Journal of Advanced Zoology
ISSN:0253-7214
Volume 43 Issue 4 Year 2023 Page 1336-1353

Effect Of Occupational therapy Training On Balance and Cognitive In Older Adults with Mild Cognitive Impairment

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Abstract

Background: Older adults with MCI are at an increased risk of falls and other mobility issues due toimpaired cognitive function, which can affect balance and gait. As the population ages, findingeffective interventions to mitigate these risks and improve quality of life is crucial. Occupationaltherapy has been recognized as a beneficial approach to enhance both cognitive and physicalfunctionsinvarious populations,includingolderadults.
Studydesign: Randomizedcontrolledtrial
Aim: To assess the impact of occupational therapy training on balance and cognition in older adultswithmildcognitiveimpairment.
Objective: Toevaluateoutcomeofoccupationaltherapytrainingonbalanceand cognitioninolderadultswithmildcognitiveimpairment.
Participants: The participants were recruited on the basis of exclusion and inclusion criteria. Theparticipantsweredividedintwogroup controlgroup andexperimentalgroup20participantsineachgrouptotal40participants were includedinthestudy.
Methods:A randomized control trial was conducted on 40 patients with mild cognitive impairment(MCI) at AGAN OLD AGE HOME, Noida. The total sample was randomly divided into two equalgroups. Experimental group (N = 20) and a control group (N = 20). The control group was provideddual task training and the experimental group was administered with occupational therapy program which include physical training,cognitive training and physical&cognitive training.
Result: Montreal Cognitive Study (MOCA) pre and post in resulted that the pre mean of MOCA(17.80) accompanied by standard error (0.869) and subsequently post mean value of MOCAincreased (24.75) standard error (0.580) and standard deviation(2.593) which indicate progress ofpostmean value (24.75)indicatingan improvementtoalevelofcognitivefunction.

Tinetti performance oriented mobility assessment (POMA) pre and post resulted that the pre mean ofPOMA GAIT(7.15) POMA BAL(10.75) accompanied by standard error (0.494),(0.814) andsubsequently post mean value decrease (13.00),(8.75)standard deviation (1.682),(3.340) whichindicate progress of post mean vale(13.00),(8.75) signifying that increased in balance & Gait amongolderadults.

Conclusion: Considering all aspect of social life my study show effectiveness of occupational therapy training programe give insight to maintain productive aging which will closely related with cogntion and balance.This study show significantly improvement in cognition and balance.

Keywords: Cognition, balance, occupational therapy, olderadults & physicaltraining

INTRODUCTION:

Geriatrics refers to medical care for older adults, an age group that is not easy to define precisely.Gerontology is the study of aging,including biologic, sociologic, and psychologic changes.“Older” is preferred over "elderly," but both terms are equally imprecise. It is important to avoidterms and attitudes that suggest bias against older people (ageism) 1.The information providedhighlights the rapid growth of the elderly population globally, with a particular focus on India,which is expected to become the second largest contributor after China. The projected increase inIndia's elderly population,from 93 millionin 2011 to 323 millionin2050,representsa significant demographic shift. The aging process can bring about health issues and a potentialdecline in the ability to perform daily activities independently, impacting the overall quality oflife for older individuals.The increase in the number of elderly people often leads to increaseddependence on othersforvariousforms of support.This dependence can extend to medical services ,assistance with daily work,and emotional support.Meeting these need sposes challenges for both the family and the social structure. Impact of Brain Aging on Cognition and Balance: Addresses changes during brain aging that affect cognition and balance by highlighting physiological aspects of aging. Cognitive impairment can affect memory, decision-making andproblem-solving abilities.Balance problemscan increase the risk of falls,injuries and subsequent dependence on caregivers.[1]

Cognition is fundamental to human thought and experiences ,involving the identification,selection, interpretation, storage, and utilization of information.Maintaining cognitive function is imperative for independent living and is indicative of overall brain health.Researchers in Western countries report a correlation between the physical health of older adults and their cognitive status.Various health problems such as mobility difficulties,falls,bone fractures,fatigue,weakness,cardio vascular events ,obesity ,constipation and others related to cognitive impairment.Cognitive changes can lead to challenges such as forgetfulness, difficulty concentrating, andslower processing speed. These factors can affect an individual's ability to live an independentand fulfilling life.Changes in balance can contribute to a higher susceptibility to falls, which is asignificantconcernforthe elderly.[2]

Mild Cognitive Impairment (MCI), introduced by Petersen in 1997, is a diagnostic term used to characterize cognitive impairment in individuals not diagnosed with dementia.It denotes the transitional phase between typical aging and pathological aging, where those with MCI exhibit more cognitive decline than expected for their age but do not meet dementia criteria. The risk of progressing to dementia is notably higher in individuals with MCI, being 10 times more likelythantheircognitivelyhealthycounterparts.[3]

Addressing these balance and gait problems is crucial for enhancing overall health and mitigating the serious consequences associated with falls in older adults. Maintaining equilibriumis essential for individuals to uphold their posture, respond to intentional movements, and adapt to external disruptions. The fundamental aspect of balance involves ensuring that an individual's center of mass remains with in the dynamic base of

support.

the vestibular system and cerebellum are considered primary contributors to regulating postural control, with the cerebellum particularly crucial in adjusting limb and trunk movements and harmonizing opposing muscle forces for specific tasks. Postural control relies on a combination of sensory in puts,encom passing somatosensory information from muscle and joint proprioceptors, cutaneous sensory information for discerning surface characteristics, vestibular information for determining head and trunk orientation in space, gravity information received from graviceptors in thetrunk,and visual input.Additionally,situational cues and pastexperiences can alter these sensory inputs, influencing the regulation of activities that contributeto maintaining balance. Significantly, the absence of dementia ensures cognitive soundness in theintricate process ofbalancing.[4]

METHODOLOGY:

This study was a randomize controlled trail study, a total 40 subjects who are olderadults andincluded on the basis of exclusion and inclusion criteria. This study carried out in 2 phases: pretest&posttestassessment.
As per inclusion criteria both male & female with age 60 above and those are diagnosed withMCI are included.As per exclusion criteria ,those whoare having any visual impairment &hearing impairment, who are in medication of epilepsy, alzheimer's, dementia are excluded. Thisstudy is divided into 2 groups: Experimental group and Control group with 2 phases of pre testand post test study assessment. Each participant undergoes pre test&post test assessment byusingMOCAandPOMA outcomemeasures.

TreatmentProtocol:

1. Experimentalgroup-Occupationaltherapyprogram

A. Physical training program

Peiods	**Exercise**	**progression**
Warm-up (10 min)	Calisthenics and general flexibility	
Multicomponent exercise programme (20 min)	Walking over 10 m 1. Walking forwardbackward, sideways 2. Turning figure of8 walking 3. Tandem walking	10–12 rounds; 1–3 sets Increase step length and speed Over obstacles
	Sit-to-stand	8–12 repetitions; 1–3 setsLower chair height

	Heel and toe raises	8–12 repetitions; 1–3 setsHold or raise for longer
	Stepping in different directions	8–12 repetitions; 1–3 sets Longer or faster steps Step over obstacle
	Step-ups 1. Forward	8–12 repetitions; 1–3
	2. 2. Lateral	sets Increase step height

	8–12 repetitions; 1–3 setsIncrease step height	8–12 repetitions; 1–3 sets Narrower foot placement Increase distance to reach Standing on a softer surface (rubber mat) Stepping while reaching
Cool-down (5 min)	Calisthenics and general flexibility	

B .Cognitive Training program

Periods	**Components**	**Content**
Warm-up (10min)	Giving of instructions	

Giving of instructions (20 min)	Orientation training	Orientation to person, place, and time with or without external cues like newspaper, calendar a. person – give full name, relatives, neighbors, age, occupation; name public officials b. place – provide address, location of islands/cities/provinces, favorite place/ destination c. time – determine current time, day, month and year; schedule of TV shows; special occasions; weather, season.
	Memory training	Rehearsal • verbally repeating a series of numbers or letters Association • facename recognition – associating person's name with facial or behavioral characteristics Visual imagery • having mental representation of a set of animals,

		fruits, or common objects and combinations Concentration • play card game to turn over 3–6 pairs of matching cards
	Attention training	Auditory attention a. Clapping, tapping or stamping upon hearing specific words b. Coloring a picture or folding a paper following dictation c. Identifying the title or artist of a song being played Visual attention a. Counting the number of animals seen in a picture b. Encircling specified words in a paragraph/ word hunt c. Completing a trace Maze.
	Executive function training	From a mixed set of objects on a table, a. Group the items into three and set aside objects which do not

		belong to any group. b. Arrange items followinga model (e.g. table setting, smallest to largest, alternating pattern) Copying a drawing (pyramid, cylinder, house); dot copy Computation of allowance, expenses, change
Cool-down (5min)	Feedback and processingof responses	

C. Physical and cognitive training program

Periods	**Exercises**	**Progression**
Warm-up (10 min)	Calisthenics and general flexibility	

Multicomponent exercise programme (20 min)	Walking with executive function training • From a mixed set of objects(30 pieces) on a table at the start of the line, bring one object at a time walking over 10 m towards another table to sort the objects properlyin 3– 4 separate groups. Walking is done forward, backward, sideward, in figure of8, or tandem.	10–12 rounds; 1–3 sets Increase step length and speed Walking over obstacles
	Sit-to-stand with orientation training • Stand every time to answer questions about orientation to person, place and time	8–12 repetitions; 1–3 sets Lower chair height
	Heel and toe raises with attention training • Follow visual cues to do heel or toe raise	8–12 repetitions; 1–3sets Hold or raise for longe
	Stepping in different directions with memory training	8–12 repetitions; 1–3sets Longer or faster

	• Stepping on a set of specified number and sequence of markers on the floor	steps
	Step-ups with attention training • Follow verbal instructions on which foot to use to step-up	8–12 repetitions; 1–3sets Increase step height
	Graded reaching in standing with executive function training a. Table setting activity (arrange plates, utensils, glasses based on picture model) b. Arranging objects fromsmallest to largest, or inalternating pattern c. Copying a drawing (pyramid, cylinder, house); dot copy d. Computation of allowance, expenses, change.	8–12 repetitions; 1–3sets Narrower foot placement Increase distance to reach Standing ona softer surface (rubber mat) Stepping while reaching
Cool-down (5min)	Calisthenics and general flexibility With memory	

	training (summarize what activities were accomplished after the session in correct sequence and details)	

1. Control Group- Dual Task Training Program (45 min)

SL.NO	TRAINING	ACTIVITY	REPETATIONS&DURATION
1	Resistance Training	1. Simple squats 2. Sit ups 3. Heel touch 4. Brisk walk	15 to 20 repetition for 4 set rest duration between 30s and rest duration between exercise 1 to 2 min
2	Motor-motor dual task training	1. Throwing a ball up and down 2. Throwing bag 3. Holding a bag 4. Balancing the cup on the palm of the hand	15 to 20 repetition for 4 set rest duration between 30s and rest duration between exercise 1 to 2 min
3	Motor-cognitive dual task training	1. Matching a card with a card previously shown. 2. Backward number counting 3. Remembering shapes 4. Remembering colors	15 to 20 repetition for 4 set rest duration between 30s and rest duration between exercise 1 to 2 min

Outcomemeasure:

1. TinettiPerformanceOrientedMobilityAssessment:

Impairments of balance and gait are among the most important reported risk factors for fall in olderadults .One screening modality that can be used in many different settings such as outpatientprimary care, inpatient hospital

ward, or physical therapy office is the Tinetti gait and balanceassessment, also known as the performance-oriented mobility assessment (POMA). This test isuseful because it can be applied to different patient populations, including the elderly, patients withParkinson disease or multiple sclerosis, traumatic brain injury (TBI), and stroke patients. The testassesses a patient's balance and gait using a standardized scoring system. In the Tinetti Gait andBalance scale, balance and gait are assessed and scored individually in a 16-item test. Balance isassessed while the evaluated person is sitting, arising, standing (immediate and prolonged), andturning. Additionally, maintenance of balance is tested against attempts at disruption (nudge) andwithout a horizon reference (eyes closed). In gait testing, right and left feet are evaluated separatelyfor swing (step length) and clearance, and then compared. Each foot should completely clear thefloor and should step completely ahead of the other foot. Comparison includes step symmetry andcontinuity.Theinter-raterreliability,sensitivity,and specificity show good and strong reliability.[31]

2. MontrealCognitiveAssessment(MoCA):

The Montreal Cognitive Assessment (MoCA) was developed as a brief screening test for mildcognitive impairment (MCI). It is widely used across the world in a variety of settings. MOCA having 6 component to assess cognition which are visuospatial/executivefunction,naming,attention, abstraction, delayed recall, orientation, etc. visuospatial/ executive function assigned 5,naming 3, attention 6, language 3, abstraction 2, delayed recall 5, orientation 6 ,etc. The MoCAshows good validity in multiple languages. The MoCA has not yet been validated in old age psychiatry settings,where patientsare referred with multidimensional causes for MCI.[32]

DATACOLLECTION:

There are 40 subjects aged ≧60 years in the baseline survey, and 40 subjects with Mild Cognitive Impairment who participated in the baseline survey. A randomized control trial was conducted on 40subjects in which, in control group seven female and thirteen male are participated andin experiment group nine female and eleven male are participated with mild cognitive impairment (MCI). The participants are recruited from AGANOLD AGEHome,Noida.

The total sample was randomly divided into two equal groups. Experimental group (N = 20) and a control group (N = 20). The control group was provided conventional dual task training, and the experimental group was administered with occupational therapy program.

Participants were distributed randomly in experimental and control group using covinent method by assigning numbers twoeach participant. Researcher placed chits containing numbers allocated to each participant and randomly selected chits for both groups.

The intervention consisted of 105-minute per sessions, conducted for six days a week and for six weeks, at OLD AGE HOME. Researcher provided intervention weekly basis as per intervention protocol. Immediately before intervention the administration of outcome measure was done through MOCA & POMA for pre test assessment, after the intervention period, participants underwent a post-test assessment through re-administration of the same measures as the pre-assessment to evaluate any changes or improvements.

DATAANALYSIS:

After completion of all (pre treatment and post treatment) evaluation, results were collected and data were put in the master chart. The scoring of pre-treatment and post- treatment data of outcome measures MONTREALCOGNITIVESCALE(MOCA),Tinetti's Performance – Oriented Mobility Assessment(POMA) were analysed using IBM SPSS for statistical significance result. This pre-testand post-test for scoring of experimental and control group were analyses through parametric test, T-test was used to analyse the cognition and balance & gaits cores for analysis of outcome measure.The collected data were analysed using SPSS trail version Statistics, Trial Version.To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and themean & S.D were used for continuous variables.To find the

significant difference between the bivariate samples in Paired group the T-test was used.

RESULT:

This study result conducted in two phases, pre test assessment and post test assessment of both Control group and experimental group. The significance of occupational therapy program was determined through MOCA and POMA, which administered to the participants before providing intervention. In second phase the post test assessment of MOCA and POMA, Re-administered was done after duration of 6 weeks, per week 6 sessions for 105 minutes was provided for intervention of experimental and control group.

Table1. Descriptive statistics of outcome measure and T-Test statistics of Pre-test & Post-test of MOCA and POMA in experimental group And control group.

GroupStatistics

	TYPE	N	Mean	Std. Deviation	Std. Error Mean	Pvalue
AGE	Control	20	66.25	6.016	1.345	0.442
	Exp	20	67.95	7.722	1.727	
MOCAPre	Control	20	20.50	2.328	.521	0.012
	Exp	20	17.80	3.888	.869	
MOCAPost	Control	20	21.45	2.946	.659	0.001
	Exp	20	24.75	2.593	.580	
MOCA	Control	20	.95	1.432	.320	<0.001
	Exp	20	6.95	3.187	.713	

POMA BAL Pre	Control	20	12.20	1.673	.374	0.117
	Exp	20	10.75	3.640	.814	
POMA BAL Post	Control	20	13.05	1.669	.373	0.953
	Exp	20	13.00	3.340	.747	
POMABAL	Control	20	.85	1.137	.254	<0.001
	Exp	20	2.25	1.164	.260	
POMA GAT Pre	Control	20	8.50	1.433	.320	0.028
	Exp	20	7.15	2.207	.494	
POMA GAT Post	Control	20	8.80	1.542	.345	0.922
	Exp	20	8.75	1.682	.376	
POMAGAT	Control	20	.30	.470	.105	<0.001
	Exp	20	1.60	1.353	.303	
POMAPre	Control	20	20.50	2.838	.635	0.079
	Exp	20	17.95	5.577	1.247	
POMAPost	Control	20	21.65	2.834	.634	0.906
	Exp	20	21.80	4.884	1.092	

TABLE-6GROUPSTATISTICS

Table 1. Showing the Descriptive Statistics of MOCA and POMA in Pre-test and Post-test of experimental and control group and p-value that established statistical significance.

In experimental group, Montreal Cognitive Study (MOCA) pre and post in resulted that the pre mean of MOCA (17.80) accompanied by standard error (0.869) and subsequently post mean valueof MOCA increased (24.75) standard error (0.580) and standard deviation(2.593) which indicate progress of post mean value(24.75).

In control group, Montreal Cognitive Study (MOCA) pre and post in resulted that the pre mean of MOCA (20.50)accompanied by standard error (0.521)and sub sequently post mean value of MOCA increased (21.45) standard error (0.659) and standard deviation(2.946)which indicate progress of post mean value(21.45).

As per Changein MOCA: The Experiment group shows a significant improvement in cognitive scores post-intervention compared to the Control group(p=0.001).

In experimental group, Tinetti Performance Oriented Mobility Assessment (POMA) pre and post in resulted that the pre mean of POMA(17.95) accompanied by standard error(1.247)and subsequently post mean value of POMA increased (21.80) standard error (1.092) and standard deviation(4.884)which indicate progress of post mean value(21.80).

In control group, POMA pre and post in resulted that the pre mean of POMA (20.50) accompanied by standard error (0.635) and subsequently post mean value of POMA increased (21.65) standard error(0.634)and standard deviation(2.834)which indicate progress of post mean value (21.65).

As per Change in POMA : The Experiment group shows a significant improvement in cognitive scores post-intervention compared to the Contro lgroup(p=0.906AND0.079).

DISCUSSION-

The objective of this proposed study is to determine the effectiveness of occupational therapy training program on cognition and balance & gait in older adults with mild cognitive impairment . Balance & cognition could result in fatal or non-fatal physical injuries, psychosocial problems ,and also brings about economic burden to the family and community . Older people with MCI are at a heightened risk for falls . It is essential, therefore, to scientifically determine which treatment programs are most effective in this population.

This study time duration is 6 week and 6 days in a week. A total 40 participant participated. In which 20 participants in experimental group and another 20 participants in control group. Before starting occupational therapy program pre-test data will taken and after intervention post- datawill be collected. Occupational therapy program include 105 min every day in which client perform physical training,cognition training and multi-compnent training.

Physical training includes walking,sit to stand, toe raise, stepping in different directions,stepup, etc. Cognition training includes orientation training, memory training, attentions training,executivetraining,etc.In physical and cognition training program includes walking with executive function, sit up with orientation training, heels and toe raises with attention training,stepping in different direction with memory training, step up with attentions training, graded reaching with executivefunctions etc.

The MOCA scores wer eassessed pre-and post-intervention.

Pre-intervention, the Control group had a mean MOCA score of 20.50 (SD = 2.328), while the Experiment group had a significantly lower mean score of17.80(SD=3.888),with a p-value of
0.012. This indicates a significant baseline difference in cognitive function between the groups.Post-intervention, the Control group's mean MOCA score increased to 21.45 (SD = 2.946),whereasthe Experiment group’s score increasedto24.75(SD =2.593).The p-value of 0.001indicates a significant improvement in cognitive function in the Experiment group compared to the Control group.

The net change in MOCA scores (MOCA) further supports this, with the Control group showing a mean increase of 0.95(SD=1.432) and the Experiment group showing a significant increase of
6.95 (SD=3.187),with a p-value of <0.001.

The POMA scores were assessed pre and post intervention in Balance.

Pre-intervention,the Control group had a mean balance score of 12.20(SD=1.673),while the Experiment group hada mean score of 10.75 (SD = 3.640),with a p-value of 0.117,indicatingno significant difference.Post-intervention,theControlgroup'smeanbalancescoreincreasedto
13.05 (SD = 1.669), and the Experiment group's score increased to 13.00 (SD = 3.340), with ap-value of0.953,suggesting no significant post-intervention difference.

However, the net change in balance scores showed a significant difference, with the Control group having a mean increase of 0.85 (SD = 1.137) and the Experiment group having an increaseof2.25(SD=1.164),with a p-value of <0.001.

The POMA scores were assessed pre and post intervention in Gait.

Pre-intervention,the Control group had a mean gait score of 8.50(SD=1.433),and the Experiment group had a significantly lowermeanscoreof7.15(SD=2.207),with a p-value of
0.028. Post-intervention, the Control group's mean gait score increased to 8.80 (SD = 1.542),while the Experiment group's score increased to 8.75 (SD = 1.682), with a p-value of 0.922,indicatingnosignificantpost-interventiondifference.

The net change in gait scores showed a significant difference, with the Control group having a mean increase of 0.30 (SD = 0.470) and the Experiment group having an increase of 1.60 (SD =1.353),with a p-value of <0.001.

The experimental group in MOCA showed significant improvements both post- intervention andin net change scores compared to the control group, indicating enhanced cognitive function.POMA Balance pre-

and post-intervention scores showed no significant differences between the groups, the net change scores were significantly higher in the experimental group, indicating improved balance.The experimental group POMA GAIT score showed significant base line differences but achieved similar post- intervention scores to the control group, with a significant net change indicating improved gait.

CONCLUSION:

This study concluded that the intervention appears to have significantly improved both cognitivefunction and certain aspects of physical function (balance and gait) in the experimental groupcompared to the control group. Despite the significant baseline differences in cognitive and gaitscores, the intervention group demonstrated greater improvements, highlighting the potential efficacy of the intervention. These findings suggest that targeted interventions can effectively enhance cognitive and physical outcomes in older adults.

LIMITATIONOFTHESTUDY:

The study may have a Smaller sample size, limiting its ability to draw broad conclusions. This study limited to only mild cognitive impairment and also those having declined cognitive function compared to five year ago.

FUTURERECOMMENDATIONS:

Future studies need to include who having anxiety with mild cognitive impairment,future research established with larger sample size in relation to gender and their quality of life. And future research could be done in hospital set up where more environment and followup study can be implement.

ACKNOWLEDGMENT-

My gratitude to Dr. P. Mahalingam, Chairman and Vice Chairman of Santosh Medical College,Santosh College of Occupational Therapy, Ghaziabad, Dr. R. K. Sharma,Dean, Paramedical &Principal of occupational therapy college and Dr. CHHAVI KALRA,Assistant Professor.Alsosubjects of this study for their support & participation in the research project and thanks to God andmy parents for their blessings. The project was made possible with the guidance and encouragement of these individuals.

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