

IMPACT OF BALANCE, ENDURANCE AND STRENGTHENING EXERCISES ON BORG SCORE AND SIX MINUTE WALK TEST IN GERIATRIC POPULATION-**C. V. Senthil Nathan¹, V. Rajalaxmi^{2*}, G. Yuvarani³, G. Tharani⁴ and T. Hemalatha⁵**

^{1,2}Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University, Velappanchavadi, Chennai - 600 077, Tamil Nadu, India.

^{3,4}Assistant Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University, Velappanchavadi, Chennai - 600 077, Tamil Nadu, India.

⁵Physiotherapist, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University, Velappanchavadi, Chennai - 600 077, Tamil Nadu, India.

***Corresponding Author: Dr. V. Rajalaxmi**

Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational & Research Institute University, Velappanchavadi, Chennai - 600 077, Tamil Nadu, India.

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ABSTRACT

Objective of the Study: To find the effects on strength, balance and endurance training on physical activities of persons aged between 60-65 years. Impact of balance, endurance and strengthening exercises on borg score and six minute walk test. Physical activity is defined as any bodily movement produced by energy expenditure, physical activities such as cycling, walking- has significant benefits for health. **Materials and Methods:** Once the study is approved by the institutional review board 60 samples from 75 volunteers were selected based on the inclusion criteria of both male and female aged above 60-65 years who complains of Osteoarthritis, Falls, Diabetes and excluded samples with Recent fracture, Myocardial infarction, Recent surgery. 60 samples were equally divided into Group A and Group B. Group A received balance, endurance and strengthening exercises and Group B sham control group received a regular activities which gave placebo effect. Pre-test and post-test measurements were taken using Borg rate of perceived exertion scale and six minute walk test. **Result:** On comparing the pre and post-test values Borg rate of perceived exertion scale and six minute walk test of, group A showed a significant difference in the mean values than group B.

KEYWORDS: BORG Score (Perceived Exertion Scale (RPT), six-minute walk test, Strength, Balance and Endurance.

INTRODUCTION

The number of elderly persons in our country have increased in recent time as the life expectancy have increased, so more attention is being given to geriatrics in maintaining and improving their physical activity and fitness levels.^[1] The physical activity is defined as any bodily movement produced by skeletal muscle that requires energy expenditure. Physical inactivity has been identified as the fourth leading risk factor for global mortality causing 3.2million deaths globally. Regular moderate intensity physical activity such as walking, cycling or participating in sports has significant benefits for health for instance; it can reduce the risk of cardiovascular disease, diabetes and depression.^[1] Moderate activity will increase your heart rate and make your breath faster and feel warmer one way to tell if you can still talk, but you can't sing the words. Vigorous activity like jogging leads to hard and fast breath. If you're working at this level, you won't be able to say more than a few words without pausing for breath. Light intensity requires the least amount of effort compared to moderate and vigorous activities such as walking slowly.

Physical activity has been shown to reduce the risk factor over the chronic conditions including coronary heart disease, stroke, hypertension, diabetes and osteoporosis.^{[1][2]} Regular physical activity of higher levels of fitness allow daily task to be accompanied with greater ease and comfort with less fatigue. Weight bearing physical activity reduces the rate of bone loss associated with osteoporosis. Regular physical activity maintains strength and flexibility, balance and coordination, and can help to reduce the risk of falls. In short, physical activity helps prolong good health and independence. Heart disease and stroke are the leading causes of death but following guidelines and getting at least 150 minutes a week. (2 hours of 30mins) of moderate intensity activity can put at a lower risk for this disease.^[3] This can reduce the risk of developing any disease condition. Regular physical activity can also help to control the blood pressure and also reduce the cholesterol level. It is also reduce the risk of developing type 2 diabetes. At least moderate level of physical activity should be done a week.

As in older age it's important to protect their bones, joints and muscles. Regular physical activity helps to prevent arthritis and condition affecting the joints. Physical activity will be improved by strengthening, balance and endurance exercises. Strength is a quality or state of being physically strong. The ability to resist being moved or broken by a force. It is well known that muscle performance diminishes with age and deficits in muscle strength, endurance are associated with a higher incidence of functional limitations. The major role of resistance training in older adult is to maintain or improve their levels of functional independence. Select low loads exercise that allows a minimum of 8 to 12 repetitions, Emphasizing multi joint, combined movements. Strength training is a type of physical exercise especially in the use of resistance to induce muscular contraction which builds the strength, anaerobic endurance and size of skeletal muscles. Strength training can help to prevent Osteoporosis in which skeletal material begins to weaken and decrease. This can cause deformity and fractures in spine and hip. Arthritis like osteoarthritis or rheumatoid arthritis will attack your joint cartilage and synovial membrane respectively.

Strength training can help to control blood sugar enhancing the quality of life. There are many ways to work your muscles one of the most common are progressive resistance exercise. Caution to be taken when performing Progressive Resistance Exercise when you lift free weights or elastic exercise bands and it is heavy, it may also cause injury and increase the blood pressure in older adults. Balance exercise can help you to maintain your balance specially an older adult, balance exercise are especially important because they can help

you to prevent falls and maintain your independence.^[4] Some exercise can help you maintain good balance but specific exercise designed to include in your daily routine and can help to improve your stability. For example, stand in one leg with support. The state of having your weight spread equally so that you don't fall. The ability to move or to remain in a position without losing control or falling. Endurance exercise is one of the important exercises for older adults. The ability to sustain a physical activity, perform repetitive sub maximal contractions, or exert a force for a prolonged period.^[5] The term endurance training generally refers to training the aerobic system as opposed to anaerobic.

MATERIALS AND METHODOLOGY

Once the study is approved by the institutional review board 60 samples from 75 volunteers were selected from the outpatient department of ACS medical college and hospital, based on the inclusion criteria of both male and female aged above 60-65 years who complains of Osteoarthritis, Falls, Diabetes and excluded samples with Recent fracture, Myocardial infarction, Recent surgery. After collecting the basic demographic data's, the subjects were fully explained about the benefits of participating in the study and asked to fill the consent form in acceptance with participation of the study which is duly signed by the participants and the researcher. 60 samples were equally divided into Group A and Group B. Group A received balance, endurance and strengthening exercises and Group B sham control group received a regular activities which gave placebo effect. Pre-test and post-test measurements were taken using Borg rate of perceived exertion scale and six minute walk test.

STUDY MATERIAL



Fig 1: Theratube.



Fig 2: Paper & Pen.



Fig 3: Dumbbells.



Fig 4: Stopwatch.

GROUP A: ENVIRONMENTAL GROUP

STRENGTHENING EXERCISE: a) **Wrist Curls:** Rest your forearm on the arm of the study chair with hand over the edge, Hold weight with your wrist facing upward, Slowly bend your wrist up and down, Repeated 10-15 times, Repeated with other hand 10-15 times. b) **Biceps Curls:** Strengthens the upper part of your arm with elbow exercise will make lifting easier. Sit with good posture in a chair (remember to engage your core by imagining your sternum moving backwards your spine, to stabilize your posture) are dumbbell in each hand, palms facing forward, shoulder related, and elbows close to your body. Focusing on your biceps muscle, bend your arm at the elbow and lift the weight above 3/4 of the way forward your shoulders. Avoid rotating your shoulders forward and keep your elbow fixed at your side. Breathe out as your lift the weight, and breathe in as your lower it. Do 10 to 15 repetitions. c) **Triceps Extension:** Hold on to the end of the dumbbell with both hands, Begin with your arms straight and your feet & hip width apart keep your arms still while bending your elbows to lower the weight slowly behind your head. Then straighten arms and return to the starting position. Attempt 10-15 repetitions, but do not over exert. Begin with fewer repetitions and as time passes and the muscle gets stronger, you'll be able to have more repetitions. d) **Hamstring Strengthening:** The patient is seated with padding on the lower leg, and around the back of the chair and the end held in the hand. The patient pulls the strap until a tight feeling is felt on the thigh/knee. The position is held for 10-15 minutes before or attempting to increase the stretch/ strength.

BALANCE EXERCISE: a) **Stand On One Foot With Wall Support:** Stand on one foot with wall support, holding on for balance. Hold position for up to 10 seconds. Repeat 10 to 15 times. Repeat 10 to 15 times in other leg. b) **Heel To Toe Walking:** Position the heel of one foot just in front of toe of the other foot. Your heel and toe should touch or almost touch, choose a spot ahead of you and focus on it to keep you steady as you

walk. Take a step. Put your heel just in front of the toe of your other foot. Repeat for 10-15 steps alternative legs. c) **Sit and Arm Crossed- Upper Body Twist:** This stretch will develop and maintain flexibility in the upper back. Sit upright with your feet flat on the floor, cross your arms and reach for your shoulders, Without moving your hips, turn your upper body to the left as far as comfortable hold for 5 seconds. Repeat on each side.

ENDURANCE EXERCISE: a) One of the easiest forms of early endurance work is brisk walking. Walking has been referred to as the "king of exercise". This starts with 2-5 minutes of continuous walking. Try this a few times per day. Then build up to 30 minutes, 2 times a week. This exercise can be split into three intervals for 10 minutes.

GROUP B: SHAM CONTROL GROUP B received flexibility exercises and active movements for all the joints. They perform normal activity of daily life. Both the groups received treatment for 4 days a week for 4 months.

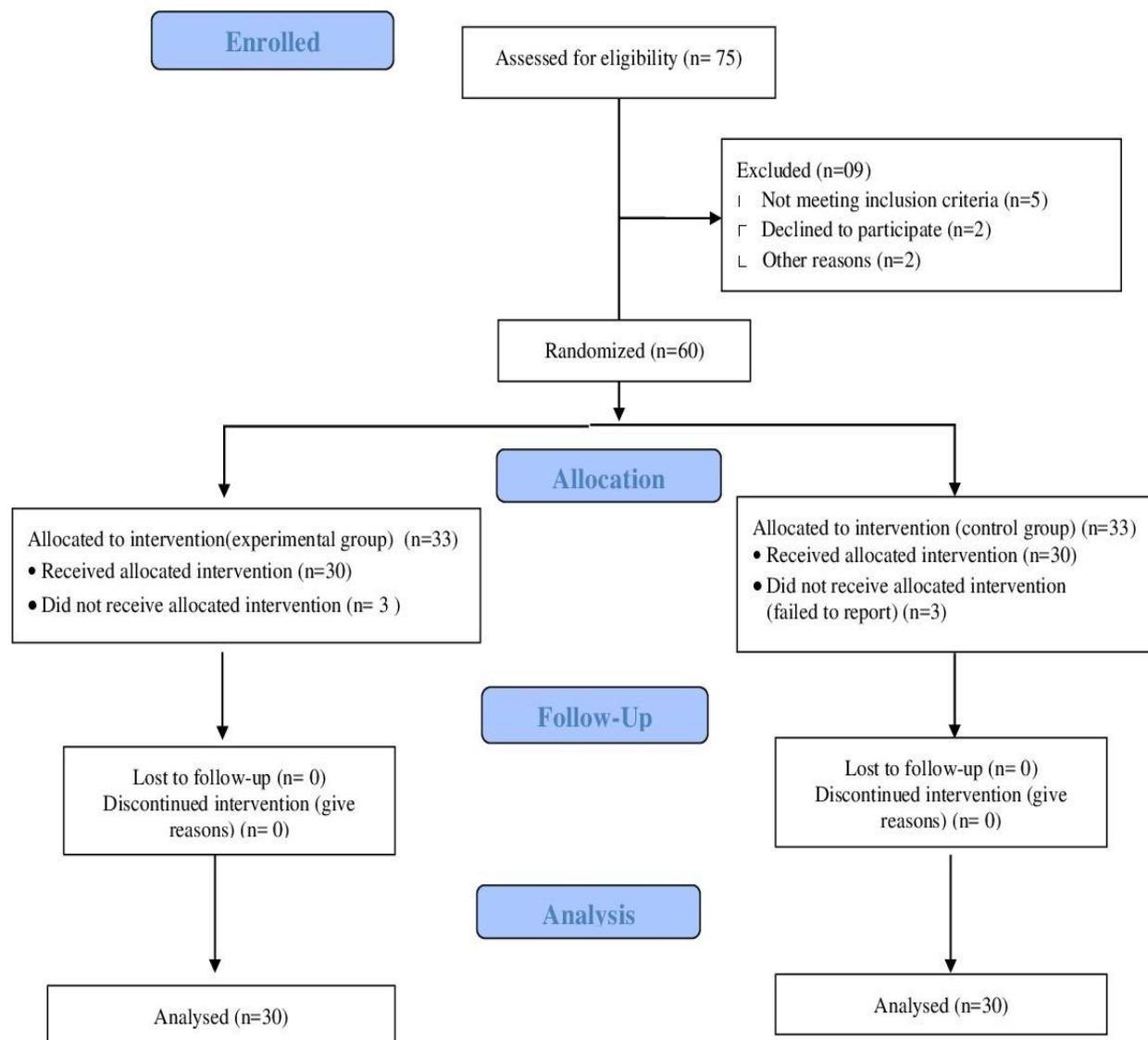


Fig. 1: CONSORT 2010 Flow chart.

Blinding: First, patients were blinded to the group allocation and to the fact that one group would receive sham treatment as it was recommended for physical fitness trials, instead they were told that 2 exercises would be tested. Second the investigator assessing the outcomes remained blind to the patient's allocation during the whole study period. Third the statistician who conducted outcome analyses was blinded to the group allocation by renaming the groups with numbers.

RESULTS

DATA ANALYSIS

The collected data were tabulated & analysed using descriptive & inferential statistical. Mean & standard deviation were used to assess all parameters of the data using statistical package for social science (SPSS) version 16. Paired t test was adopted to find out the effectiveness within Group- A & B in subjects with physical activities in independent t- test (students t - test) was used to compare the changes in mean values of all

parameters between Group- A & Group- B. There is a significant difference in the post-test values of Borg scale & Six minute walk test scores between Group-A & Group- B at $P \leq 0.001$.

On comparing mean values of Group- A & B on Borg scale & Six minute both the Groups show improvement in the post-test mean but Group- A showing higher mean values. Higher value is more effective. There is a significant difference in the post-test values between Groups – A & Group – B at $P \leq 0.001$. On comparing mean values of Group- A & Group- B Both the Groups show reduction in the post-test mean but Group – A showing higher mean value is more effective than Group- B at $P \leq 0.001$. Hence the Null hypothesis is rejected.

Table 1: Comparison of Pre & Post Test Values Of Borg (Rpt) Of Group A & Group B.

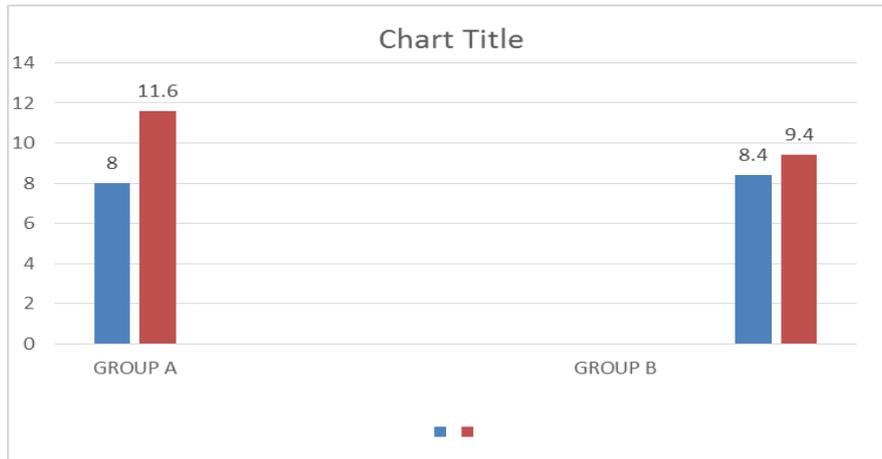
BORG	GROUP A		GROUP B		T-test	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	8.0	1.4	8.4	1.5	.834	.411
POST TEST	11.6	1.3	9.4	1.4	4.37	.000

*** $p \leq 0.001$

Table 1

The above table reveals the mean, standard deviation (SD), t – value & p value of the Borg & six minute between pre & post-test values within Group-A. Table-1

shows significant difference between the pre & post-test values of Borg scale Group A (***- $P \leq 0.001$) & In six minute walk test there is a significant difference between pre & post-test values.(***- $p \leq 0.001$).

**GRAPH-1.****Table 2: Comparison of Pre & Post Test Values Of Six Minue Walk Test Group A And Group B.**

SIX	GROUP A		GROUP B		T-test	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	27.3	4.2	27.4	3.5	.046	.963
POST TEST	34.2	1.4	31.0	3.2	3.5	.000

*** $p \leq 0.001$

Table 2

The above table reveals the mean, standard deviation (SD), t – value & p value of the Borg rate of perceived exertion scale & six minute walk test between pre & post-test values within Group-A. Table-1 shows

significant difference between the pre & post-test values of Borg Group A (***- $P \leq 0.001$) & In six minute walk test there is a significant difference between pre & post-test values.(***- $p \leq 0.001$)

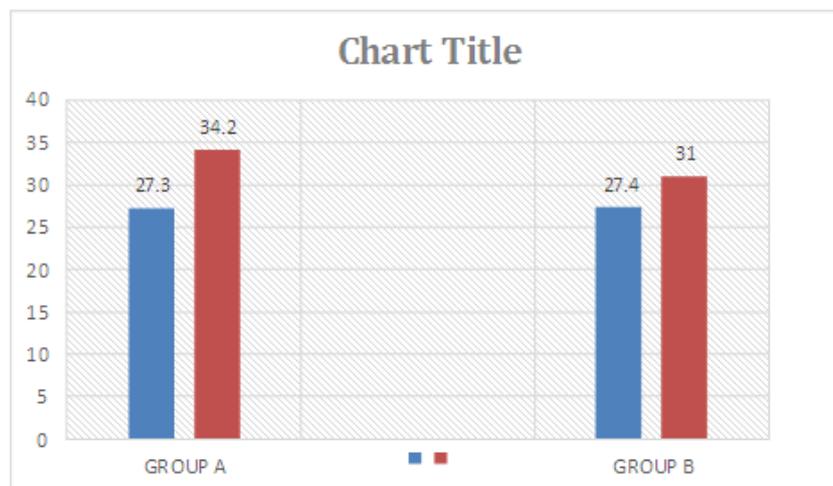
**GRAPH-11**

Table 3: Comparison Of Pre & Post Test Values Of Borg (Rpt) & Six Mintue Walk Test Of Group A & Group B.

BORG	GROUP A		GROUP B		T-test	SIGNIFICANCE
	MEAN	SD	MEAN	SD		
PRE TEST	8.0	1.4	8.4	1.5	23.0	.000
POST TEST	11.6	1.3	9.4	1.4	7.2	.000
SIX MIN PRE TEST	27.3	4.2	27.4	3.5	6.6	.000
POST TEST	34.2	1.4	31.0	3.25	5.0	.000

DISCUSSION

The present study proves the effectiveness of strength, balance and endurance training on physical activities of persons aged between 40-65 years.

K.JASON CRANDALL, CIARAN FAIRMAN and DEWIGIT 2015: Suggest minimal level of muscular strength and balance is necessary for older adults for remain mobility capable of performing activities of daily living and to reduce the falls rise. All the measure of muscle strength and balance has improved at the end of investigation and physical activity are also improved.^[6] Kimberly J. et al 2015 suggested that improvements the physical performance occurred along with improvements in balance and reduced falls.^[7]

In Table-1; its shows significance increase in the post-test mean value of Group A. which has more effective mean value than Group B. In Table 2 shows significant decrease in the post-test mean value of Group B. However from the analysed statistical mean value it showed that the strength and endurance training reported significant improvement in physical activities.

The Borg rate of perceived exertion scale and Six minute walk test score showed improvement in physical activities in Group A than Group B. On comparing those statistical values of experimental group and control group. The experimental group is more effective than the control group. Hence, the physical activities are more improved in experimental group. In this study, we examined the effective of strength, balance and endurance training on physical activities persons aged between 40-65 years in 3 months. Therefore the use of strength, balance and endurance training will serve the purpose of increase physical activities.

Rajalaxmi et al concluded that as the mean value of 6 MWT increases, the mean of stress also increases showing a positive correlation, which clearly states that a person in depression and anxiety don't have a proper physical fitness nor unable to perform in any physical task efficiently. In other words a person whose physical fitness is compromised or sedentary for long time will lead to depression and anxiety later. The study emphases on regular physical activities to have a good psychological well-being.^[8]

AGUS KARTONO, et al 2017 in their study concluded that, the effect of physical exercise on the dynamics of

glucose and insulin in order to confirm the role of physical exercise as a prevention for subjects at risk, to stress the benefit that can be gained by T2DM from improving SI index.^[8]

Bijal Majiwala, Trupti Warude, Amrutkuvar Pawar 2017 concluded that Isometric And Isotonic Exercises Are Equally Effective In Reducing Pain, Increase Endurance, Physical Fitness And Improve Functional Disability In Patients With Non-Specific Low Back Pain.^[9]

Arbind Kumar Choudhary, 2016 in this study, it is concluded that sedentary habits in the kitchen may increase accumulation of adiposity, lead to overweight increasing sympathetic dominance and decreasing parasympathetic dominance, lead to cardiometabolic risk in women. Early detection and management by weight reduction and regular exercise/ yoga may reduce these risks. Next to sedentary behavior, light physical activities, such as cleaning, cooking, and slow walking, are considered for interventions for healthy lifestyle to promote activeness in the long-term.^[10]

Aishwarya Pramod Benkar, Smita Bhimrao Kanase 2017 in their study concluded that both aerobic exercises and resistance training prove to be beneficial in controlling blood glucose levels in T2DM subjects.^[11]

CONCLUSION

The present study concluded that strength, balance and endurance training yielded significant to improve physical fitness. The result suggested that strength, balance and endurance training on experimental group showed greater improvement in physical activities than normal ADL activities in control group.

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Ethical Considerations

The manuscript is approved by the Institutional Review board of faculty of physiotherapy. All the procedures were performed in accordance with the ethical standards of the responsible ethics committee of both (Institutional and national) on human experimentation and the Helsinki Declaration of 1964 (as revised in 2008).

Conflict of Interest: All contributing authors declare that they have no Conflicts of interest. This study was approved by Institutional Review Board of Physiotherapy, Dr. MGR Educational and Research Institute University, Chennai.

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