater mental effort after retirement, exhibited a steeper decline in the cognitive performance than other individuals.

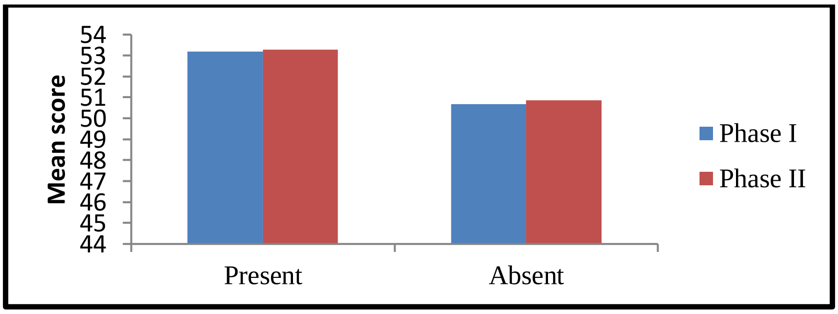
4.2.3. Analysis of cognitive communication skills with reference to co-existing medical conditions.

4.2.3.1. Analysis of results of CLAP with respect to cardiac issues and phases as the independent variables.

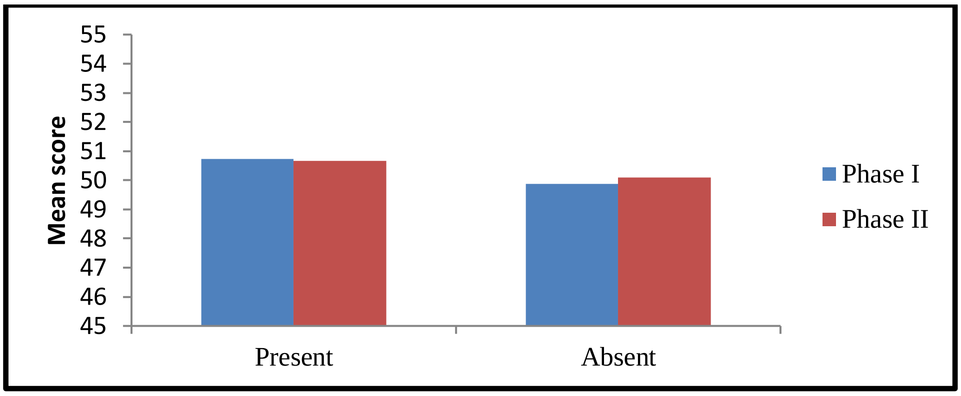
Table 4.21: *Descriptive statistics for subtest of APD in CLAP for Cardiac issues (cardiac issues present, n= 15; cardiac issues absent, n=126; N= 141)*

Cardiac issues		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	53.20	53.27	50.73	50.67	49.80	48.27	21.67	22.60
	Median	54.00	54.00	50.00	51.00	50.00	48.00	20.00	23.00
	SD	4.229	3.535	3.453	2.845	4.693	4.061	6.466	6.843
Absent	Mean	50.68	50.86	49.88	50.09	46.33	46.10	23.44	23.56
	Median	53.00	52.50	51.00	50.00	46.00	46.00	23.00	23.00
	SD	6.929	5.400	3.821	3.230	6.645	5.036	7.813	7.232

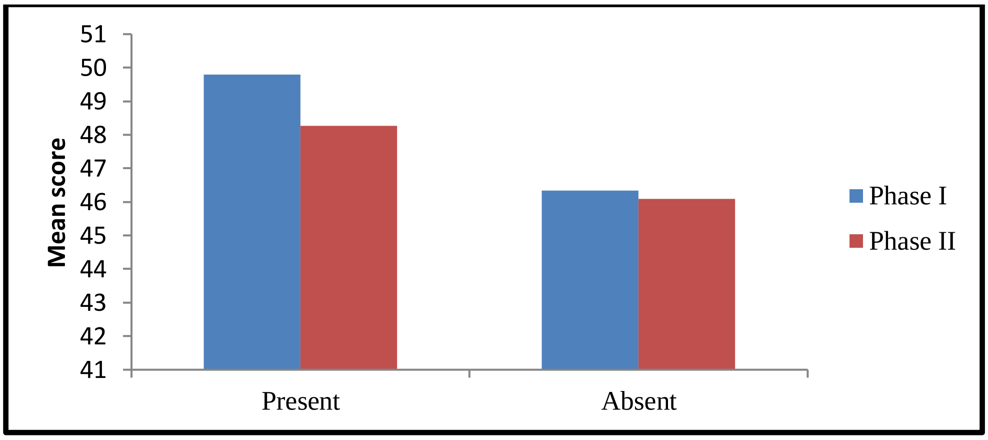
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



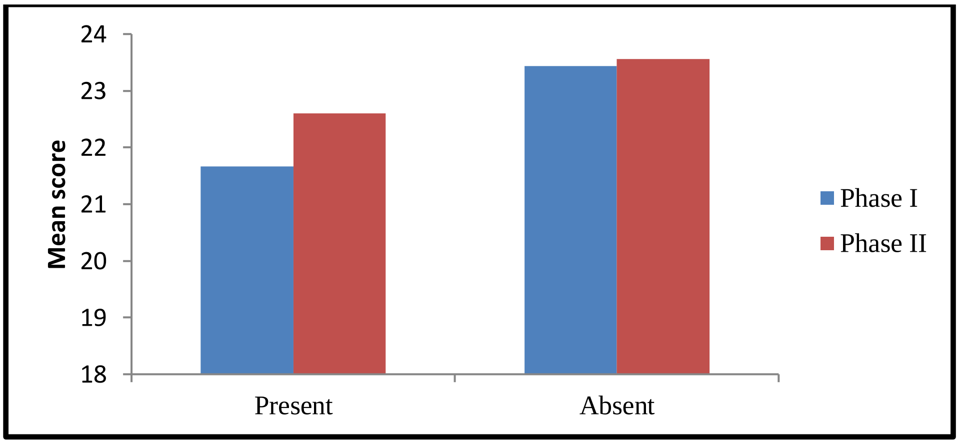
Graph 4.80: *Mean scores of APD subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



Graph 4.81: *Mean scores of Memory subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*



Graph 4.82: *Mean scores of Problem solving subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues.*



Graph 4.83: *Mean scores of Organisation subtest between the phases for participants who had cardiac issues and those who did not have cardiac issues*

APD: When Wilcoxon signed ranks test was done to analyze the within subject effects in participants with and without cardiac issues, it was observed that participants with cardiac issues showed no significant difference between phase I and phase II ($|z| = 0.039$, $p > 0.05$). In those participants who had negative history of cardiac issue also showed no significant difference from phase I to phase II ($|z| = 0.026$, $p > 0.05$). The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems within both the phases. There was no significant difference between participants during phase I ($|z| = 0.995$, $p > 0.05$) and phase II ($|z| = 1.489$, $p > 0.05$).

Memory: The participants who reported to have cardiac issues were compared on their scores for memory between the two phases of the study and there was no significant difference ($|z| = 0.120$, $p > 0.05$). A similar analysis to compare the participants with no cardiac issues also showed no significant differences ($|z| = 0.093$, $p > 0.05$) between the two phases. The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase I ($|z| = 0.678$, $p > 0.05$) and during phase II ($|z| = 0.611$, $p > 0.05$) no significant differences were observed between the two categories.

Problem solving: Wilcoxon signed ranks test revealed no significant results ($|z| = 1.616$, $p > 0.05$) betwen the phases for participants with cardiac issues as well as for participants with no cardiac issues ($|z| = 0.477$, $p > 0.05$). The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase I of the problem solving subtest significant differences was observed ($|z| = 1.965$, $p < 0.05$) between the participants with cardiac issues (mean = 49.80) and those without cardiac issues (mean = 46.33) but during phase II ($|z| = 1.808$, $p > 0.05$) no significant differences were observed between the two categories.

Organisation: The participants who reported to have cardiac issues were grouped into a category and were compared on their scores for memory between the two phases of the study. This analysis was done using the Wilcoxon signed ranks test and no significant results ($|z| = 0.446$, $p > 0.05$) were obtained. A similar analysis to compare the participants with no cardiac issues showed no significant difference ($|z| = 0.004$, $p > 0.05$) between the two phases. The Mann-Whitney test was done to compare the participants with cardiac problems versus the participants without any cardiac problems during both the phases. During phase I ($|z| = 0.924$, $p > 0.05$) and during phase II ($|z| = 0.489$, $p > 0.05$) no significant differences were observed between the two categories.

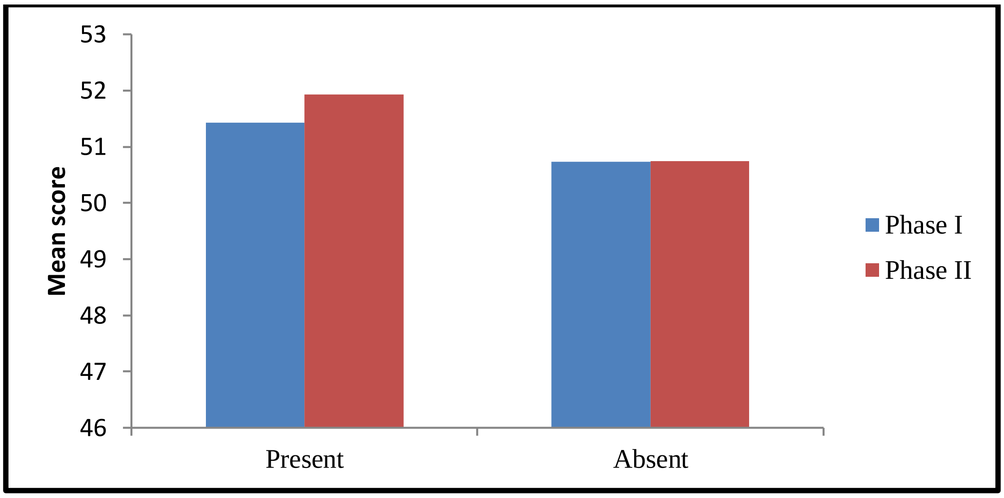
Within the duration of the study, a noticeable difference in the scores between the two phases was not seen. Hence, suggesting that a practice effect for the tasks of CLAP cannot be expected over a 3 month period. There was also no significant decline in the performance of the participants, suggesting maintenance of the cognitive performance of these participants, considering the fact that they were normal healthy elderly. These results are in line with the results of ACE-R. These findings, although contradictory to the studies in literature (Elliott et al, 2010), suggest that presence of a cardiac issue is not a key factor affecting cognition in the elderly. Surprisingly too, on comparison of participants with and without cardiac issues the overall results showed no significant difference between the two groups. The only exception was the problem solving subtest, where participants with cardiac issues performed better than the rest of the participants.

4.2.3.2. Analysis of results of CLAP with participants suffering from diabetes.

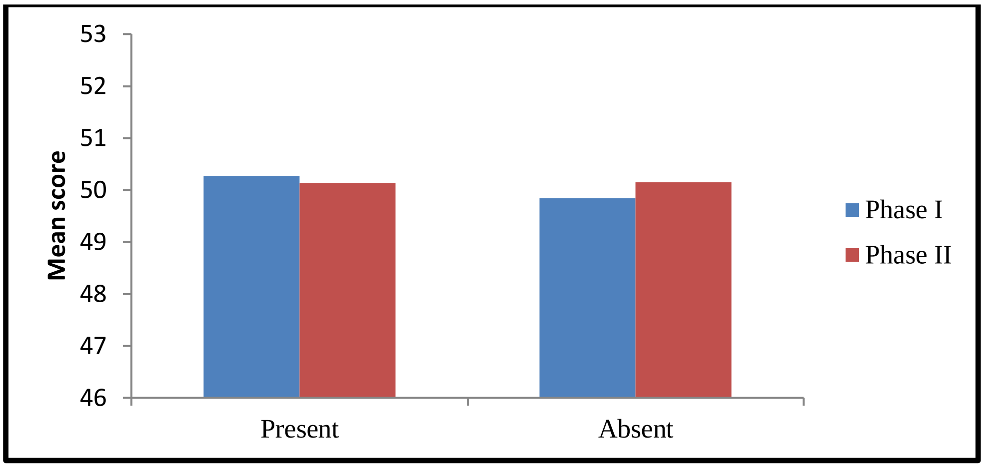
Table 4.22: *Descriptive statistics for subtests of CLAP for Diabetes and phase as the independent variable (Diabetes present, n= 44; Diabetes absent, n=97; N= 141)*

Diabetes		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	51.43	51.93	50.27	50.14	46.68	46.77	23.89	22.93
	Median	54.00	53.00	51.00	50.50	46.50	47.00	23.50	23.00
	SD	6.475	5.214	4.083	3.115	6.404	4.670	6.962	6.814
Absent	Mean	50.73	50.74	49.84	50.15	46.70	46.13	22.96	23.70
	Median	53.00	53.00	51.00	50.00	47.00	46.00	22.00	24.00
	SD	6.861	5.290	3.651	3.235	6.635	5.117	8.002	7.353

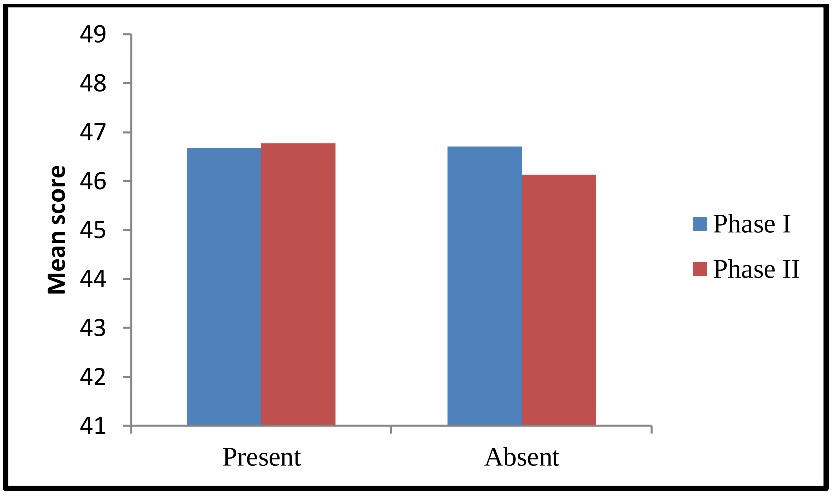
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



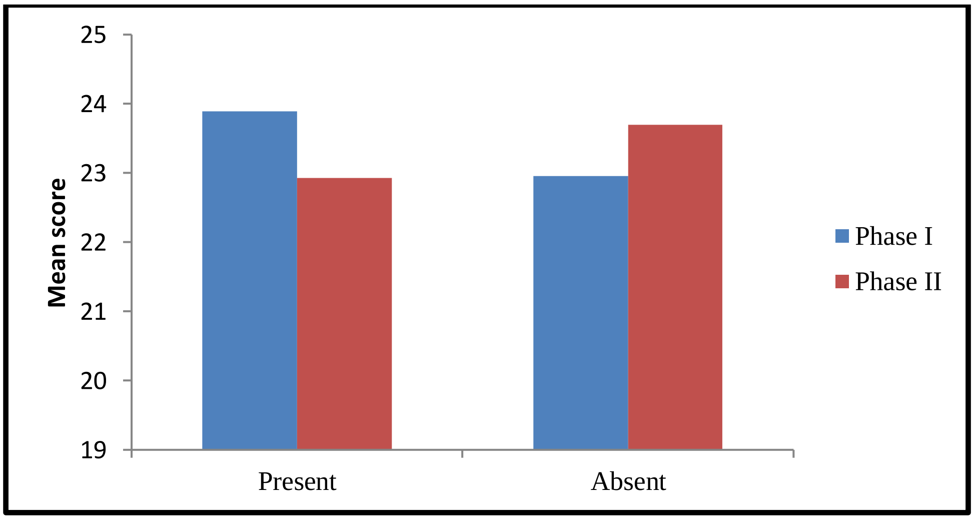
Graph 4.84: *Mean scores of APD subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.85: *Mean scores of Memory subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.86: *Mean scores of Problem solving subtest between the phases for participants who had diabetes and those who did not have diabetes*



Graph 4.87: *Mean scores of Organisation subtest between the phases for participants who had diabetes and those who did not have diabetes*

APD: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase II and no significant difference ($|z| = 0.243$, $p > 0.05$) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences ($|z| = 0.188$, $p > 0.05$). Comparison of persons with and without diabetes showed no significant difference in the first phase ($|z| = 0.459$, $p > 0.05$) as well as phase II of the study ($|z|= 1.285$, $p > 0.05$).

Memory: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase II and no significant difference ($|z| = 0.825$, $p > 0.05$) was observed. Similar comparison in scores of the participants with no diabetes during the two phases showed no significant differences ($|z| = 0.594$, $p > 0.05$). Comparison of persons with and without diabetes showed no significant differences ($|z| = 0.679$, $p > 0.05$) in the first phase as well as phase II ($|z|= 0.069$, $p > 0.05$) of the study.

Problem solving: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase II and no significant difference ($|z| = 0.21$, $p > 0.05$) was observed. On comparison of scores of the participants with no diabetes during the two phases a significant difference was not observed ($|z| = 0.865$, $p > 0.05$). In phase I comparison of persons with and without diabetes showed no significant differences ($|z| = 0.016$, $p > 0.05$). Comparison of these two categories for performance on phase II ($|z|= 0.797$, $p > 0.05$) of the study also showed no significant differences.

Organisation: The participants who reported to have diabetes were compared for any difference in their performance during phase1 and phase II and no significant difference ($|z| = 1.462$, $p > 0.05$) was observed. On comparison of scores of the participants with no diabetes during the two phases a significant difference was not observed ($|z| = 1.06$, $p > 0.05$). In phase I comparison of persons with and without diabetes showed no significant differences

(|z| = 1.014, p > 0.05). Comparison of these two categories for performance on phase II (|z|= 0.718, p > 0.05) of the study also showed no significant differences.

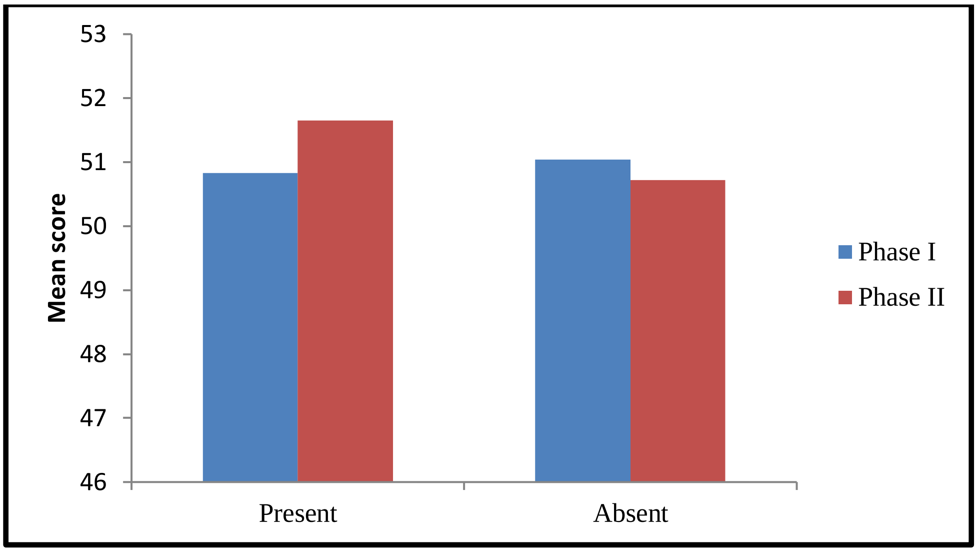
Contrary to findings of Spauwen et. al. (2013) who reported diabetes as an important factor for cognitive decline, the results in CLAP demonstrated no significant difference between person with and without diabetes. On the other hand, Katon et. al. (2012) in their study on 19,239 participants, found that only 1.2 percent of the total participants with diabetes had cognitive-communicative issues at 3 and 5 years of follow up. The participants demonstrated a stable cognitive performance between phase I and phase II of the present study. A possible explanation to this could be that all of the participants in the study who had diabetes were undergoing treatment, and the blood sugar levels were under control in these participants. Similar findings were seen even in the subtests of ACE-R for persons with and without diabetes.

4.2.3.3. Analysis of results of CLAP obtained from persons with hypertension

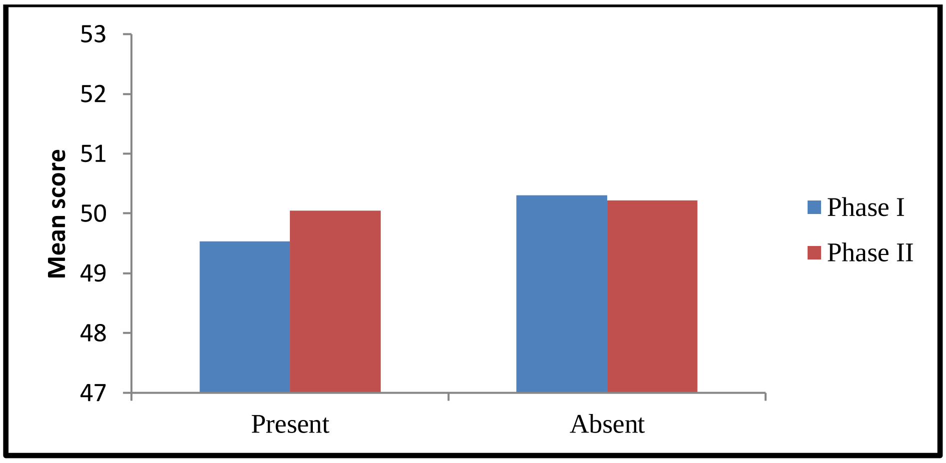
Table 4.23: *Descriptive statistics for subtests of CLAP for Hyper/ Hypotension issues and phase as the independent variable (Hyper/ Hypotension issues present, n= 60; Hyper/ Hypotension issues absent, n=81; N= 141)*

Hyper/ Hypotension		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	50.83	51.65	49.53	50.05	46.70	46.77	23.15	22.65
	Median	53.00	53.00	50.00	50.00	46.00	47.00	23.00	23.00
	SD	6.325	5.361	3.925	3.154	6.725	4.806	7.337	6.777
Absent	Mean	51.04	50.72	50.30	50.22	46.69	46.01	23.32	24.06
	Median	54.00	52.00	52.00	51.00	47.00	46.00	23.00	24.00
	SD	7.049	5.211	3.662	3.229	6.443	5.100	7.970	7.439

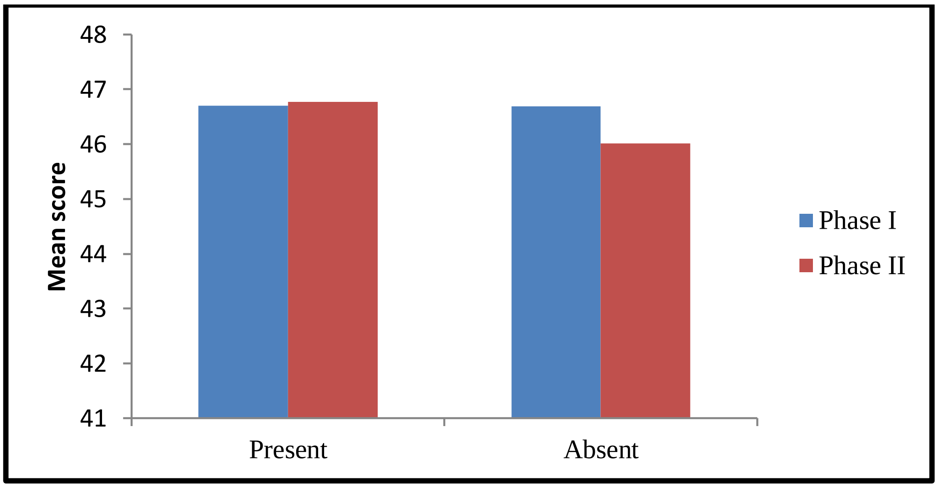
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



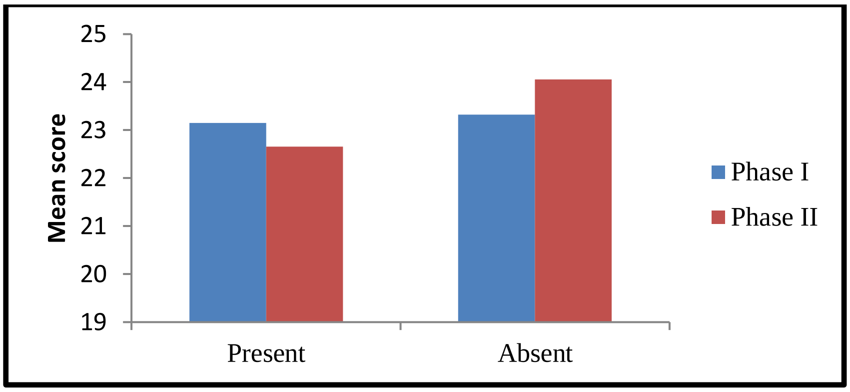
Graph 4.88: *Mean scores of APD subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



Graph 4.89: *Mean scores of Memory subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*



Graph 4.90: *Mean scores of Problem solving subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension.*



Graph 4.91: *Mean scores of Organisation subtest between the phases for participants who had hyper/ hypotension and those who did not have hyper/ hypotension*

APD: Participants who reported to have hypertension were compared for their scores on APD subtest during phase I and during phase II. As observed through the Wilcoxon signed ranks test, no significant difference ($|z|= 1.261$, $p > 0.05$) was observed between the two phases. In participants with no hypertension , again, significant difference between phase I and phase II was not observed ($|z|= 1.016$, $p > 0.05$). When the participants with and without hypertension during phase I were compared using the Mann-Whitney test no significant differences ($|z|= 0.485$, $p > 0.05$) was observed. Also during phase II of the study, no significant difference was observed between the two groups ($|z|= 1.282$, $p > 0.05$).

Memory: As observed through the Wilcoxon signed ranks test no significant differences ($|z|= 0.579$, $p > 0.05$) were observed between the two groups during the phase of the study. A similar analysis of the participants with no hypertension issues also showed no significant differences ($|z|= 0.439$, $p > 0.05$) between phase I and phase II. When the participants with and without hypertension issues during phase I were compared using the Mann-Whitney test no significant differences ($|z|= 1.346$, $p > 0.05$) were observed. During phase II of the study also no significant differences were observed between the two groups ($|z|= 0.419$, $p > 0.05$).

Problem solving: Participants who reported to have hypertension issues were compared for their scores on language during phase I and during phase II, as observed through the

Wilcoxon signed ranks test no significant differences (|z|= 0.103, $p > 0.05$) were observed during the two phases. A similar analysis of the participants with no hypertension issues also showed no significant differences (|z|= 1.131, $p > 0.05$) between phase I and phase II. When the participants with and without hypertension were compared using the Mann-Whitney test there was no significant differences (|z|= 0.08, $p > 0.05$) during phase I and phase II (|z|= 0.797, $p > 0.05$) of the study.

Organisation: Participants who reported to have hypertension were compared for their scores on language during phase I and during phase II, no significant differences (|z|= 0.714, $p > 0.05$) were observed during the two phases. A similar analysis of the participants with no hypertension also showed no significant differences (|z|= 0.945, $p > 0.05$) between phase I and phase II. When the participants with and without hypertension issues during phase I were compared using the Mann-Whitney test no significant differences (|z|= 0.061, $p > 0.05$) were observed. During phase II of the study also no significant differences were observed between the two groups (|z|= 1.371, $p > 0.05$).

Comparison between participants with and without hypertension revealed no significant differences in their performance. A study by Elias, Wolf, D'Agostino, Cobb and White (1993), reported their findings on 1,702 participants with hypertension, where only part of them received treatment for hypertension. It was observed that a steeper cognitive decline in terms of attention and memory was observed only in participants who did not receive treatment for hypertension. In the present study, all the participants who reported the presence of hypertension also reported that they were under medications for the same, and underwent regular medical follow-up. Given this, it can be concluded that a regular medical check-up and treatment at the early stages to keep the systemic disorders under control can prevent the cognitive decline that otherwise might be seen in persons not availing any treatment for the same.

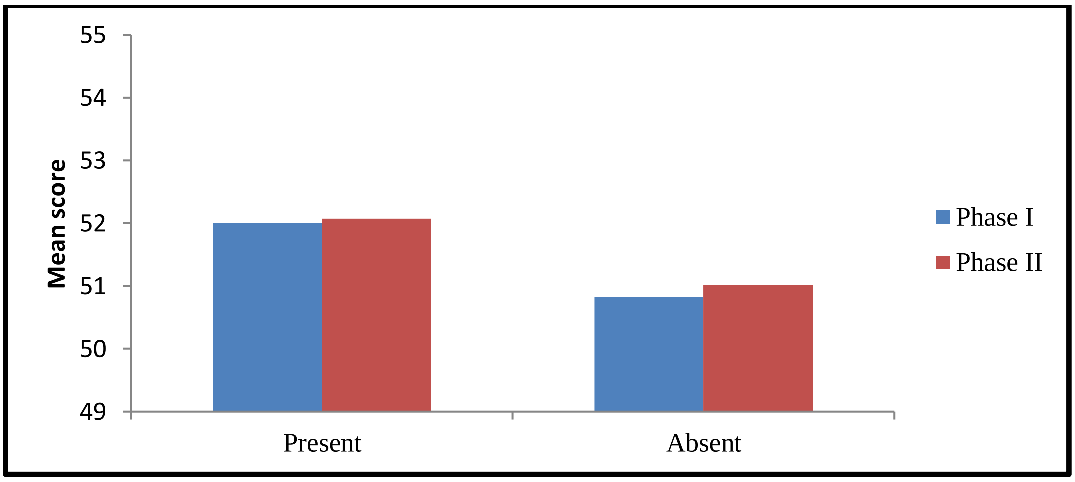
4.2.4. Analysis of cognitive communication skills with reference to habits.

4.2.4.1. Analysis of results obtained from persons with smoking.

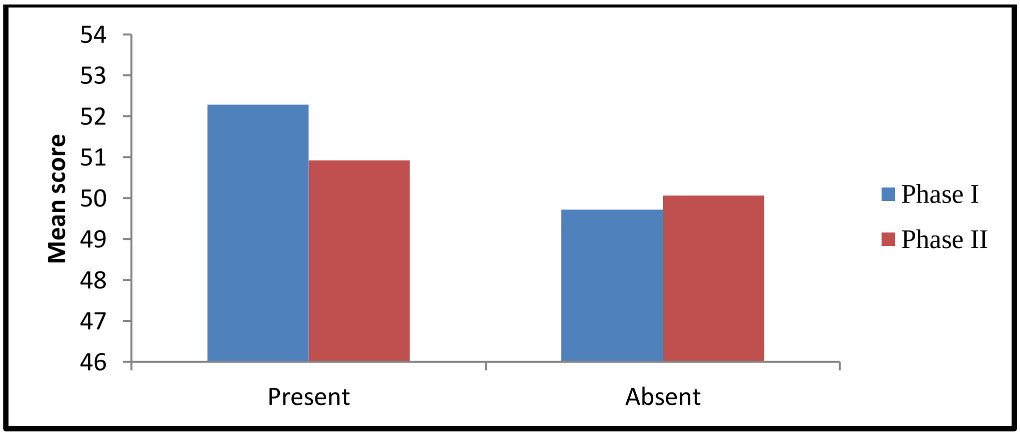
Table 4.24: *Descriptive statistics for subtest of CLAP for Smoking habits and phase as the independent variable (Present, n= 14; Absent, n=127; N= 141)*

Smoking habits		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	52.00	52.07	52.29	50.93	48.57	47.07	26.57	25.71
	Median	53.50	53.00	53.00	51.00	48.50	47.00	25.00	23.50
	SD	5.364	4.565	2.998	3.316	6.136	4.480	6.272	8.185
Absent	Mean	50.83	51.01	49.72	50.06	46.49	46.25	22.88	23.21
	Median	54.00	52.00	51.00	50.00	47.00	47.00	23.00	23.00
	SD	6.869	5.355	3.782	3.174	6.574	5.035	7.754	7.046

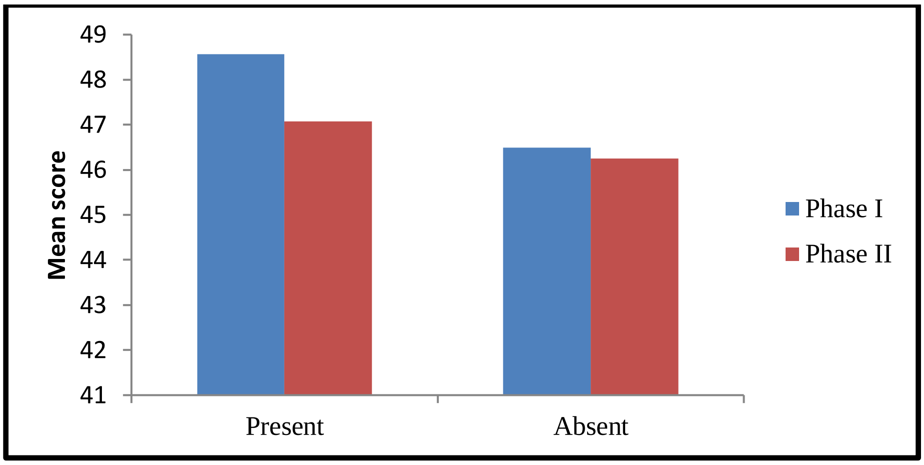
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



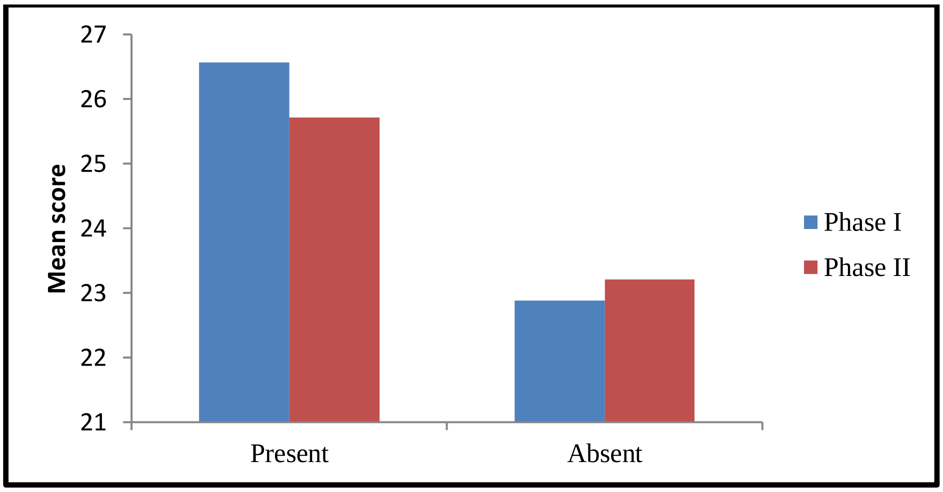
Graph 4.92: *Mean scores of APD subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.93: *Mean scores of Memory subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.94: *Mean scores of Problem solving subtest between the phases for participants who had smoking habits and those who did not have smoking habits*



Graph 4.95: *Mean scores of Organisation subtest between the phases for participants who had smoking habits and those who did not have smoking habits*

APD: Participants who reported of smoking habits and the non smokers were analysed for any differences in performance between phase I and phase II of the APD subtest. No significant difference was observed for the smokers ($|z|= 0.000$, $p > 0.05$). Also in non-smokers, no significant difference was seen between phase I and 2 ($|z|= 0.012$, $p > 0.05$). Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase I ($|z| = 0.266$, $p > 0.05$) as well phase II ($|z| = 0.657$, $p > 0.05$) of the APD subtest.

Memory: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase I and phase II of the study. This was analysed using the Wilcoxon's signed ranks test. No significant difference was observed for the persons with smoking ($|z| = 1.815$, $p > 0.05$) as well as the non smokers ($|z| = 0.598$, $p > 0.05$). Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. No significant effects was observed between the two categories during phase I ($|z| = 2.654$, $p > 0.05$) as well phase II ($|z| = 0.987$, $p > 0.05$) of the study.

Problem solving: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase I and phase II of the study. This was analysed using the Wilcoxon's signed ranks test. No significant difference was observed for the the persons with smoking ($|z| = 0.907$, $p > 0.05$). The non smokers as well did not show a significant difference ($|z| = 0.597$, $p > 0.05$) in performance during the two phases of the study. Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. Significant differences was not observed between the smokers and non smokers during phase I ($|z| = 0.963$, $p < 0.05$). The difference between the two categories was also not significant ($|z| = 0.54$, $p > 0.05$) during phase II of the study.

Organisation: Participants who reported to have habits such as smoking as well as the non smokers were analysed for any differences in performance during phase I and phase II of the study. This was analysed using the Wilcoxon's signed ranks test. No significant difference was observed for the the persons with smoking ($|z| = 0.988$, $p > 0.05$). The non smokers did not show a significant difference ($|z| = 0.343$, $p > 0.05$) in performance during the two phases of the study. Mann-Whitney test was done to examine if there was any difference in performance of the participants who smoked versus the participants who did not smoke. Significant differences was observed between the smokers (mean = 26.57) and non smokers (mean = 22.88) during phase I ($|z|= 1.999$, $p < 0.05$). The difference between the two categories was however not significant ($|z|= 0.922$, $p > 0.05$) during phase II of the study

Generally, the results on CLAP for participants with a past history of smoking, and participants who did not smoke at all did not show significant variations, except on the subtests of Memory and Organisation tasks. Participants with a past history of smoking were observed to perform better than the others on these two subtests. Smoking habits have been widely reported to cause a faster decline or impairment to the cognitive performance of the individual (Wang et. al., 1999; Fratiglioni et al., 2007). To explain these contradictory findings in the present study, the demographic variables of the participants were closely examined. It was seen that 92 percent of the participants with a past history of smoking were also multilingual or bilingual and 56 percent of participants with habits of smoking were in occupations which required a greater mental effort. This would have accounted for balanced performance in these individuals.

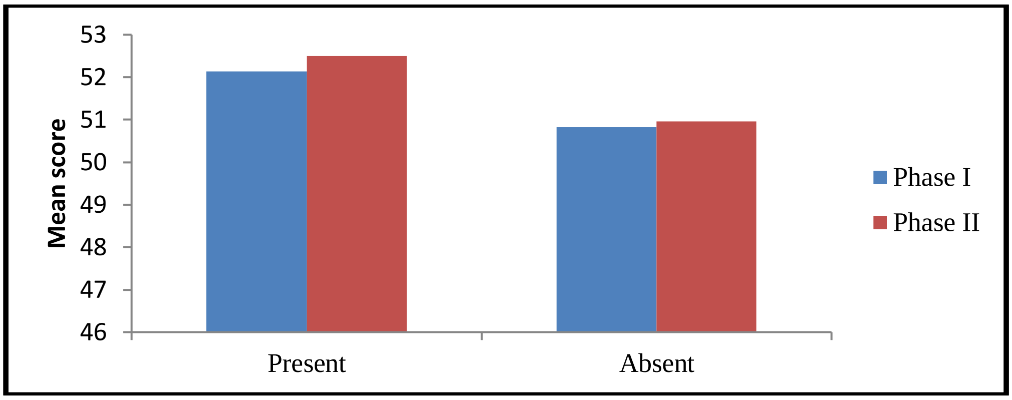
4.2.4.2. ALCOHOLISM: Analysis of results obtained from persons with alcoholism

Table 4.25: *Descriptive statistics for subtests of CLAP for Alcoholism and phase as the independent variable (Present, n= 14; Absent, n=127; N= 141)*

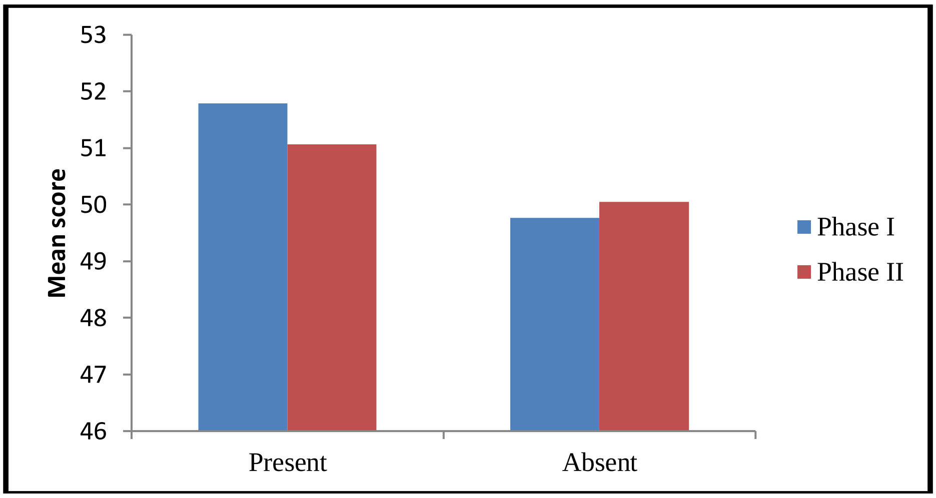
Drinking habits		**APD**		**Memory**		**Problem solving**		**Organisation**	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	52.14	52.50	51.79	51.07	49.00	47.64	28.86	27.43
	Median	53.00	53.00	52.00	51.00	49.50	47.00	27.00	26.00
	SD	5.628	4.879	2.860	3.407	6.325	5.078	8.047	8.537
Absent	Mean	50.82	50.96	49.77	50.05	46.44	46.19	22.63	23.02

Median	54.00	52.00	51.00	50.00	47.00	47.00	23.00	23.00
SD	6.845	5.315	3.826	3.159	6.539	4.961	7.415	6.908

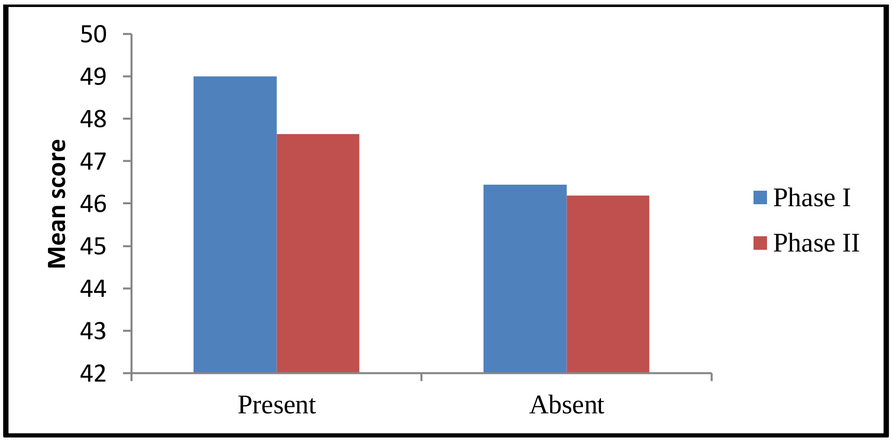
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



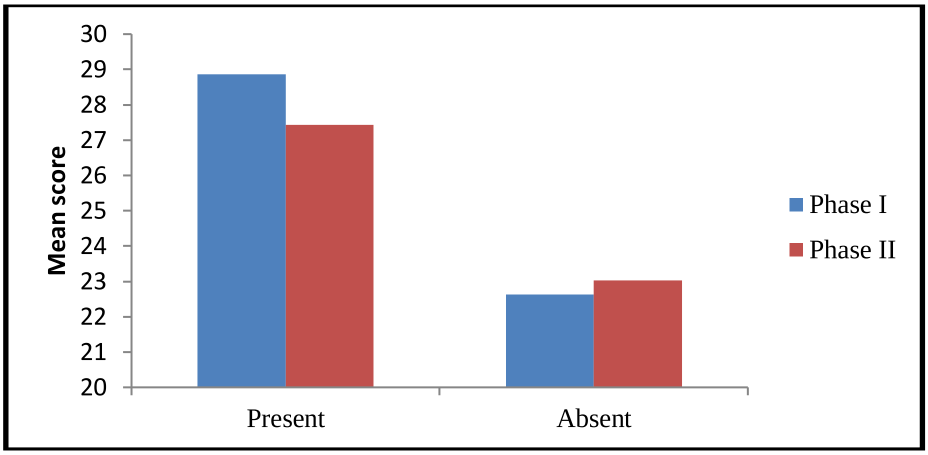
Graph 4.96: *Mean scores of APD subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.97: *Mean scores of Memory subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.98: *Mean scores of Problem solving subtest between the phases for participants who had drinking habits and those who did not have drinking habits*



Graph 4.99: *Mean scores of Organisation subtest between the phases for participants who had drinking habits and those who did not have drinking habits*

APD: When the performance of persons who reported to consume alcohol was compared between phase I and 2, no significant difference was observed (|z|= 0.277, p > 0.05). Participants who had never consumed alcohol also showed no significant difference between phase I and phase II (|z|= 0.103, p > 0.05). No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 (|z|= 0.408, p > 0.05) and during phase II (|z|= 0.995, p > 0.05).

Memory: When persons who reported to consume alcohol were compared for their performance, no significant difference (|z|= 0.907, p > 0.05) was observed during the two phases of the study. Participants who did not consume alcohol also showed no significant differences (|z|= 0.337, p > 0.05) between the two phases of the study. No significant differences was observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 (|z|= 1.897, p > 0.05) and during phase II (|z|= 1.167, p > 0.05).

Problem solving: When the performance of persons who reported to consume alcohol were compared for their performance, no significant difference (|z|= 0.906, p > 0.05) was observed during the two phases of the study. Participants who did not consume alcohol also did not show a significant differences (|z|= 0.654, $p > 0.05$) between the two phases of the study.Significant differences was not observed between the performance of the participants who consume alcohol and those who did not consume alcohol when compared during phase1 (|z| = 1.236, $p > 0.05$) also during phase II (|z|= 0.84, $p > 0.05$) no significant differences was observed.

Organisation: When the performance of persons who reported to consume alcohol were compared for their performance, no significant difference (|z|= 1.018, $p > 0.05$) was observed during the two phases of the study. Participants who did not consume alcohol also did not show a significant differences (|z|= 0.418, $p > 0.05$) between the two phases of the study. Significant differences was observed between the performance of the participants who consume alcohol (mean = 28.86) and those who did not consume alcohol (mean = 22.63) when compared during phase1 (|z| = 2.710, $p < 0.05$) but during phase II (|z|= 1.838, $p > 0.05$) no significant differences was observed.

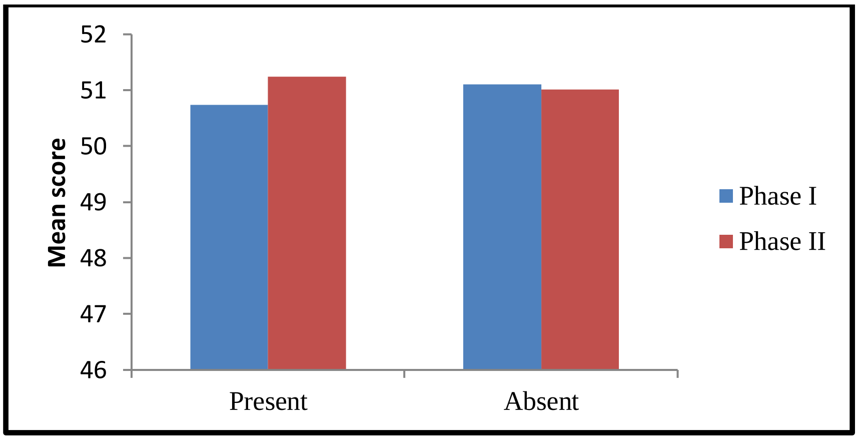
Within the variable of drinking habits, none of the participants were seen to show a difference between phase I and phase II. Participants with drinking habits when compared to participants without drinking habits showed no significant difference in their performance except during the first phase of Organisation subtest of CLAP. On observation of the demographic details of the participants with drinking habits, it was seen that they had an added advantage that 58 percent of these participants were in occupations that required greater mental effort, as opposed to 43 percent in participants with no drinking habits. Also, 93 percent of the participants with a past drinking habit were bilingual or multilingual, whereas only 61 percent of participants with no drinking habits were bilingual or multilingual. On the whole, it is observed that participants with drinking habits performed equally well as the other participants, and this result can be justified due to their advantage in number of languages known and the indulging in occupations with greater mental effort.

4.2.5. Analysis of results obtained by participants' self report of cognitive-communication difficulties.

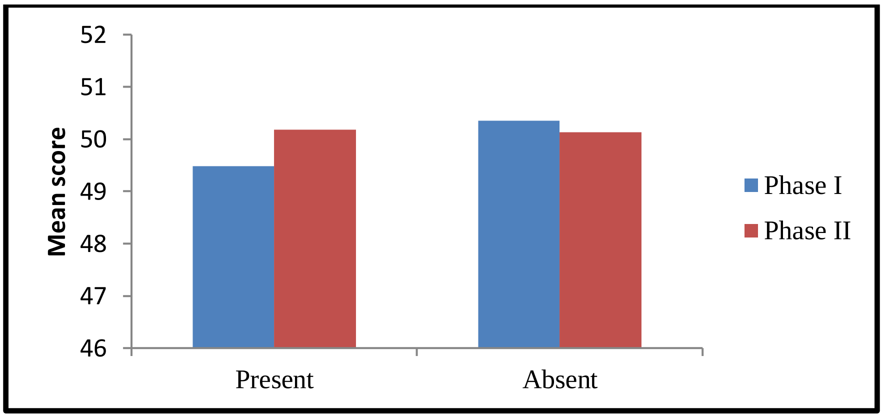
Table 4.26: *Descriptive statistics for subtest of APD in CLAP for Cognitive-communicative abilities*

Cognitive-communicative issues		APD		Memory		Problem solving		Organisation	
		Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Present	Mean	50.74	51.24	49.48	50.18	45.66	45.85	22.27	23.32
	Median	54.00	53.00	50.00	50.50	45.50	46.00	20.50	23.00
	SD	7.211	5.075	4.072	3.016	6.756	5.343	7.742	6.868
Absent	Mean	51.11	51.01	50.35	50.13	47.51	46.71	24.01	23.57
	Median	53.00	53.00	51.00	50.00	48.00	47.00	24.00	24.00
	SD	6.365	5.460	3.516	3.333	6.292	4.663	7.593	7.447

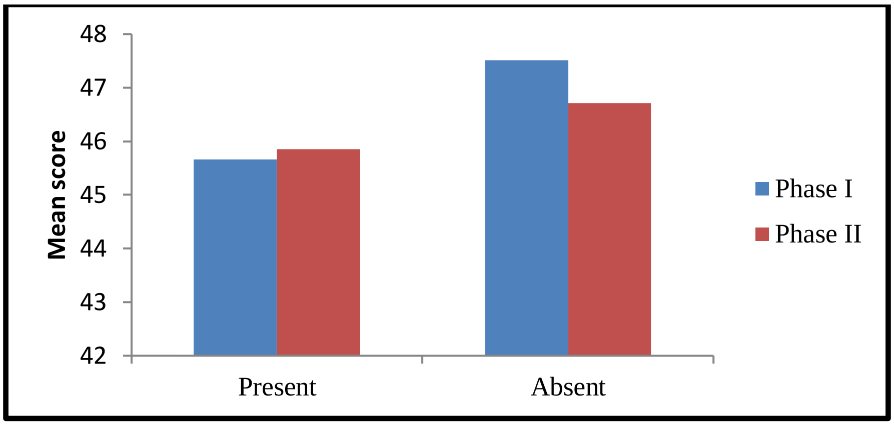
Note: n= number of participants within the category; N= total participants in the study; Phase I= subtests of CLAP administered at the beginning of the study; Phase II= subtests of CLAP administered after 3 months of initial testing; SD= standard deviation



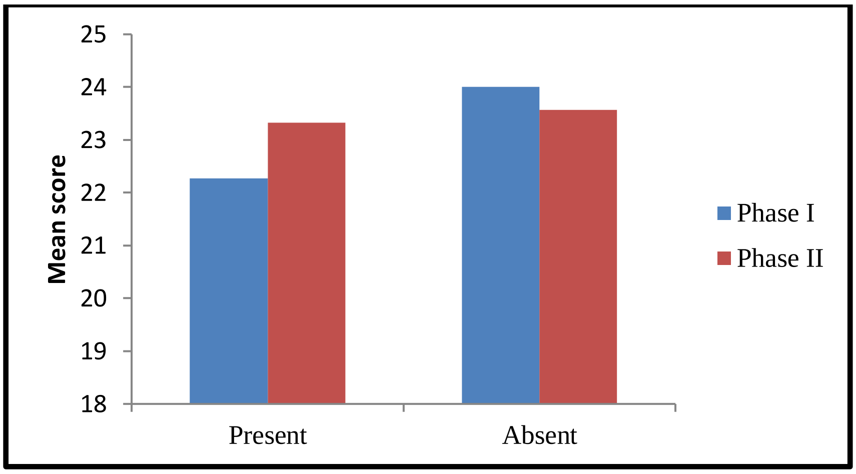
Graph 4.100: *Mean scores of APD subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.101: *Mean scores of Memory subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.102: *Mean scores of Problem solving subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues*



Graph 4.103: *Mean scores of Organisation subtest between the phases for participants who had cognitive-communicative issues and those who did not have cognitive-communicative issues.*

APD: No significant difference was seen in the performance of the participants who reported to have cognitive-communicative issues ($|z|= 0.661$, $p > 0.05$) when their scores during the two phases of APD subtest were compared. Similarly, no significant difference between the performance on the two phases was observed for the participants who reported no cognitive-communicative difficulties in the first phase of the study ($|z|= 0.552$, $p > 0.05$). Comparing the performance of participants who reported to have issues in cognitive- communication abilities during the first phase of the study with those who did not report any issues, no significant difference was noticed ($|z|= 0.381$, $p > 0.05$) during phase I. In phase II of the APD subtest, the same categories were examined for any differences in performances and no significant differences was observed ($|z|= 0.125$, $p > 0.05$).

Memory: There was no significant difference ($|z|= 0.919$, $p > 0.05$) in the performance of the participants who reported to have Cognitive-communicative issues when compared for their scores during the two phases of the study. Similarly no significant differences ($|z|= 0.755$, $p > 0.05$) were observed for the participants who reported to having no cognitive-communicative issues during the two phases of the study. On comparing the performance of participants who reported to have issues during the first phase of the study and those who reported to have no issues, no significant differences was observed during phase I ($|z|= 1.112$, $p > 0.05$). During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z|= 0.008$, $p > 0.05$) was observed.

Problem solving: There was no significant difference ($|z|= 0.004$, $p > 0.05$) in the performance of the participants who reported to have cognitive communicative difficulties when compared for their scores during the two phases of the study. No significant differences ($|z|= 1.11$, $p > 0.05$) were observed for the participants who reported to having no memory issues during the two phases of the study. On comparing the performance of participants who reported to have cognitive communicative difficulties during the first phase of the study and those who reported to have no such difficulties no significant differences ($|z|= 1.795$, $p > 0.05$) was observed during phase I. During the next phase of the study the same categories were examined for any differences in performances and no significant differences ($|z|= 0.906$, $p > 0.05$) was observed.

Organisation: There was no significant difference ($|z|= 1.179$, $p > 0.05$) in the performance of the participants who reported to have cognitive communicative difficulties when compared for their scores during the two phases of the study. No significant differences ($|z|= 0.812$, $p >$

0.05) were observed for the participants who reported to having no cognitive communication issues during the two phases of the study. During the first phase of the study the performance of participants who reported to have cognitive communication was compared with those who reported to have no cognitive communicative issues no significant differences ($|z| = 1.383$, $p > 0.05$) was observed. Similarly there was no significant differences ($|z| = 0.300$, $p > 0.05$) in phase II.

Contrary to what one might expect in individuals with a self report of cognitive communicative issues, these participants performed on par with those who did not have any issues. It was observed that those participants who did not report of any cognitive communicative issues performed slightly better but none of these differences were significant. Also, the participants did not show any significant difference in their performance from phase I to phase II. In the present study, the general difficulties reported in their cognitive functioning were restricted to memory and attention domains. Yet, no significant change in participants' performance from phase I to phase II was observed. Though these participants reported to experience difficulties with recalling names of unfamiliar persons, misplacing common objects such as keys, and forgetting to take their pills, these difficulties were not severe to impede their performance on CLAP. Although these participants experienced certain difficulties in their daily, the tasks of CLAP did not have a high ecological value and hence it did not reflect in their scores between the two phases.

Summing up the findings of the study, it was clear that cognitive-linguistic abilities remained stable over a three-month period in healthy elderly participants. Moreover, an improvement was seen on a majority of the subtests, implying two possibilities. One, the role of practice effects was evident wherein previous exposure to the test material led to familiarity of the material, and hence had an advantage while performing the tasks during the second phase of the study. Secondly, this implies the ability of the elders to learn and recall information even with a single exposure. On the demographic variable, where we examined the effect of age on cognitive-linguistic performance, the 60-70 year old participants showed a minimal but better performance than the 70-80 year-olds on majority of the subtests of ACE-R and CLAP. As expected, minimal or no changes were seen between the two age groups, suggesting a very gradual change in performance as age increases. The next demographic variable we looked into was the effect of gender. Males in the study performed consistently better than the female participants. Although literature evidence generally has shown females to perform better on tasks of memory, this was not apparent in our study possibly because of the influence of factors as low education among 75 percent of the female participants.

In consonance with previous literature, the multilinguals and bilinguals performed better than the monolinguals. As observed by Bialystok, et. al. (2004), bilinguals performed better than monolinguals on working memory and speed tasks. In our study, both bilinguals and multilinguals outperformed the monolinguals on tasks of attention, memory, problem solving, organisation and language, irrespective of presence/ absence of other demographic and lifestyle factors as age/ gender/ medical conditions, etc. Similarly educational level of the participants had a significant influence on their performance on the cognitive tasks in the present study. Even the variable of occupation showed clear differences in the scores of participants who were housewives/ farmers compared to participants who were teachers/ doctors/ nurses, etc. In the case of medical conditions as cardiac issues, diabetes and hyper/ hypotension, no significant influence was observed of these factors on cognitive abilities of the participants in this study. A probable reason that might have led to these findings is the fact that a strong advantage of being a multilingual, having more years of formal education, and being in occupations that required more mental effort was present in a larger percentage of the participants with these medical conditions. A similar trend was also seen in the participants who had habits as smoking and alcoholism, wherein a greater percentage of them were multilingual, had more years of formal education, and who were in occupations that required more mental effort. The participants who reported of any cognitive-communicative issues during the period of the study, showed a slightly poorer performance than those who did not have any issues on tasks of memory, problem solving and organization. Overall, the present study looks at those factors listed in literature reported to affect cognition in aging. We have seen repeatedly in our findings that age of the participants is an important factor affecting cognition, but only certain aspects of cognition. The number of languages known by a person, stood out as a very important factor to reduce the negative effects of aging and lifestyle factors on the cognitive performance of the participants. Education and occupation were the other variables that showed a significant influence in reducing the negative effects of aging on cognitive performance.

4.2.5 Interaction effect of ACE-R and CLAP

The total scores of ACE-R and CLAP between two phases were subjected to correlation analysis using Spearman's rank correlation test. The results are as shown in Table 4.27. There was a positive correlation observed between the two protocols. As the scores of ACE-R increased from phase I to phase II there was also increase in scores of CLAP from phase I to phase II. There was a positive correlation observed for each protocols between two phases. It is suggested that both the tests are equally sensitive in examining effect of aging on cognitive linguistic skills.

Table 4.27 *Results of Spearman's rank correlation for ACE-R and CLAP across phase I and II*

Parameter	S-rho value	Significance	SOC (in %)
ACE-R I & ACE-R II	0.856	0.000	73.27
CLAP I & CLAP II	0.756	0.000	57.15
ACE-R I & CLAP I	0.725	0.000	52.56
ACE-R II & CLAP II	0.723	0.000	52.27

Note: SOC = Strength of correlation, S-rho = spearman's correlation co-efficient

Chapter 5

Summary and Conclusion

Contents

Summary and Conclusion

Life expectancies have improved with the increase in medical care over recent decades. But it is questionable as to how many report to medical care for cognitive-communication decline. The reason is the lack of awareness of cognitive-communication abilities in the elderly and a dearth of studies in the Indian context. The study aimed to profile cognitive-communication impairments in the elderly and to further explore some of the potentially important predictor variables of cognitive-communication status in a sample of Kannada speaking healthy elderly.

The participants for the study were healthy elderly aged 60 to 80 years having Kannada as their first language. A total of 150 individuals participated in the present study. The participants were drawn from senior citizen homes/ laughter clubs/ residential places in Mysore, Karnataka, India. The participants had undergone a minimum of five years of formal education. Their vision and hearing acuity was normal or was corrected to normal/ near normal limits. The participants' demographic details along with their medical concerns were collected from all the participants along with the consent for agreeing to participate in the study. They were screened using Quick Neurological Screening Test and NIMHANS Mental Health Screening Questionnaire to rule out presence of any neurological soft signs and psychological disturbances.

The present study used a longitudinal cohort research design. The study assessed the cognitive performance of participants with a three month interval between the two phases. The first phase involved testing for cognitive linguistic abilities using Cognitive linguistic assessment protocol (CLAP; Rajasudhakar & Shyamala, 2005) and Addenbrooke's Cognitive Examination Revised (ACE-R, Indian adaptation in Kannada by Krishnan & Lokesh, 2010).

The second phase involved re-assessment of the same participants using CLAP and ACE-R. A cross sectional standard group comparison research design was used for the study.

The data obtained during the two phases of the study were subjected to statistical analysis using SPSS version 17.0. Descriptive statistics was obtained for the scores of ACE-R and CLAP. To examine the differences in performance of the participants between the two phases the Wilcoxons signed-ranks test was used. In order to study the effect of each independent variables, the participants were grouped within that variable and Kruskal-Wallis and Mann-Whitney tests were performed to compare these groups.

The results of this study were discussed under two sections, i.e., ACE-R and CLAP. To summarize these results, the participants either maintained their cognitive-linguistic performance as observed on the CLAP test, or showed an improvement as seen in the ACE-R test. This provided evidence for the likelihood of practice effect on ACE-R scores in spite of the three month interval between the two phases.

Thus the conclusions made from the present research were:

- Cognitive abilities remain stable trough a three month period in healthy elderly in the age range of 60-80 years.
- The 60-70 year old participants performed on par with the 70-80 year old participants in our study.
- Males were found to perform better than the females.
- The positive indicators for better performance on tasks were more years of education, occupations that demanded higher mental effort than manual effort and being multi-linguals/bilinguals.
- Medical issues such as cardiac problems, diabetes, and hyper/ hypotension, a past history of smoking and drinking habits, the self-perceived decline in the cognitive

abilities did not affect the cognitive performance of the participants for three months interval between the two evaluation.

- The interaction effect of ACE-R and CLAP indicated that both the tests are equally sensitive and elicit equal results. Both the tests can be used in the routine clinical trials but not absence of others. Although both check the cognitive skills, CLAP taps cognition in the presence of strong linguistic stimuli.

To conclude, demographic variables such as gender, number of languages known, education and occupation of the participants were crucial determinants of cognitive performance of the participants. Presence of these advantages had a higher impact than variables of age, medical history and habits of smoking and/or drinking.

5.1 Implications of the study

- Clinical assessments should consider the influence of practice effects when re-assessing individuals within durations such as three months. The ACE-R test had a large number of ecological tasks, but this could have given a larger scope for practice effects to influence performance. Hence, use of alternate forms as stimulus material during re-assessments is suggested.
- The CLAP test has tasks that are more complex and less ecologically valid but this had the counter effective advantage of being more resistant to practice effects.
- Since the multilinguals and bilinguals had a clear advantage over the monolinguals, learning a new language and stimulating thought processes implies better cognitive performance during later stages of life.
- Being involved in a primary occupation that required a higher mental effort than manual effort and more number of years of education implied better cognitive performance. Although this implication should be taken into consideration it could

also imply that occupations that demands higher mental effort at the cost of manual effort maybe sedentary in nature. This could lead to other health related issues such as obesity. Hence it is pertinent that a balanced lifestyle with equal importance to manual and mental effort is maintained.

- The participants who had habits such as drinking and smoking performed on par with participants who did not have these habits. Since a majority of them were bilinguals/ multilinguals, and were involved in occupations that required higher mental effort, the influence of these variables overrode the effects that these habits may have had on their cognitive performance.

5.2 Future Recommendations

- As seen in the present study, certain variables were found to have a positive influence on the cognitive performance. These variables need to be explored further as possible preventers of cognitive impairment/ dementia.
- Cardiac issues are by nature broad in its severity and type and hence require a more detailed approach to elicit its effects on cognitive-linguistic performance.
- Future studies should consider the duration of health related concerns as an important factor when evaluating its influence on cognitive performance.
- A longitudinal study to evaluate the cognitive performance of healthy elderly individuals to track the effect of aging on cognitive performance beyond 60 years of age is essential.
- To study the performance of elderly individuals who reside in various home settings such as at old-age homes/ in nuclear families or joint families.
- Use of other tests and instruments that assess global cognitive performance and are user friendly can be utilized.

- Development of a cognitive-linguistic test that can be used in the assessment of illiterate individuals is warranted.

5.3 Limitations of the study

- Information regarding details such as the duration, and type of health related concerns could have been obtained to further strengthen their effect on cognitive performance.
- Information concerning details of the quantity of alcohol consumed, and the number of cigarettes smoked could have been obtained to further understand their influence on cognitive performance.
- Only individuals having a minimum of five years of education were included as a part of the study. Individuals who were illiterates could not be included due to the task requirements.
- The study excluded participants above the age of 80 years, considering that there are a large number of individual above 80 years, the age range could have been expanded.
- The study considered only two phases with 3months interval between the phases. It is suggested to carryout study in multiple phases and increased duration between the phases.

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