



EFFECT OF CIRCUIT TRAINING TO IMPROVE BALANCE, ENDURANCE AND HIGHER MENTAL FUNCTIONS IN ELDERLY

Physiotherapy & Rehabilitation

Komal Nagar*

Assistant Professor, Department Of Physiotherapy Teerthanker Mahaveer University, Moradabad – 244001 India *Corresponding Author

Sunita Kumari

Assistant Professor, Department Of Physiotherapy, Faculty Of Allied Health Sciences, Manav Rachna International Institute Of Research & Studies, Faridabad - 121004 India

ABSTRACT

Objectives: Aging is associated with general body deterioration and falls are also associated with the aging. The purpose of this study was to determine the effect of Circuit training on balance, endurance ability and higher mental functions in elderly. **Methods:** 30 elderly participants were randomly allocated into two groups- group 1 (conventional training group) with mean age (63.53 ± 2.13) and BMI (28.11 ± 4.14) kg/m² and group 2 (circuit training group) with mean age (63 ± 2.17) and BMI (26.86 ± 3.23) kg/m². Berg balance scale, timed up & go test, two-minute walk test and Mini mental state examination were assessed before and after 4 weeks of training. Training session included 3 sessions for 35 minutes per week for 4 weeks. **Result:** T test was used to analyze the data. There was a significant improvement in balance, endurance and higher mental functions in both the groups. But when compared to each other, group 2 was found to be significantly improved. **Discussion** – After 4 weeks of circuit training, balance, endurance as well as higher mental functions can be improved in elderly when compared to conventional training. More studies can be done by doing it gender specific and more sample sizes.

KEYWORDS

Circuit training, Aging, Elderly, Balance, Endurance, Cognition

INTRODUCTION -

Fall among older adults of around 65 years of age is a very significant clinical problem and is one of the supreme causes of accidental deaths which possibly lead to catastrophic physical, psychological and social outcomes. Aging is generally related to deterioration in musculoskeletal and sensory systems. Major intrinsic risk factors of loss of the independence and fall are lower limb muscular weakness along with the impaired balance. People with 60 year of age or above when administered with certain group of exercises like balance, coordination, gait, functional training, strengthening exercises and other three-dimensional exercises programs are found to be effective. [1] In addition, fall prevention strategies in elderly people, particularly involves the exercises that focuses and challenges balance. Moreover, other strategies if added, prevent fall in elderly involves improvement in balance training program, improvement in muscle strength and reduced functional dependence.[2]

American College of Sports Medicine's "Exercise and Physical Activity for Older Adults" states that two exercise techniques- aerobic exercises and resistance exercises should be included in the exercise regime as a pillar of the regime.[3] It is also found to be effective in reducing body fat. Furthermore, circuit training is an approach that's time saving and can obtain considerable improvement in various health and fitness outcomes.[4]

Endurance training is found to be more effective in decrement of fat mass, resting heart rate and blood pressure. Cardiovascular and strength benefits are thought to be promoted by circuit weight training. Maximum oxygen consumption, maximum pulmonary ventilation, functional capacity and strength found to be increased by the use of circuit-based resistance training. Cardio-respiratory capacity deterioration of an elderly is basically associated with a general reduction in HR max and oxygen arterio-venous difference changes. Few studies have concluded cardiovascular adaptation to circuit weight training has increased VO₂ max from 15% to 18%. Circuit training, versatile training modality, is an innovative method which improves the body composition, muscle strength, cardiovascular function and eventually maintains functional capacity in elderly. [5]

This training upgrades and boosts physical functioning by improving balance, coordination, endurance and upper body flexibility. Circuit resistance training is a form of strength training that is performed in a sequence with small hold time for recovery. The standard motor dual-task design in a circuit training involves a comparison of a motor task performed alone versus the same task performed with a concurrent cognitive task. This comparison has a basis for the calculation of dual-task costs (single- minus dual-task performance), which indicates the degree of interference or attention recruitment that the motor task incurs.[6]

Many evidences demonstrated that physical exercise (PE) affects brain plasticity, influencing cognition and wellbeing [7]. So, the purpose of this study was to find out the effectiveness of circuit training on dynamic balance, endurance capacity & higher mental functions in elderly.

MATERIALS & METHODS-

30 old age individuals were recruited, using convenient sampling for the study; Inclusion criteria included 60-65 years old, individuals without any musculoskeletal or neuromuscular disorder. Any previous head injury or CVA, serious systemic disease, major psychiatry issue, epilepsy, or any medication that may alter the cognition were excluded. Study was explained, consent form was signed prior to participation. Pretest and posttest data collections took place at session 1st and 12th of training. There were 03 dropouts in the study. Training session lasted for 35 minutes. Baseline measurement was done by using Berg balance scale (BBS) [8], Timed up & go test (TUG) [9], Two-minute Walk test (2MWT) [10] and Mini mental state Examination (MMSE). [11]

Group 1 received basic conventional training that includes 05 minutes of Warm up; 05 minutes of upper limb ROM exercises; 05 minutes of lower limb ROM exercises; 10 minutes of core exercises; 05 minutes of D1 and D2 PNF flexion-extension; 05 minutes of Cool down. Group 2 received circuit training. Each session of the training was designed into 4 stations apart from the warm up and cool down, that includes 10 minutes of Warm up; 05 minutes at Station I- Stability without manipulation (Standing on the top of foam mattress with eye closed); 05 minutes at Station II- Gait without manipulation (walking on a narrow path); 05 minutes at Station III- Stability with manipulation (rotating waist to left-right); 05 minutes at station IV- Gait manipulation activities (backward walking); 05 minutes of Cool down. Between each station, participants were asked to perform a transition exercise of sit to stand for 5 times [12].

RESULTS:

Data analysis was done using T test in SPSS software, version 20. Descriptive statistics were calculated using Mean $\pm$ SD. The mean score for pre intervention BBS for both the groups was 45.13 ± 7.95 and 46.73 ± 5.82 respectively and no significant difference observed with $p < 0.05$ at $t = 0.629$. The mean score for post intervention BBS for both the groups was 45.80 ± 7.60 and 51.06 ± 5.13 respectively and significant difference observed with $p < 0.05$ at $t = 2.22$.

The mean score for pre intervention TUG for both the groups was 11.35 ± 2.27 and 11.31 ± 1.46 respectively and no significant difference observed with $p < 0.05$ at $t = 0.054$. The mean score for post intervention TUG for both the groups was 11.24 ± 2.30 and 9.83 ± 1.32 respectively and significant difference observed with $p < 0.05$ at $t = 2.051$.

The mean score for pre intervention 2MWT for both the groups was

72.04±11.94 and 90.71±16.94 respectively and significant difference observed with $p<0.05$ at $t=3.487$. The mean score for post intervention 2MWT for both the groups was 72.80±11.87 and 94.25±17.59 respectively and significant difference observed with $p<0.05$ at $t=3.913$.

The mean score for pre intervention MMSE for Group 1 & Group 2 was 27.80±1.89 and 28.00±1.55 respectively, there was no significant difference with $p<0.05$ at $t=0.315$. The mean score for post intervention MMSE for Group 1 & Group 2 was 28.40 ±1.88 and 29.13± 1.12 respectively, there is significant difference with $p<0.05$ at $t=1.295$.

Table depicts the Between group comparison of Pre and Post value of all the variables.

VARIABLE	GROUP 1	GROUP 2	t value	p value
Pre BBS	45.13±7.95	46.73±5.82	0.629	0.535
Post BBS	45.80±7.60	51.07±5.13	2.222	0.035
Pre TUG	11.35±2.27	11.31±1.46	0.054	0.95
Post TUG	11.24±2.30	9.83±1.32	2.051	0.05
Pre 2MWT	72.04±11.94	90.71±16.94	3.487	0.002
Post 2MWT	72.80±11.87	94.25±17.59	3.913	0.001
Pre MMSE	27.80±1.89	28.00±1.55	0.315	0.755
Post MMSE	28.40±1.88	29.13±1.12	1.295	0.206

DISCUSSION:

The result of the present study shows significant improvement in both the groups suggesting the possible benefits of physical activity. There is constant evidence in the literature that balance, endurance and cognitive ability can be enhanced by giving instruction to the subjects that directs their attention to the effect of their movement. The result shows the same result that circuit training performed better than conventional training. In the present study, balance was improved significantly in group 2 with circuit training as compared to the group 1 with conventional training which is consistent with another study which states, the possible rationale behind the improvement could be Balance Exercise Circuit helps in promoting functional independence in older women and forms the evidence that it's effective in reducing the risk of fall, promote enjoyable life and promoting it to be a reliable intervention. Researcher found that there is significant improvement in all physical aspects like flexibility, balance, body-handling skill, reaction speed and coordination by low intensity exercises, pre and post program. [13]. Similar improvement was also observed in a study where a series of low intensity exercises like standing and sitting was administered in a group of clinically defined- at risk individuals which are either hospitalized or at bed rest for 2 or more days [14].

The current study suggests that there is an improvement in the endurance in both the groups but group with circuit training improved better as supported by another study. It states, improved walking capability also increased cardiovascular fitness post training. Their study also supported that motor learning was facilitated; gait was enhanced along with the strength and endurance. It also improves the physical fitness for activities of daily living, regardless of what type of training protocol is being administered. Moreover, when analyzed separately, functional training was found to have greater impact on lower limb strength, cardiovascular capacity and mobility pattern than traditional training [14].

Another study stated that Physical exercises establish certain physical and psychological effects that can alter the cognitive activity of the brain and hence a matter of wellbeing. Current researches have shown that "PE triggers potent neuroplastic phenomena, partly mediated by epigenetic mechanisms". Few studies suggests that fitness training enhances the performance, regardless of what type of cognitive activity, training protocol or subject's behavior [7]. Recent study as well as the literature highlights that fitness training also improves the cognitive function of an older adult. There was a remarkable difference observed in the strength gain in all tested exercises. They also stated that all type of exercises increased muscle strength level in pre versus post intervention. But the gains were dependent on the type and order of exercises. [15]. The present study showed significant improved in balance and endurance after 4 weeks of training. However, the study had few limitations. As sample size was too small and data was gathered from only one old age home.

CONCLUSION:

There is a significant improvement in individual's balance after 4

weeks of circuit training as well as after 4 weeks of conventional training. There's also a significant enhancement in endurance but only slight improvement in the higher mental functions, Subjects undergone Circuit training found to be improved significantly.

REFERENCES:

- Silsupadol, P., Siu, K. C., Shumway-Cook, A., & Woollacott, M. H. (2006). Training of balance under single-and dual-task conditions in older adults with balance impairment. *Physical therapy*, 86(2), 269-281.
- Avelar, B. P., Costa, J. N. D. A., Safons, M. P., Dutra, M. T., Bottaro, M., Gobbi, S., ... & Lima, R. M. (2016). Balance Exercises Circuit improves muscle strength, balance, and functional performance in older women. *Age*, 38, 1-11.
- Treacy, D., Schurr, K., & Sherrington, C. (2013). Balance circuit classes to improve balance among rehabilitation inpatients: a protocol for a randomised controlled trial. *BMC geriatrics*, 13, 1-6.
- Suzuki, F. S., Evangelista, A. L., Teixeira, C. V. L. S., Paunksnis, M. R. R., Rica, R. L., Evangelista, R. A. G. D. T., ... & Bocalini, D. S. (2018). Effects of a multicomponent exercise program on the functional fitness in elderly women. *Revista Brasileira de Medicina do Esporte*, 24(01), 36-39.
- Romero-Arenas, S., Martínez-Pascual, M., & Alcaraz, P. E. (2013). Impact of resistance circuit training on neuromuscular, cardiorespiratory and body composition adaptations in the elderly. *Aging and disease*, 4(5), 256.
- Li, K. Z., Roudaia, E., Lussier, M., Bherer, L., Leroux, A., & McKinley, P. A. (2010). Benefits of cognitive dual-task training on balance performance in healthy older adults. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 65(12), 1344-1352.
- Mandolesi, L., Polverino, A., Montuori, S., Foti, F., Ferraioli, G., Sorrentino, P., & Sorrentino, G. (2018). Effects of physical exercise on cognitive functioning and wellbeing: biological and psychological benefits. *Frontiers in psychology*, 9, 347071.
- Muir-Hunter, S. W., Graham, L., & Montero Odasso, M. (2015). Reliability of the Berg Balance Scale as a clinical measure of balance in community-dwelling older adults with mild to moderate Alzheimer disease: a pilot study. *Physiotherapy Canada*, 67(3), 255-262.
- Nordin, E., Rosendahl, E., & Lundin-Olsson, L. (2006). Timed "Up & Go" test: reliability in older people dependent in activities of daily living—focus on cognitive state. *Physical therapy*, 86(5), 646-655.
- Chan, W. L., & Pin, T. W. (2019). Reliability, validity and minimal detectable change of 2-minute walk test, 6-minute walk test and 10-meter walk test in frail older adults with dementia. *Experimental gerontology*, 115, 9-18.
- Fountoulakis, K. N., Tsolaki, M., Chantzi, H., & Kazis, A. (2000). Mini mental state examination (MMSE): a validation study in Greece. *American Journal of Alzheimer's Disease & Other Dementias*, 15(6), 342-345.
- Fernandes, A., Rocha, N., Santos, R., & Tavares, J. M. R. (2015). Effects of dual-task training on balance and executive functions in Parkinson's disease: A pilot study. *Somatosensory & motor research*, 32(2), 122-127.
- Tse, A. C., Wong, T. W., & Lee, P. H. (2015). Effect of low-intensity exercise on physical and cognitive health in older adults: a systematic review. *Sports medicine-open*, 1, 1-13.
- Resende-Neto, A. G. D., Aragão-Santos, J. C., Oliveira-Andrade, B. C., Silva Vasconcelos, A. B., De Sá, C. A., Aidar, F. J., ... & Da Silva-Grigoletto, M. E. (2019). The efficacy of functional and traditional exercise on the body composition and determinants of physical fitness of older women: a randomized crossover trial. *Journal of Aging Research*, 2019(1), 5315376.
- Cardozo, D. C., De Salles, B. F., Mannarino, P., Vasconcelos, A. P. S., Miranda, H., Willardson, J. M., & Simão, R. (2019). The effect of exercise order in circuit training on muscular strength and functional fitness in older women. *International journal of exercise science*, 12(4), 657.