



## Effectiveness of home-based cognitive training program on a cognitive level, the activity of daily living among elderly persons with mild cognitive impairment in selected community settings of Puducherry

Govindakumari R<sup>\*1</sup>, Vijayalakshmi<sup>2</sup>, Sai Sailesh Kumar Goothy<sup>3</sup>, Vijay Raghvan<sup>1</sup>

<sup>1</sup>Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India

<sup>2</sup>Vignesh Nursing College, Thiruvannamalai, Tamil Nadu, India

<sup>3</sup>Department of Physiology, R.D. Gardi Medical College, Ujjain, Madhya Pradesh, India

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### ABSTRACT

Aging is a physiological process that leads to both biological and psychological changes. The brain undergoes structural changes as a part of aging. According to the investigator's best knowledge and based on the extensive review, no structured study was conducted in India to test the effectiveness of cognitive training program. Hence, the present study was conducted to test the effectiveness of a home-based training program on select outcomes. A total of 314 elderly participants were recruited for the study after obtaining the written informed consent. After recruiting, the participants were randomly grouped into two groups, that is control and intervention groups, with 157 participants in each group. The intervention was administered to the experimental group. The present study results suggest that the home-based cognitive training program is effective in improving cognitive functions and daily life activities. The study recommends further detailed and multi-centered studies in this area to recommend the implementation of the program in the management of the cognitive impairments of the elderly.



### \*Corresponding Author

Name: Govindakumari R

Phone: 9677428255

Email: govind.harimukesh@gmail.com

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1992). Aging is a natural process where the ability of the cells of the body declines. Along with the other cells, the brain cells also affected, which accounts for a decrease in the cognitive functions (Harada *et al.*, 2013). Cognitive functions are essential for the management of daily life activities in the elderly population (Barnes and Yaffe, 2011). Cognitive therapies have shown to have a positive impact on the cognitive functions in the elderly population. It improves synaptic transmission and prevents the formation of the Beta-amyloid proteins. This prevents the initiation of age-related decline in cognitive impairment and thus improves the cognitive functions and day-to-day functioning.

### INTRODUCTION

Aging is a physiological process that leads to both biological and psychological changes. The brain undergoes structural changes as a part of aging. However, these changes in the brain are not the same in all the areas, and these changes affect the different cognitive domains in a different way (Craik,

The home-based cognitive therapy was reported to act through the principle called neuronal plasticity as the brain has the capability to habituate and learn. So, if the brain is trained properly, then the lost functions can be restored. Improvement in the major cognitive domains like attention, mem-

ory was observed, followed by home-based cognition therapy (Jamuna and Shibu Pillai, 2010). A further advantage of this therapy is that it reduces the number of hospital visits. It also reduces the cost and hence affordable to all classes of the population. The present lack of effective drug therapy for these conditions makes it imperative to investigate other potential therapeutic interventions. Cognitive training has been described as possibly useful in improving cognitive function in elderly subjects with mild impairment and early dementia. However, there have been few well-designed studies to date, and the results are equivocal. Further to date, according to the investigator's best knowledge and based on the extensive review, no structured study was conducted in India to test the effectiveness of cognitive training program. Hence, the present study was conducted to test the effectiveness of a home-based training program on select outcomes.

## MATERIALS AND METHODS

### Study design

Experimental study

### Study setting

The present study was conducted at selected community settings of Puducherry.

### Study participants

A total of 314 elderly participants were recruited for the study after obtaining the written informed consent. A convenient sampling technique was used in the selection of the participants. The following criteria were used while recruiting the participants.

### Inclusion criteria

1. The client with Age  $\geq$  60
2. Client whose score in MMSE greater than 20
3. Clients who are a permanent resident of the locality for at least in the past 6 months.
4. Clients who are willing to participate in the study

### Exclusion criteria

1. Clients with significant neurological deficit
2. A Client who is in antidepressants
3. Clients with a history of alcohol abuse
4. Clients with a significant physical disability

After recruiting, the participants were randomly grouped into two groups, that is control and intervention groups, with 157 participants in each group.

### Home Based cognitive Training Programme

Each training session comprised the following steps

#### Orientation in time and space

Performed using external aids such as a calendar and the day's newspaper, whereby participants determined the current day, month, and year.

#### Presentation of the names

Participants and the researcher presented their names. Verbal associations were elicited between the person's name and their appearance.

#### Visual and auditory attention exercises

The visual attention task entailed identifying details in photographs, letters, or figures amongst several stimuli spread out on a single printed sheet, as well as spotting differences between two similar photographs, among other activities. The auditory attention exercises included tasks such as detecting words in songs and identifying whether two consecutively repeated sequences of numbers or words matched or differed.

#### Memory exercises using visual aids

The categorization strategy with ecological tasks were used, i.e., simulated activities of daily living, graded from simple to more complex. Grocery items were used in the early stages of training progressing to supermarket item lists only, by the end of the training.

#### Transfer task

Practical tasks from activities of daily living were used, such as to the supermarket, giving and checking change, etc. The older adults were expected to calculate the total cost of the purchase and offer change or check the change received.

Cognitive training was given to all eligible subjects individually two sessions weekly continuously for a period of 1 month i.e., a total of 8 sessions. Each session will take approximately 1 hour.

#### Ethical considerations

The present study protocol was approved by the institutional human ethical committee. The study was conducted as per the guidelines of ICMR.

#### Data analysis

Data was analyzed using SPSS 20.0. Data were expressed in frequency and percentage and mean and SE. The paired and unpaired t-test was used to observe the significance of the difference. A chi-square test was used to observe the association. A

**Table 1: Frequency and percentage-wise distribution of demographic variables among elderly persons with mild cognitive impairments**

S. No	Demographic data	Experimental group (n=30)		Control group		Association for homogeneity test	
		Frequency	Percentage	Frequency	Percentage	Chi-square value	p-value
1	Age (in years):						
	60-70	4	13.3	5	16.7	4.32 (df=4)	0.364
	71-75	4	13.3	5	16.7		
	76-80	7	23.3	9	30		
	81-85	8	26.7	2	6.7		
Above 85	7	23.3	9	30			
2	Gender :					0.3 (df=1)	0.584
	Female	11	36.7	9	30		
	Male	19	63.3	21	70		
3	Residence:					3.64 (df=2)	0.162
	Rural	8	26.7	14	46.7		
	Urban	12	40	6	20		
	Semi Urban	10	33.3	10	33.3		
4	Education:					2.4 (df=4)	0.663
	No formal education	4	13.3	6	20		
	Up to primary education	8	26.7	8	26.7		
	Up to Higher secondary	7	23.3	7	23.3		
	Graduate-level	4	13.3	6	20		
	Others	7	23.3	3	10		
5	Occupation:					0.797 (df=4)	0.939
	Homemaker	5	16.7	5	16.7		
	Coolie	7	23.3	5	16.7		
	Self employee	5	16.7	4	13.3		
	Govt. employee	7	23.3	8	26.7		
	Private employee	6	20	8	26.7		
6	Marital status:					0.635 (df=1)	0.426
	Single	10	33.3	13	43.3		
	Married	20	66.7	17	56.7		
7	Religion:					1.32 (df=2)	0.517
	Muslim	8	26.7	12	40		
	Christian	11	36.7	10	33.3		
	Hindu	11	36.7	8	26.7		
	Others	0	0	0	0		

*Continued on next page*

Table 1 continued

S. No	Demographic data	Experimental group (n=30)		Control group		Association for homogeneity test	
		Frequency	Percentage	Frequency	Percentage	Chi-square value	p-value
8	Type of family:					2.05 (df=2)	0.358
	Nuclear family	9	30	10	33.3		
	Joint family	15	50	10	33.3		
	Extended family	6	20	10	33.3		
9	Monthly family income:					3.24 (df=3)	0.356
	Less than Rs.5000	7	23.3	7	23.3		
	Rs.5000-10000	4	13.3	9	30		
	Rs.10001-15000	12	40	7	23.3		
	Above Rs.15000	7	23.3	7	23.3		
10	Status of Co-morbid disease:					2.16 (df=2)	0.453
	Diabetes mellitus/Other endocrine disorders	11	36.7	10	33.3		
	Hypertension/other cardiac disorder	7	23.3	12	40		
	Respiratory disorder	12	40	8	26.7		
	Any other disorders	0	0	0	0		
11	Status of caregiver:					1.29 (df=2)	0.524
	First degree relatives	7	23.3	11	36.7		
	Second-degree relatives	14	46.7	12	40		
	Guardians	9	30	7	23.3		
	Others	0	0	0	0		
12	Duration of care providing:					3.01 (df=3)	0.389
	1 to 2 years	7	23.3	8	26.7		
	3 to 4 years	5	16.7	10	33.3		
	4 to 6 years	8	26.7	6	20		
	Above 5 years	10	33.3	6	20		

Continued on next page

Table 1 continued

S. No	Demographic data	Experimental group (n=30)		Control group		Association for homogeneity test	
		Frequency	Percentage	Frequency	Percentage	Chi-square value	p-value
13	Age of the caregiver:						
	20-30 years	11	36.7	7	23.3	1.763 (df=3)	0.184
	31-40 years	8	26.7	9	30		
	41-50 years	6	20	8	26.7		
	51-60 years	5	16.7	6	20		
14	Gender of the caregiver:						
	Female	14	46.7	9	30	1.76 (df=1)	0.184
	Male	16	53.3	21	70		
15	Education of caregiver:						
	No formal education	6	20	7	23.3	0.356 (df=3)	0.986
	Up to primary education	7	23.3	7	23.3		
	Up to Higher secondary	5	16.7	6	20		
	Graduate-level	7	23.3	6	20		
	Others	5	16.7	4	13.3		
16	Occupation of caregiver:						
	Homemaker	5	16.7	5	16.7	2.13 (df=4)	0.712
	Coolie	7	23.3	4	13.3		
	Self employee	5	16.7	8	26.7		
	Govt.employee	6	20	8	26.7		
	Private employee	7	23.3	5	16.7		
17	Monthly income of caregiver:						
	Less than Rs.5000	7	23.3	4	13.3	1.784 (df=3)	0.618
	Rs.5000-10000	7	23.3	6	20		
	Rs.10001-15000	7	23.3	11	36.7		
	Above Rs.15000	9	30	9	30		

probability value of less than 0.05 was considered significant.

## RESULTS AND DISCUSSION

Table 1 depicts that in experimental group, 60 to 70 years were 4 (13.3%), 71 to 75 were 4 (13.3%), 76 to 80 were 7 (23.3%), 80 to 85 were 8 (26.7%) and above 85 were 7 (23.3%). As well in control group 60 to 70 years were 5 (16.7%), 71 to 75 years were 5 (16.7%), 76 to 80 years were 9 (30%), 81 to 85 years were 9 (30%) with homogeneity mean difference 4 and p - value 0.364. 11 (36.6%) were females and 19 (63.3%) were male in experimental group. 9 (30%) were females and 21 (70%) were males in control group with mean difference 0.3 and p - value 0.584. 8 (26.7%) in rural, 12 (40%) in urban and 10 (33.3%) in semi urban in experimental. 14 (46.7%) in rural, 6(20%) in urban, 10 (33.3%) in semi urban in control group with mean difference 2 and p - value 0.162. 4 (13.3%) had no formal education, 8 (26.7%) studied up to primary education, 7 (23.3%) studied up to higher secondary, 4 (13.3%) graduated, and 7 (23.3%) were other in experimental group. 6 (20%) had no formal education, 8 (26.7%) studied up to primary education, 7 (23.3%) up to higher secondary, 6 (20%) graduated and 3 (10%) others in control group. Mean difference 4 and p- value 0.663. Regarding occupation 5 (16.7%) were homemaker, 7 (23.3%) were coolie, 5 (16.7%) were self employee, 7 (23.3%) were govt. employee, 6(20%) were private employee in experimental group. 5 (16.7%) were homemaker, 5 (16.7%) were coolie, 4 (13.3%) were self employee, 8 (26.7%) were govt. employee and 8 (26.7%) were private employee In control group. Mean difference 4 and p- value 0.939.

Regarding marital status 10 (33.3%) were single, 20 (66.7%) were married in experimental group and 13 (43.3%) were single, 17 (56.7%) were married in control group. Mean difference 1 and p- value 0.426. Regarding religion in experimental group, 8 26.7 were Muslim, 11 36.7 were Christian, 11 36.7 Hindu. In control group 12 (40%) Muslim, 10 (33.3%) Christian, 8 (26.7%) Hindu. The mean difference 2 and the p- value 0.517. In experimental group, 9 (30%) nuclear family, 15 (50%) joint family, 6 (20%) extended family. In control group 10 (33.3%) nuclear family, 10 (33.3%) joint family, 10 (33.3%) extended family. The mean difference was 3 and the p- value 0.356. In experimental group 7 (23.3%) earned less than Rs 5000, 4 (13.3%) Rs 5000 to 10000, 12 (40%) Rs 10001 to 15000, 7 (23.3%) Rs above 15000. In control group 7 (23.3%) Rs less than 5000, 9 (30%) Rs

5000 to 10000, 7 (23.3%) Rs 10001 to 15000, 7 (23.3%) Rs above 15000. The mean difference was 3 and the p- value 0.356. In experimental group 11 (36.7%) had diabetic and other endocrine disorders, 7 (23.3%) hypertension and other cardiac disorder, 12 (40%) respiratory disorder in control group 10 (33.3%) diabetic and other endocrine disorder , 12 (40%) hyper tension and other cardiac problems, 8(26.7%) respiratory disorders. The mean difference was 2 and the p- value 0.453. In experimental group 7 (23.3%) first degree relatives provided care, 14 (46.7%) second degree relatives, 9 (30%) guardians. In control group 11 (36.7%) first degree relatives, 12 (40%) second degree relatives, 7 (23.3%) guardians. The mean difference 2 and the p- value 0.524. In experimental group 7 (23.3%) provided 1 to 2 years of duration, 5 (16.7%) 3 to 4 years, 8 (26.7%) 4 to 6 years , 10 (33.3%) above 5 years. In experimental group 8 (26.7%) 1 to 2 years, 10 (33.3%) 3 to 4 years, 6 (20%) 4 to 6 years, 6 (20%) above 5 years. The mean difference was 3 and the p- value 0.389. In experimental group 11(36.7%) 20 to 30 years, 8 (26.7%) 31 to 40 years, 6 (20%) 41 to 50 years, 5 (16.7%) 51 to 60 years. In control group 7 (23.3%) 20 to 30 years, 9 (30 %) 31 to 40 years, 8 (26.7%) 41 to 50 years, 6 (20%) 51 to 60 years. The mean difference was 3 and the p- value 0.184. In experimental group 14 (46.7%) female, 16 (53.3%) male. In control group 9 (30%) female and 21(70%). The mean difference was 1 and the p- value 0.384. In experimental group 6 (20%) had no formal education, 7 (23.3%) primary education, 5 (16.7%) higher secondary , 7 (23.3%) graduated. In control group 7 (23.3%) no formal education, 7 (23.3%) primary education, 6 (20%) higher secondary, 4 (13.3%) graduated. The mean difference was 3 and the p- value 0.986. In experimental group 5 (16.6%) homemaker, 7 (23.3%) coolie, 5 (16.7%) self employee, 6 (20%) govt. employee, 7 (23.3%) private employee. In control group 5 (16.7%) homemaker, 4 (13.3%) coolie, 8 (26.7%) self employee, 8 (26.7%) govt. employee, 5 (16.7%) private employee. The mean difference was 4 and the p- value 0.712. In experimental group 7 (23.3%) care giver earned less than Rs 5000, 7 (23.3%) earned Rs 5000 to 10000, 7 (23.3%) Rs 10001 to 15000, 9 (30%) above 15000.

The mean difference was 3 and the p-value 0.618. Here parametric test, paired 't' test and unpaired 't' test used to assess the existing relationship between the variables among the level of cognition, the activity of daily living, quality of life, and caregiver burden among persons with mild cognitive impairment. Regarding the level of cognition, in paired' test p-value of control group 0.005 and in an experimental

**Table 2: Cognitive, the activity of daily living, caregiver burden, and quality of life of control and experimental groups**

S. No	Parameter	Group	Mean±SE	Paired 't'-test		Un paired 't'-test	
				Con- pre test - post test	Experiment pre -post	Con- pre test - experiment pre test	Control post - experimental post
1	Cognitive level	Control pre test	22±0.17				
		Control post test	22.23±0.19	t=2.97 p=0.005**		t=1.486 p=0.143	t=18.86 p<0.001***
		Experimental pre test	22.36±0.17		t=35.94 p<0.001***		
		Experimental post test	27.03±0.16				
2	The activity of daily living	Control pre-test	40.47±1.17	t=3.24 p=0.002*			
		Control post test	40.73±1.16				
		Experimental pre test	39.93±1.21		t=25.22 p<0.001***		
		Experimental post test	21.2±1.07			t=0.316 p=0.753	t=12.39 p<0.001***
		Control post test	67.8±2.11				
		Experimental pre test	68.27±1.94		t=15.59 p<0.001***		
		Experimental post test	37.07±2.29				
		Experimental post test	222.9±4.97				

group more than 0.001. In the unpaired t-test, the comparison between the control pretest and experimental pretest, the p-value was 0.143.

And the comparison between the control post-test and the experimental post-test p-value was more than 0.001. Regarding the activity of daily living, in paired't' test, the control group p-value 0.002 and the experimental group p-value more than 0.001. In the unpaired 't' test, the control and experimental pretest p-value were 0.753. And between the control group and the experimental group, the p-value was more than 0.001 (Table 2).

Cognitive skills play an important role in the day to day functions of the old people. However, as a process of aging, the cognitive functions decline (Harada *et al.*, 2013; Reichman *et al.*, 2010;

Craik, 2006). The risk factors responsible for the decline in the cognitive functions are classified as modifiable and non-modifiable factors. Modifiable factors include lifestyle, education, metabolic disorders (Norton *et al.*, 2014). Though this condition can be managed medically, still the treatment is not affordable to most of the public. Hence, there is a strong need for affordable treatment or management of cognitive functions in the elderly population. Home-based cognitive therapy is simple, affordable, and easy to implement, even in the elderly population. As it minimizes the cost of the treatment, it is also preferred by many of the people (Salthouse, 1996).

The present study was undertaken to observe the effectiveness of the Home Based cognitive Train-



ing Programme on Cognitive level, Activity of daily living among Elderly persons with mild Cognitive Impairment in Selected Community Settings of Puducherry. There was a significant improvement in the cognition level and cognitive impairment in the experimental group when compared with the control group. Earlier studies reported that Home Based cognitive Training Programme is very effective for improving cognition in the elderly (Rapp *et al.*, 2002; Belleville *et al.*, 2007). However, there are certain controversies in this aspect as some studies reported that Home Based cognitive Training Programme is beneficial (Salt-house, 1996; Belleville *et al.*, 2006) other studies reported there is no improvement in the cognition followed by the intervention program (Sunderland *et al.*, 1989; Levine *et al.*, 2007). These differences in the results may be due to the inclusion of the participants with different age groups and from different areas. Further, there are differences in the application of training programs. The training program was reported to be beneficial when applied on a long-term basis (Belleville, 2008). It was reported that there was a significant increase in the attention score, execution speed followed by the intervention (Olchik, 2008; Hampstead *et al.*, 2008; Kurz *et al.*, 2009). Our study results are in accordance with earlier studies as we have observed significant improvement in the cognitive functions followed by the intervention.

## CONCLUSION

The present study results suggest that the home-based cognitive training program is effective in improving cognitive functions and daily life activities. The study recommends further detailed and multi-centered studies in this area to recommend the implementation of the program in the management of the cognitive impairments of the elderly.

## Conflicts of interest

The authors declare that they have no conflict of interest for this study.

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