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EFFECT OF FIXED PRIORITY TRAINING (FPT) VERSUS VARIABLE PRIORITY TRAINING (VPT) ON COGNITION IN COMMUNITY-DWELLING OLDER ADULTS - A COMPARATIVE STUDY

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ABSTRACT

Background - Considering the current limited availability of effective disease-modifying treatments for cognitive impairment in elderly, immediate efforts with nonpharmaceutical interventions are needed to prevent the development of cognitive impairment in elderly. Dual Task (DT) training in elderly is an intervention that has shown to improve cognition in many studies. Dual-tasking is the ability to perform two tasks simultaneously. Eg-Counting serially while bouncing a ball (Motor-Cognitive Dual Task). It challenges the many components of cognition like divided attention, memory, processing speed, executive function and language. While training in a dual task condition both the tasks can be equally prioritized (Fixed Priority Training) or one task can be prioritized over other task (Variable Priority Training) for a period and vice versa. This study aims to determine which type of training in dual task conditions is better in improving cognition by using a MOCA (Montreal Cognitive Assessment) battery in Community Dwelling Elderly by the end of 4 weeks. **Methodology:** The study included 69 participants who were randomized to Variable Priority Training group (n=35) and Fixed Priority Training group (n=34) and baseline measures of MOCA were obtained. Both the groups carried out dual task exercises assigned to the particular training group for 4 weeks. Post-Interventional values of MOCA were noted and statistical analysis was done. **Results:** The result of the study showed statistically significant differences on comparing Pre-Post values within the group on MOCA scale indicating improvement in both groups. There was a statistical difference seen on comparing Post-interventional values of both the groups on a MOCA scale indicating VPT group had better outcome than FPT. **Conclusion:** This study conclude that both types of dual-task training improves cognition in community dwelling older adults but Variable priority training (VPT) has better effect than Fixed priority training (FPT) in improving cognition on a MOCA scale in Community Dwelling Older adults by the end of 4 weeks.

KEYWORDS : Dual Task (DT), Cognition, Variable Priority Training (VPT), Fixed Priority Training (FPT).

INTRODUCTION-

Aging is a natural and inevitable process associated with the time-based deterioration of physiological functioning and capacities. The number of people older than 65 years has been increasing worldwide [1].The loss of the ability to live independently is one of the adults' greatest fears when considering old age. To live independently, or interact with the environment, an adult not only requires a sensorimotor but also cognitive skills. It is essential to recognize that in the normal course of aging one experiences a decline in many core cognitive abilities [2]. This can result in cognitive impairment. There are some risk factors for the development of cognitive impairment (CI); among these, age is the greatest risk factor [3]. Mild cognitive impairment (MCI) is an early stage of memory loss or other cognitive ability loss (such as language or visual/spatial perception) in individuals who maintain the ability to independently perform most activities of daily living [4]. MCI can have several outcomes, with the most important being the progression to dementia. Other cases may revert to normal or remain stable in the MCI stage [5]. The prevalence of Cognitive impairment (CI) in the elderly was found to be 4.3% in India [6,7,8,9] . The aging brain is malleable and that cognitive function can be facilitated through cognitive training or engagement in demanding tasks that provide a sustained cognitive challenge. [2,3,10]. Dual Task (DT) training is an intervention that has shown to improve cognition in many studies [11,12] . Dual-tasking is the ability to perform two tasks simultaneously. Dual-tasking challenges a component of executive function as participants are required to coordinate their attention to both tasks while they are being performed. The risk of dementia is higher in persons with mild cognitive impairment (MCI) compared with cognitively normal subjects. The annual rate of progression to dementia ranges from only 8% in clinical trials to 13% [13].

Based on fear of pathological age-related cognitive decline, the issue of whether one can combat this cognitive decline has become a highly salient issue. Considering the current limited availability of effective disease-modifying treatments for dementia, immediate efforts with nonpharmaceutical interventions are needed to prevent the development of MCI and progression of MCI to dementia [3,4,5,14] . Physical activity or exercise is a low-cost and accessible nonpharmaceutical intervention for the primary and secondary prevention of dementia. Several studies have demonstrated that physical activity and exercise interventions can prevent cognitive decline in healthy older adults and patients with MCI [15]. Among many of the interventions Dual-task exercise program is one of the promising interventional strategies that combines cognitive training and physical activity programs for older adults with mild cognitive impairment [11,12]. Many studies have reported that exercises that apply dual tasks have demonstrated potential in enhancing cognitive capabilities [15,16,17,18]. These studies did not take into consideration the way in which these dual tasks were carried out. Specific instructions have an impact on individual prioritization strategies in the dual task paradigm [19,20,21]. The individual while listening to specific instructions can prioritize both the tasks equally (Fixed Priority) or can prioritize one task over the other (Variable Priority). There is a scarce literature on the superiority or inferiority of one type of dual task training on the other type of dual task training on improving cognition in older adults. This study aims to find out the difference between the effects of Fixed Priority Training and Variable Priority Training.

Methodology -

Study Design: Comparative study.

Study Setting: In and around the city.

Sampling Technique: Random sampling

Study population: Community-Dwelling Older Adults

Study Duration: 2 Years

Sample Size: 70 ((calculated by WinPepi V.1165 Software) Approximate Sample 1 mean and SD 25.85 ± 1.52 and Sample 2 mean and SD 24.90 ± 2.1 based on previous study , At a 5% significance level at 80% power (1 - β) and minimum sample size came out to be as 24 in each group. Considering a sample loss of 20%, 70 participants were assessed and allocated to both groups in a 1:1 ratio.

Inclusion Criteria

- Age- 65-80, Including both Genders.
- Score on MoCA- 18-25 (Indicating Mild Cognitive impairment)
- Score on Berg Balance Scale - 52-56 (Indicating low risk of falls)
- Able to walk for 10m with or without assistance. [22]

Exclusion Criteria: -

- Adults with diagnosed Neurological condition which affect cognition such as Alzheimer's Disease, Parkinson's Disease, Cerebrovascular Accident, Multiple Sclerosis, Motor neuron disease, Traumatic Brain Injury, Frontotemporal Degeneration, Huntington's Disease, Normal Pressure Hydrocephalus, Epilepsy etc. Adults with Neuropsychiatric

Disorders like Delirium, Dementia.
- Cardiac anomalies like recent history of Myocardial Infarction, recent history of angina, abnormal blood pressure and not on medications, Uncontrolled Diabetes, atrial or ventricular Arrhythmias and not on medications.
- Recent Orthopedic surgeries and musculoskeletal injuries post Total Hip Replacement less than 6 weeks, post Total Knee Replacement like less than 4- 6 weeks, 3- 6 weeks post Anterior and Posterior Cruciate ligament tear, Meniscus tears, Medial and Lateral Collateral Ligament tear. Recent fractures less than 8 weeks
- Adults with complete visual loss.
- Adults with complete hearing loss without any aids.
- Refusal to give informed consent.

Study Instrument (OUTCOME MEASURE)
MoCA- Montreal Cognitive Assessment Scale
- It is a clinician-reported measure that takes about 10 minutes to administer. It measures cognition under the following domains: visuospatial skills, executive functions, attention, concentration, calculation, language, abstraction, memory, and orientation.
- Reliability: MoCA has high test-retest reliability (ICC = 0.92, $p < 0.001$) and has good internal consistency (Cronbach's alpha = 0.82) 1221
- Sensitivity- 100% Specificity- 87% 1322 (46,47)

Procedure -
Study began with a synopsis presentation in front of the ethical committee College of Physiotherapy. Ethical Clearance was obtained from the committee. Participants were selected according to inclusion and exclusion criteria. Informed consent was taken and procedure was explained to the willing participants of the study. Socio-Demographic data such as Age, Gender etc was collected from participants. Participants were screened on MoCA (Montreal Cognitive Assessment Scale) pre-intervention and scores were documented. Participants were allocated by odd and even method into 2 groups, one group receiving Dual Task Training with Fixed Priority Instructions (FPT) and one group receiving Dual Task training with Variable Priority Instructions (VPT). Both the groups underwent The dual task training for 4 weeks and post-intervention scores on MoCA were documented and analysed. The dual task intervention protocol has been patented with the Copyright Office, Government of India Certificate No. LD-20250164782.

DATA ANALYSIS AND RESULTS -
Data was analysed using Microsoft Excel 2013 (©Microsoft Corporation) and SPSS v.21.0.

Means and Standard deviation was calculated for gender in both groups.

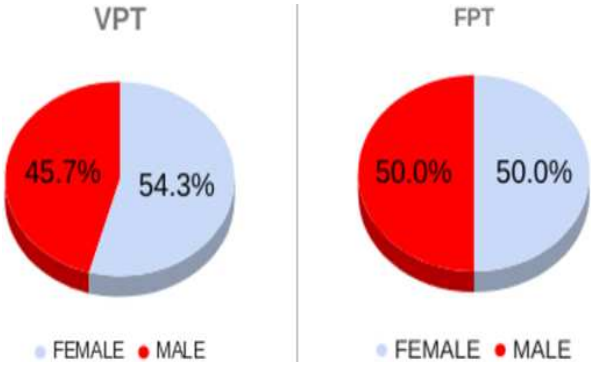
The Kolmogorov-Smirnov (K-S) test was used to check normality of the data. The data showed non-normal distribution.

Wilcoxon Signed rank test was used to analyze pre post interventional values within the group.

Mann-Whitney test was used to analyze between groups.

The confidence interval was 95% and a p-value of <0.05 was considered significant

RESULTS



Graph 1: Gender Distribution:

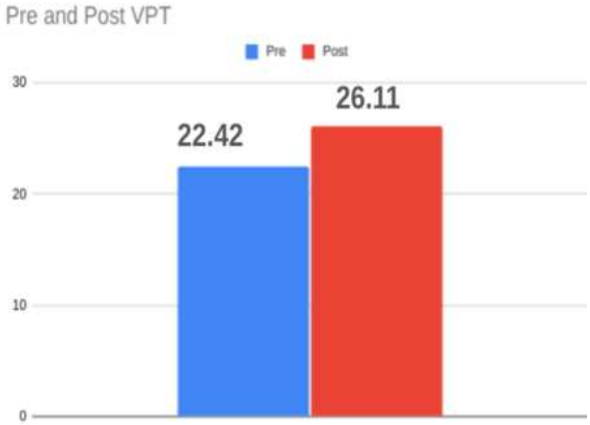
VPT - Variable Priority Training **FPT -** Fixed Priority Training

Table 1: Represent Demographic Data For Both Groups

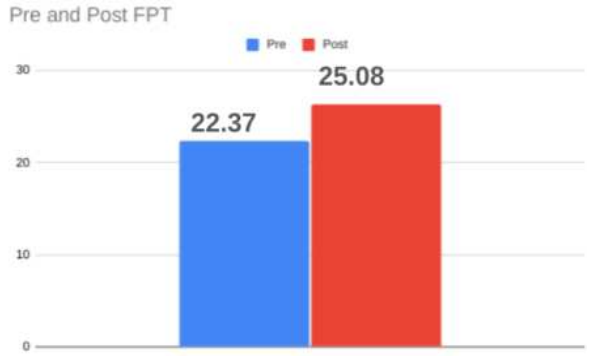
Demographic Data	AGE	GENDER
VPT	68.8 ± 2.121320344	F- 19 M-16
FPT	67.9142 ± 1.707106	F- 17 M-17

Interpretation : Table 1 and Graph one represents demographic data for both the groups. There were 19 females and 16 males in variable priority training group and 17 males and 17 female in fixed priority training group

Within Group Analysis

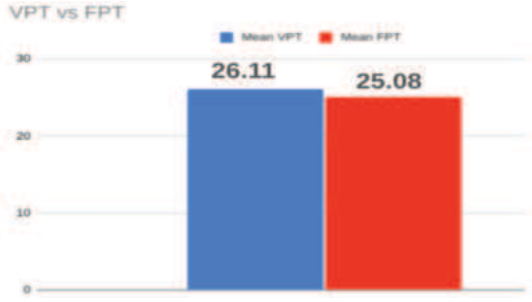


Graph 2
Interpretations : Graph 2 represents Pre and Post Mean of MOCA in VPT group. Pre and Post Median were 23 and 26 respectively There was a statistically significant difference ($p< 0.001$) observed between the pre (22.42 ± 1.42) and Post (26.11 ± 1.56) intervention mean scores of MOCA which was analyzed by Wilcoxon Signed Rank Test. Thus Variable Priority Training was effective in improving cognition in Community Dwelling] Older Adults



Graph 3
Interpretation: Graph 3 represents Pre and Post Mean of MOCA.There was statistically significant difference ($p< 0.001$) observed between the pre (22.37± 1.7) and Post (25.08±1.4) intervention mean scores of MOCA which was analyzed using Wilcoxon Signed Rank test Thus Fixed Priority Training was effective in improving cognition in Community Dwelling Older Adults.

BETWEEN GROUP ANALYSIS



Graph 4:

Difference between means of VPT and FPT groups was statistically significant P Value - 0.0088 (Considered very significant). Post VPT - (26.11 ± 1.56) Post FPT - (25.08± 1.4) which was analyzed using Mann-Whitney test. Showing Variable Priority Training showed better effect than Fixed Priority Training in improving Cognition in Community Dwelling Older Adults

Type of Training	MEAN AND SD PRE-INTERVENTION MOCA	MEAN AND SD POST-INTERVENTION MOCA	K-S NORMALITY TEST VALUE	P-Value	INTERPRETATION
VARIABLE PRIORITY TRAINING	22.4285 1.42014	26.11428 1.56752	0.2386	<0.0001 (considered extremely significant)	Non - Normal Data Distribution
FIXED PRIORITY TRAINING	22.37142 1.7071	25.08714 1.414213	0.2424	<0.0001 (considered extremely significant)	Non - Normal Data Distribution

WILCOXON MATCHED PAIRS SIGNED RANK TEST

TYPE OF TRAINING	SUM OF ALL SIGNED RANKS	NON_PARAMETRIC SPEARMAN CORRELATION COEFFICIENT [r]	PRE-MEDIAN	P-VALUE
VARIABLE PRIORITY TRAINING	630	0.7771	23.00 26.00	<0.0001 (considered extremely significant
FIXED PRIORITY TRAINING	561	0.7294	22.00 26.00	<0.0001 (considered extremely significant)

MANN-WHITNEY TEST

U - STATISTIC	SUM OF RANKS IN COLUMN A	SUM OF RANKS IN COLUMN B	P VALUE
389.50	1465.5	1019.5	0.0088 (considered very significant)

DISCUSSION

A comparative study was done to see the difference between the effects of Variable priority training and fixed priority training on cognition in community-dwelling older adults using a Moca scale by end of 4 weeks. Montreal cognitive assessment was used as an outcome measure to assess cognition.

A total of 70 participants completed the study and were divided equally into two groups.

There was one drop out from the fixed priority group and was thereby excluded from the study. Apart from the drop out every participant enrolled in the study completed the study.

Pre and Post values of MOCA were compared for both the groups. Post- Interventional values of Variable Priority Training (VPT) and Fixed Priority Training (FPT) group were compared to see for any differences.

A significant difference was seen in the pre and post-interventional values of MOCA in the variable priority training group with p-value <0.001.

This result can attributed to the practice effect of dual-task training which led to the participant able to coordinate between the two task in the dual task condition. Time required to alternate between the two task after 4 weeks intervention might be less as compared to baseline due to training effect optimizing motor and cognitive performance.

Also, while training in this dual task condition there is competition for attentional resources to carry out both the task. In variable priority training, participant is asked to give priority to one of the task while carrying out both the task. This can lead to participant emphasizing more of the attentional resource to the prioritized task. More attention to the prioritized task would have led to optimized performance in the prioritized task.

Hence the gains of emphasizing or prioritizing attention to the prioritized task in dual task condition would have led to transfer of training effects thereby improving cognition.

Also, a significant difference was seen in the pre and post-interventional value of MOCA in the Fixed priority training group with p-value <0.002.

This can also be due to the practice effect of dual-task training which led to the participant able to coordinate between the two task in the dual task condition. Time required to alternate between the task must be less due to practice effect and hence motor and cognitive performance was optimized.

The inability of the brain to process all information simultaneously demands division of attention, which splits or rapidly switches the attentional focus [23] . In fixed priority training both the tasks were given equal priority and were carried out in dividing attention equally. Both the tasks were competing for the attentional resource equally. The participants in this training were able to perform and optimize their task performance in the dual task condition with limited available attentional resources. Time required to alternate between the task and attentional resources allocated to the task might be reduced due to the practice effect and hence motor and cognitive performance was optimized.

Training of cognitive task in dual task condition with limited attentional resource would have led to transfer of training effect thereby improving cognition. A significant difference was seen in our study in the two post- interventional groups of Fixed priority training and Variable priority training respectively showing variable priority training has better/superior effects than fixed priority training in improving cognition.

This can be attributed to the ability to modulate attention and prioritize the task with the help of verbal instructions [19]. In fixed-priority training, both tasks are given equal priority and both tasks compete equally for the attentional resource. Emphasis is given on both the tasks hence sharing the attentional resources equally.

In contrast Variable priority training uses the ability of the brain to prioritize a task over another and allocate more attention to the prioritize task. This can enhance skill acquisition of the prioritize task as more attention is given to the task in the dual task condition.

The results showed that the Variable Priority group improved (i.e. increased accuracy and decreased response time) significantly more than the Fixed Priority Group. Results indicated that type and magnitude of benefits vary by training type.

CONCLUSION

This study conclude that both types of dual-task training improves cognition in community dwelling older adults but Variable priority training (VPT) has better effect than Fixed priority training (FPT) in improving cognition on a MOCA scale in Community Dwelling Older adults by the end of 4 weeks.

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