

## EFFECT OF LOW INTENSITY BODY WEIGHT TRAINING ON BALANCE IN OLDER ADULTS

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### ABSTRACT

**Background:** Balance is the component which is majorly altered in older adults with approximately 21.5% of the population over 65 years of age having some balance dysfunction, particularly in functional tasks like ambulation and climbing stairs. Impaired balance and functional mobility are major risk factors for falls.

**Aims and objective:** The aim of the study was to study the effect of low intensity body weight training on balance in older adults.

**Procedure:** 60 older adults between the age group 65 to 80 with the BBS score between 46-51 were included in this study. The outcome measures used to assess the balance were the Bergs balance scale (BBS) and Performance oriented mobility assessment scale (POMA). The intervention program consisting of low intensity bodyweight training was carried out for 4 days a week for 6 weeks.

**Results:** The results after period of 6 weeks showed statistically significant post scores of BBS and POMA ( $p < 0.05$ ) respectively.

**Conclusion:** Hence the author concluded that low intensity body weight training for a period of as less as 6 weeks can result in improvement of balance in older adults.

**KEY WORDS:** Balance, bodyweight training, low intensity, older adults.

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### BACKGROUND

Aging or senescence is an inevitable progressive deterioration of physiological function with increasing age, demographically characterized by an age-dependent increase in mortality and decline of fecundity [1]. As far as the muscu-

-loskeletal system is concerned, this unfavourable change usually takes the form of loss of the ability to develop force and an increase in stiffness of joints, ligaments and muscles [2]. Also the major consequences with aging are shrinkage of articular cartilage,

vertebral discs, decreased ability to absorb shock, reduced range of motion, stiffer tissues, greater passive tension within tissues with more effort being required to move with loss of end range of motion [3]. The decline of muscle strength is to some extent a reflection of a reduction in muscle mass, and, a reduction in the number of motor units [2]. Little reduction in strength appears until age 40 or 50, with minimal loss (10-20% total) thereafter until age 60-70. Persons in their 70's and 80's experience a more severe loss (30-40%), with that loss being more pronounced in the muscles of the legs than in their hands and arms [4]. According to Baloh et al. young subjects have a higher dynamic balance capacity than ageing subjects. Getting older thus damages dynamic balance abilities. A fall, in ageing subjects is very often due to deterioration of balance and its consequences [5]. Decline in sensory (vision, vestibular and proprioception) and motor (strength, coordination, endurance) function and integration (response time, multi-task ability) have been identified as the major intrinsic factors contributing to falls. Previous research has shown that exercise such as strength, flexibility, balance training, and combinations of these activities delivered in a class situation or individually have increased strength, improved balance and improved functional ability [6].

Diminished balance ability is multifactorial. It can be due to degeneration of visual and vestibular sensory systems, degeneration of proprioception or impairment of central processing or a combination of these factors. Yet, studies have shown that lower extremity strength is a common factor associated with balance impairment in elderly fallers [7] Strength requirements have been reported for stepping and tripping to recover perturbed balance. The speed and organization of muscle force also contributes to balance problems in older age. Studies have proposed that older adults are at increased risk of injury, compared to young adults, due to differences in muscle strengths and speeds of muscle contraction. A reduced capacity for rapid force generation would limit the ability to respond quickly to a loss of balance and increase the risk of falling. Researchers also concluded that older adults, particularly those with a history of

falls, are less successful in their balance recovery following perturbations, compared to young subjects, due to a slower generation of joint moments. Hence suggesting that some of the age-related changes to the balance system may be abated by maintaining a physically active lifestyle [8].

Age-related decline in strength is associated with loss of mobility, functioning and independence. It is clear that resistance training benefits older people by increasing strength and improving some aspects of functioning. Resistance training was defined as an exercise that involves the participant exerting effort against their body weight or external resistance [9]. Studies have shown the use of high and moderate intensity strength training in improving the muscle strength in older adults [10,11]. High/moderate intensity resistance training programs are associated with small, but real, risks of muscle or joint injuries and cardiovascular event; therefore, muscle training methods for elderly subjects need to be safe to perform [12]. As a result, the proportion of elderly people who do strength (resistance) training is currently low (about 10% to 15%) [13].

Low intensity bodyweight training refers to using a relatively light load. It is a collective term, which refers to a practice of muscle training in which the load is increased and decreased extremely slowly [12]. Whereas, bodyweight training is any exercise that involves using the body as a means of resistance to perform work against gravity. Muscles work with the levers created through the bones and joints creating movement[14]. This training method has a positive effect on muscle hypertrophy and demonstrates an enhancing effect on muscle strength, even with load strength equivalent to 50% or less of the maximum muscle strength. However, studies on this method of training conducted on elderly subjects are in their accumulation stage and have predominantly been conducted on healthy elderly subjects, with the use of muscle training machines. Accordingly, a low intensity bodyweight training program that can be easily performed by elderly subjects at home is needed [12].

Therefore, the purpose of the study was aimed at finding the effect of low intensity body weight

training on balance in older adults.

### MATERIALS AND METHODS

The study design was pre-post interventional study. The sampling method used was convenient sampling. Sample size consisted of 60 older adults. The study was carried out in societies and old-age homes in Pune. The low intensity bodyweight training intervention was carried out for a total duration of 6 weeks. Inclusion criteria consisted of older adults aged 65 to 80 years of both the genders. The subjects with Bergs balance scale ranging from score 45-51 were included in the study. The older adults with any orthopaedic condition like recent fractures, acute case of osteoarthritis, lower limb surgeries, total knee replacement, etc. or any neurological involvement like stroke, Parkinsonism, diabetic neuropathy etc. or any cardiovascular condition like – myocardial infarction, angina, uncontrolled blood pressure, etc. were not taken into consideration. Performance oriented mobility assessment (POMA) and Bergs balance scale (BBS) were used as the outcome measures.

**Procedure:** After the approval of the Institutional Ethical Committee, on the basis of inclusion and exclusion criteria, 60 older adults were included in the study. The procedure was then explained to the subjects and their doubts regarding the same were cleared and a written consent was taken from all the subjects before starting the intervention. The intervention was conducted for 4 days a week for a duration of 6 weeks with progression of exercises after the first 3 weeks. Warm up and cool down exercises were given for 5 minutes before and after the session respectively. Blood pressure (BP) readings were recorded before and after the session. Sufficient rest period between the exercises was given and the subjects were instructed to inform if they likely experienced any discomfort during the session. Each exercise was performed for 5 repetitions, for 2 sets for first 3 weeks and then progressed to 10 repetitions, 2 sets for next 3 weeks. After these exercises were done, the subjects were made to do cool down exercises for 5 minutes. The intervention protocol was as follows.

### INTERVENTION

Sr.no	Exercises	Repetitions	Sets
1	Sit to stand	5	2
2	Calf raises	5	2
3	Knee -ups	5	2
4	Partial crunches	5	2
5	Alternating superman	5	2

WEEK 0-3

Sr.no	Exercises	Repetitions	Sets
1	Sit to stand	10	2
2	Calf raises	10	2
3	Knee -ups	10	2
4	Partial crunches	10	2
5	Alternating superman	10	2

WEEK 3-6

### RESULT

**Demographic Data:** Table 1 and figures 1a and 1b reflect that the mean age of subjects in the present study was  $71.22 \pm 4.438$ . Out of 60 subjects who were included in our study, 75% were females whereas 25% were males.

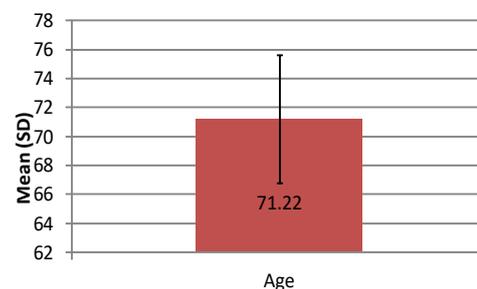
**Bergs balance scale:** Table 2 and figure 2 show statistically improvement in pre and post treatment mean values of BBS scores 47.02 and 50.47 respectively. Statistically significant improvement in pre and post treatment values of BBS scores was found with P value =  $<0.001$ .

**Performance oriented mobility assessment:** improvement in pre and post treatment mean values of POMA scores 20.95 and 24.43 respectively. Statistically significant improvement in pre and post treatment values of POMA scores was found with P value =  $<0.001$ .

**Table 1 (a):** Age and Gender Distribution of Subjects: (N=60).

	Male	15	25
	Female	45	75
<b>Age (Mean <math>\pm</math> SD) years</b>	$71.22 \pm 4.438$		

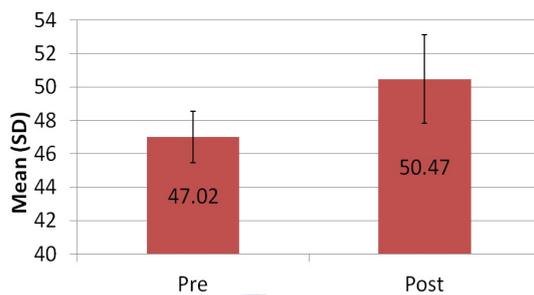
**Fig. 1 (a):** Age Distribution of Subjects: (N=60).



**Table 2(a):** Comparison of the effect of low intensity body weight training on balance using Bergs Balance Scale score in terms of {Mean (SD)} pre and post using paired t test.

	Group	N	Mean	Std. Deviation	t value	P value
Bergs Balance Scale	Pre	60	47.02	1.535	12.758	$<0.001^{**}$
	Post	60	50.47	2.646		

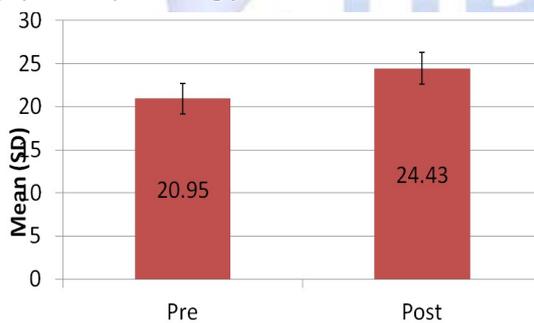
**Figure 2 (b):** Comparison of the effect of low intensity body weight training on balance using Bergs Balance Scale score in terms of {Mean (SD)} pre and post using paired t test.



**Table 3(a):** Comparison of the effect of low intensity body weight training on balance using performance oriented mobility assessment(POMA) in terms of {Mean (SD)} pre and post using paired t test.

	Group	N	Mean	Std. Deviation	t value	P value
Performance Oriented Mobility Assessment	Pre	60	20.95	1.76	17.212	<0.001**
	Post	6	24.43	1.845		

**Fig. 3(b):** Comparison of the effect of low intensity body weight training on balance using performance oriented mobility assessment(POMA) score in terms of {Mean (SD)} pre and post using paired t test.



## DISCUSSION

The purpose of the study was to find the effect of low intensity body weight training on balance in older adults. The study was conducted for a period of 6 weeks in which exercise sessions were given 4 times every week. Bergs balance scale and Performance Oriented mobility assessment scale were the outcome measures used.

Figure 2 demonstrates significantly improved values on Bergs Balance scale post treatment with respect to balance in older adults (pre mean 47.02 and after 6 weeks, post mean 50.47) Hence indicating a significant improvement ( $p < 0.05$ ).

figure 3 demonstrates significantly improved values on Performance Oriented mobility assessment (POMA) post treatment with respect to balance in older adults (pre mean 20.97 and

after 6 weeks of training, post mean 24.43). Hence indicating a significant improvement ( $p < 0.05$ ) in balance ability of older adults.

The primary possibility of improvement in balance in older adults could be improved muscular strength. Murat Karabulut et. al. 2010 mentioned that utilizing lower loads and lower training volumes compared to traditional resistance training resulted in similar changes in lower body skeletal muscle strength as the traditional high-intensity resistance training program. It is well accepted that in training protocols, the initial rapid gain (in first 4 to 8 weeks) in the tension generating capacity of muscles is largely attributed to neural responses and neuromuscular adaptations. Hess et. al 2005 explained these adaptations such as enhanced output from supraspinal centres, altered neural drive that decreases co activation of antagonist muscles and greater activation of synergist muscles, or more effective coupling within the spinal inter neuronal pathways. Sale et. al 1998 asserts that this increased neural activation of prime movers increases motor unit synchronization and enhances activation of fast-twitch motor units, resulting in better muscle coordination and efficiency. Supporting these findings, Karabulut et. al. 2010 published an article which suggested that leg muscle strength improves with the low-load vascular restriction training and the VR-RT20 training protocol was almost as effective as the RT80 training protocol for increasing muscular strength in older men.

D. L. Sturnieks et. al 2008 published a review article highlighting the correlation between balance and strength in older adults. He concluded that the speed and organization of muscle force also contributes to balance problems in older. A reduced capacity for rapid force generation would limit the ability to respond quickly to a loss of balance and thereby increase the risk of falling. In accordance to this study Dr. R. Orr et. Al 2010 also carried out a systematic review on the association of muscle strength and muscle power to balance performance in older adults. Hence we hypothesize that increase in muscle strength could be one of the reasons that lead to improvement in balance impairment.

Another factor responsible for improvement in balance could be the improved proprioception

According to D.L Sturnicks , et. al 2008 this proprioceptive input from the lower limbs is arguably the most important contributor to maintenance of balance. The receptors responsible for detecting joint position include the Pacinian corpuscles and Ruffini end-organs found in the joint capsule and the Golgi tendon organs and muscle spindles found in the muscle. All these receptors are sensitive to changes in tension within the muscle contractions or non contractile tissues. Also, the tactile information, particularly from the soles of the feet, provides additional sensory information on force distribution during weight-bearing activities, to assist in balance control. Plantar tactile sensitivity has been shown to be reduced in older adults and correlated with measures of balance and functional test performance. Proprioception is more accurate during weight bearing due to the increase in receptor activation. Similar study conducted by Fernando Ribeiro et. al 2010 highlighted that deficits in proprioception contribute to balance disorders and the risk of falls in older people.

**Limitations:** Repetitive maximum (RM) was not taken into consideration before starting the intervention program. Screening for the subjects with vestibular and visual impairments was not done in our study. The history of fall was not taken into consideration.

**Recommendations for further research:** Future studies can correlate other parameters like cognitive function , quality of life with balance in elderly subjects. Further studies can include intervention program of low intensity weight training sessions on daily basis. Further studies can also focus on finding out long term effects of low weight training on balance.

## CONCLUSION

In conclusion, the results conclude that low intensity bodyweight training protocol conducted for a period of 6 weeks has been shown to have a positive effect on the balance function in older adults.

**Conflicts of interest: None**

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