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Impact of Combined Multifaceted Cognitive and Resistance Training Approach on Physical Activity, Cognition and Activity of Daily Living in Older Adults: A Randomized Control Trial

Shubhangi[1], Prof. (Dr.) R.K. Sharma[2]*, Dr. Poonam Rani[3], Dr. Deepak Raghav[4] and Dr. Syed Hasan[5]

[1]Master of Occupational Therapy (Neurology) Student, Santosh College of Occupational Therapy, Ghaziabad, India

[2]Dean, Paramedical and principal, Santosh College of Occupational therapy, Ghaziabad

[3]Assistant Professor, Santosh College of Occupational Therapy, Ghaziabad, India

[4]Professor/Principal, Department of Physiotherapy, Santosh Paramedical college and hospital, Ghaziabad, India

[5]Professor and Head, Department of Community Medicine, Santosh Medical College, Santosh Deemed to be University, Ghaziabad India

ABSTRACT

A combined cognitive and resistance training approach presents a holistic strategy to enhance strength, cognition, and daily functioning, yet it remains insufficiently studied. This Randomized control trial study evaluated the impact of combined cognitive and resistance training on physical activity, cognition, and activity of daily living in older adults. A total of 106 older adults were randomly divided in two equal groups. Physical activity scale for elderly (PASE), mini mental state examination (MMSE) and KATZ index of activity of daily living used to analyze the outcome of study. The intervention significantly improved activities of daily living (KATZ) and physical activity (PASE), with strong correlations ($r = .622$ and $r = .850$, $p < .001$). Cognitive improvements (MMSE) were modest but statistically significant ($r = .692$, $p < .001$). Paired t-tests confirmed these findings across all domains ($p < .001$). While the control group showed greater cognitive gains, the experimental group demonstrated superior physical activity improvements. Overall, the intervention effectively enhanced physical and functional outcomes, with limited cognitive benefit suggesting a need for longer or tailored strategies. The study highlights that a combined cognitive and resistance training intervention effectively enhanced functional independence and physical activity among older adults. While physical and daily living improvements were significant in the experimental group, cognitive gains were modest and more evident in the control group, suggesting the need for longer or more targeted cognitive interventions.

KEY WORDS: ACTIVITY OF DAILY LIVING, COGNITION, OLDER ADULTS, PHYSICAL ACTIVITY, RESISTANCE TRAINING.

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INTRODUCTION

Functional mobility and physical fitness are associated with independence in old age1. However, age-related processes that are relevant for older persons include a drop in muscle mass and strength as well as decreased physical performance and mobility [1]. Elderly people's mental and general well-being rapidly decline when their mobility and cognitive capacities decline together, and they become less actively involved in activities of daily living [1].

When a decline in cognitive function affects the basic environment, functional restrictions arise. Cognitive and motor skills, including walking, standing, balancing, and engaging with the surroundings [2]. According to the WHO, functional independence and healthy aging are directly tied to age- related declines in cognitive and neuromuscular function3. Aging impairs neuromuscular function by controlling a number of processes and decreasing muscle mass, strength, power, and mobility3. Age-related declines include both cognitive and physical components that have a significant impact on day-to-day functioning [3]. In the field of geriatrics, maintaining neuromuscular and cognitive function is crucial [3].

Resistance exercise is widely used in both sports and general populations in order to cause neuromuscular adaptations that will increase muscle size and performance [4]. The necessity for strength training increases with age in order to maintain mobility for daily tasks [5]. Reducing muscle atrophy and the ensuing loss of motor function is the aim of training. An increase in muscle mass is essential for preserving strength capacity [5].

An increase in frequency and muscle activity during isometric and dynamic exercise is also observed5. Strength exercise training increases skeletal muscle hypertrophy, anaerobic endurance, and strength by using resistance against the force of muscular contraction [6]. Although resistance training has long been shown to have positive effects on the neuromuscular system, there is mounting evidence that it can also enhance cognitive performance and cause neuroplastic changes in the central nervous system (CNS), even when done acutely [7]. Enhancing one's physical and mental capacities can either stop or minimize the cognitive decline that comes with aging [8].

Resistance training has also been suggested as a unique adjuvant rehabilitation approach to mitigate age-related losses in cognitive health in populations with neurological or neurocognitive impairments (e.g., Parkinson's and Alzheimer's dementia) [9].

The mental processes that control how the body and environment interact are referred to as cognitive processes Improvements in the targeted cognitive functions—visuospatial working memory, episodic memory, executive function, and information processing speed— have also been demonstrated to be induced by single cognitive training [8]. It appears that certain executive processes benefit more from physical training than other cognitive functions, as there have been reports of significant gains in cognition following aerobic exercise [10].

There is mounting evidence that exercise may improve older persons' physical and mental health to some extent. Numerous important risk factors for dementia, cognitive decline, falls, impaired gait, and a lower quality of life are clearly linked and modifiable through mental or physical exercise, according to the findings [11]. Evidence suggests that DT training, or combined motor-cognitive training, enhances older individuals' quality of life and motor-cognitive functions for ADL.

Previous studies have demonstrated that cognitive and physical activities, either alone or in combination, can improve cognitive function in older people. The ability to multitask daily. tasks and other cognitive capacities are maintained by cognitive–motor training, which combines mental and physical exercise. Along with engaging in cognitive-motor exercises, older persons can foster neuroplasticity to improve their general brain health and cognitive resilience [1]. Therefore, the aim of present study is to investigate the impact of combined cognitive and resistance training on physical activity, cognition, and activity of daily living in older adults. This study fills a critical gap in the being literature and give practicable perceptivity for perfecting the health and wellbeing of the older adults.

MATERIAL AND METHODS

A randomized control trial study was conducted to evaluate the impact of combined cognitive and resistance training on physical activity, cognition, and activity of daily living in older adults. This study was reviewed and approved by the Institutional Ethical Committee of Santosh College of Occupational Therapy (Ref No.-SCOT/NOV-24/ECNeuro-07). 106 Participants screened using MoCA test12 for cognition and were divided into experimental and control group by random sampling method. Using Cochran's formula with a 95% confidence level and 5% margin of error, the minimum sample size was calculated to be approximately 53 participants per group. All participants were undergoing for pre and posttest assessment using KATZ scale, MMSE AND PASE questionnaire. 24 sessions were conducted 2 times in one week for 12 weeks and duration was 45 minute per session.

In the experimental group participants were received combined resistance and cognitive training approach

treatment. Participants of control group were received resistance training program. Resistance training includes- squats, split squads, push-ups, back extension, light polymetric exercises included- wall push-ups, standing up from chair, standing up from floor and wide steps walking4. Cognitive training comprises- stimulus detection, choice reaction, audio spatial, visual spatial, inhibition control, explanation, working memory and cognitive flexibility [1].

Outcome Measurements: The following outcome measurements were taken at baseline and again after 12 weeks of training. The assessment tools included Katz index of independence in activities of daily living. This includes six items covering feeding, dressing, toileting, bathing, transferring, and continence. This scale offers a total score that represents an individual's overall capacity after evaluating them according to how well they do in each category [13]. Mini-Mental State Examination (MMSE) assess 11-item in six domains—orientation, registration, attention, recall, language, and visuospatial [14]. Physical activity scale for elderly (PASE) to assess older people's physical activity. There are twelve components on the scale, five of which relate to leisure activities, six to home activities, and one to work-related activities [15].

RESULTS

Total 106 subjects aged range 65-79 years of age were enrolled in the study and data were gathered through the Katz index of independence in activities of daily living, Mini-Mental State Examination (MMSE) and Physical activity scale for elderly (PASE). Fifty-three subjects were randomly allocated in control and experimental group.

The Pre-test and Post-test scoring of experimental and control group were analyses through parametric test, T-test was used to analyze the KATZ index scale, MMSE test and PASE questionnaire scores for analysis of activity of daily living, cognition and physical activity respectively and gives the following test result.

Table 1. Baseline Characteristics of outcome measure

Outcome Measure	EG				CG					
	Mean		(SD)		Mean		(SD)			
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	T	P
KATZ	5.11	5.55	.954	.574	4.60	5.19	.987	.735	-2.702	0.2536
PASE	104.91	133.9	51.46	61.36	92.53	119.64	58.26	68.84	-1.159	0.249
MMSE	26.70	27.25	.992	1.39	26.25	25.25	.076	.152	-2.905	0.403

EG: Experimental group, CG: Control group, SD: Standard deviation

Table 2. Result of baseline and post test scores of the outcome measures in experimental and control group

Outcome measure	EG		CG	
	T	P	T	P
KATZ	- 4.229	0.0	- 5.924	0.0
PASE	- 6.546	0.0	- 5.902	0.0
MMSE	- 3.941	0.0	6.893	0.0

EG: Experimental group, CG: Control group

Table 3. Result of post data analysis of the outcome measures, Experimental vs Control group

Scale	t- Value	p- Value
KATZ	9.42	0.0
PASE	7.56	0.0
MMSE	8.158	0.0

DISCUSSION

The intervention outcomes demonstrated statistically significant improvements across three key domains: activities of daily living (measured by the KATZ Index), physical activity (assessed via the PASE), and cognitive function (evaluated using MMSE). Functional independence improved markedly, with KATZ scores rising from a mean of 4.60 (SD = 0.987) to 5.19 (SD = 0.735), while physical activity levels increased substantially from a mean PASE score of 92.53 (SD = 58.27) to 119.64 (SD = 68.84). Cognitive performance showed a more modest change, with the mean score decreasing slightly from 26.25 to 25.25, indicating that cognitive improvements may require a longer or more focused intervention. Despite this, all three domains showed strong and statistically significant positive correlations between pre- and post-intervention scores— KATZ (r = 0.688), PASE (r = 0.875), and cognitive scores (r = 0.340)—highlighting consistent participant improvements.

Compared to an alternate dataset with similar demographic trends, the present study stands out for its balanced gender representation, inclusion of left-handed individuals, and detailed categorization of marital status, all of which enhance the ecological validity of the findings. In contrast, the alternate dataset featured fewer female participants in the oldest age group (75–79) and limited left-hand dominance variation, potentially narrowing the generalizability of its outcomes. Moreover, separation consistently emerged as the most common marital status, especially among older males, suggesting the importance of addressing social isolation in future interventions [16].

When compared with previous research, such as the FINGER study17 and physical activity-focused studies like Lautenschlager et al. (2008)18, the current research presents a more focused and replicable model. While previous studies addressed lifestyle or cognitive training broadly, this study precisely targets a combination of cognitive and resistance training and evaluates its effects across multiple health domains [19].

Statistically, the results were reinforced by high t-values and confidence intervals that did not cross zero, confirming the reliability of the improvements. For instance, the KATZ Index saw a mean difference of -0.434 ($t = -4.229$, $p < .001$), and PASE scores increased with a mean difference of -29.05 ($t = -6.546$, $p < .001$). Cognitive function also improved modestly, with a mean change of 0.547 ($t = -3.941$, $p < .001$), despite some variability due to differences in the measurement tools used (MoCA pre-test and MMSE post-test)20. These results were supported by high correlation coefficients across all three domains—KATZ ($r = 0.622$), PASE ($r = 0.850$), and cognitive scores ($r = 0.692$)—further confirming the consistency of participant improvements. Interestingly, when comparing the control and experimental groups, some nuanced differences emerged.

The control group exhibited slightly greater improvements in daily living functions and cognitive outcomes, while the experimental group showed a more substantial increase in physical activity. This suggests that the CRT program may be especially effective for enhancing physical engagement, while cognitive gains might benefit from complementary or prolonged strategies. Despite this, the overall pattern across both groups supports the rejection of the null hypothesis, affirming the intervention's efficacy in improving physical, functional, and cognitive health in older adults, this study distinguishes itself from earlier research through its detailed demographic profiling, robust statistical methods, and comprehensive evaluation of multiple outcome domains.

By integrating both cognitive and physical training, the study presents a well-rounded and evidence-backed intervention model for aging populations. Its methodological strengths and generalizable findings make it a valuable contribution to geriatric health research and intervention design. Despite its promising results, the study had certain limitations. Study consisted for a short duration and small sample size. The long-term effects of the interventions were not assessed. For future reference study can be done with a larger sample size with a longer duration of the study. Specific medical condition can be taken like sarcopenia, muscle atrophy etc. and other combined intervention can be taken into account. Also, study could be done in different setups like home, parks, hospitals for more accurate result.

CONCLUSION

In conclusion, this study provides comprehensive evidence on the demographic distribution and intervention outcomes among older adults. Demographic analysis revealed a predominance of right-hand dominance and a higher proportion of separated individuals, particularly among older males. The intervention, combining cognitive and resistance training, significantly improved activities of daily living and physical activity, with strong statistical support across t-tests analyses. Cognitive improvements, while statistically significant, were more modest and varied between control and experimental groups. Notably, the control group showed better cognitive gains, while the experimental group demonstrated stronger improvements in physical activity. Overall, the intervention was effective in enhancing functional independence and physical engagement, but cognitive benefits may require longer duration or tailored strategies to yield greater impact.

Ethical Clearance
SCOT/NOV-24/ECNeuro-07 ,9/11/2024.

Conflict of interest statement - NONE.

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