

# Effects of Aerobic Exercises and Progressive Resisted Exercises on Bone Density Measurement and Quality of Life in Patients with Osteoporosis

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## Abstract

**Background:** Osteoporosis is a skeletal disorder characterized by compromised bone density that results in an increased susceptibility to fracture. Osteoporosis is a silent disease if not detected early, fractures may occur without warning because of reduced bone strength and increased load on the bone at a given time. **Purpose of the study:** To compare the effectiveness of aerobic exercise and progressive resisted exercise in osteoporotic patients. **Methodology:** A total of 28 osteoporotic male and female individuals were participated who met the inclusion & exclusion criteria and randomly divided into 2 groups where group-A received progressive resistive exercise and group-B received aerobic exercises. Exercise was given 3 days a week for six weeks. Outcome measure was BMD and SF-36 form as pre intervention and post intervention. **Results:** progressive resistive exercise and aerobic exercises both showed significant improvement in BMD & SF-36. **Conclusion:** The conclusion of the study reveals that the aerobic exercises are more effective in comparison with progressive resisted exercise.

**Keywords:** Osteoporosis, Aerobic Exercise, Progressive resistive exercise, BMD

## Introduction

Osteoporosis is a skeletal disorder characterized by compromised bone strength that results in an increased susceptibility to fracture.<sup>7</sup> It is estimated that more than 200 millions people worldwide currently suffered from osteoporosis, and the prevalence is

expected to increase with the increasing lifespan and aging process.<sup>3</sup> In the United States alone, an estimated 44 million individuals (55% of the population older than 50 years) have low bone mass or osteoporosis. This number is predicted to increase to 61.4 million by the year

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2020. Because osteoporosis is seen mainly as a disease that affects women, men often go undiagnosed and untreated, yet men are increasingly at risk for osteoporotic fractures<sup>15</sup>. The clinical relevance of osteoporosis is the dramatic increase in risk of fracture. More than 1.5 million fractures are associated with osteoporosis each year. Osteoporotic fractures are low-trauma fractures that occur with forces generated by a fall from a standing height or lower and are most common at the spine, hip, and wrist<sup>18</sup>. It is estimated that one in two women and one in four men older than 50 years of age will suffer from an osteoporotic related fracture in their lifetime.<sup>5</sup> Osteoporosis is a silent disease if not detected early, fractures may occur without warning because of reduced bone strength and increased load on the bone at a given time. Therefore, much attention is focused on early prevention, detection, and treatment of osteoporosis.<sup>15</sup>

Women entering menopause face many challenges regarding their bone health, especially those with a history of or current inactivity. Therefore, engaging the elderly in exercise programs is necessary to maintain BMD and increase the quality of life. Most of resistance exercises have shown a positive effect on increasing or maintaining BMD in postmenopausal women<sup>21</sup>.

The use of progressive resistance exercise for the restoration of muscle power and volume after injury was first described by Delorme in 1945 although

this method of promoting muscular development had been well known and used by professional muscle builders for a very long time.<sup>14</sup>

On the other hand simple aerobics exercise like walking, jogging, and running could provide an important role in maintaining and or increasing bone density in women. Although regular aerobic exercises may improve bone status and or maintain bone preventing fractures, relatively vigorous aerobics, weight bearing or strength training regimens are even more effective<sup>13</sup>.

All the above studies implies that progressive resisted exercises are helpful in improving BMD in osteoporosis and in addition aerobic conditioning is also helpful in osteoporosis so it is a need to find out the better treatment measure between progressive resisted exercise and aerobic exercises to improve BMD in patients with osteoporosis.

To compare the effectiveness of aerobic exercise and progressive resisted exercise in osteoporotic patients. Functional performance will improve effectively after aerobic exercise in comparison with progressive resisted exercise in osteoporotic patients.

## **Methods**

Twenty eight osteoporotic male and female individuals were participated in this study from Dolphin (PG) institute of medical and natural sciences. All the subjects had age related osteoporosis. (T score -2.5) and without any cardiac

problem like myocardial ischemia, chronic heart failure respiratory problem like severe pulmonary hypertension. *Study was performed in accordance with ethical consideration of the institute and their consent was taken prior to study.* All the participants were divided into two groups using random assignment where in Group A was given PRE exercise with vinyl ball with straps and Group B was given aerobic exercise on treadmill. The study was a six week study with 3 days in a week. Data was collected before and after intervention.

**Outcome measure:** bone density was measured by Bone densitometer and quality of life is measured by SF-36 scale

**Progressive Resistive Exercises:** In this group specific positioning of the ball and straps was made to create the isometric resistance to accommodate the neck flexor & extensor, elbow flexor & extensor, hip flexors, extensors, abductors and adductors and the ankle Planter flexor & Dorsiflexor. Prior to resisted exercises participant did a 5 min walk and stretch as warm up and a similar cool down was performed after the exercise session. Each exercise was performed twice at the maximum comfortable resistance against either the strap or the ball. The duration of each exercise was 5sec with the patient exhaling and counting out loud “push 1, push 2, push 3, push 4, and push 5” to minimize the valsalva effects while forcefully contracting the exercised muscle. A 1 min rest was given following each exercise including the positioning

of the patient and exercise ball for the subsequent exercise. Each day, 5 of 10 exercises were performed, with the remaining 5 exercises will be performed on the alternate days.<sup>22</sup> Neck flexor & extensor subjects was positioned in Standing and neutral vinyl ball was positioned in the forehead region. Patient was instructed to hold the vinyl ball against his/her forehead and asked to flex/extend the neck with maximal resistance and hold for 5 seconds. Elbow flexors & extensor: all the subjects were positioned in Sitting and vinyl ball was placed at the anterior aspect of forearm for flexion and posterior aspect of forearm for extension. Patient was instructed to press the vinyl ball and asked to hold for 5 seconds. Hip flexors: all the subjects were positioned in Sitting and the patient was instructed to place the vinyl ball on the anterior aspect of the thigh with the help of his or her both hand and press the vinyl ball against his or her thigh at the same time patient was instructed to flex the hip and hold for 5 seconds. Hip extensors: all the patient was positioned in standing and the vinyl ball was in the posterior aspect of the thigh. The patient was instructed to hold the vinyl ball against his or her posterior aspect of thigh with the straps of ball in front of thigh holding with his hand and extend the hip and hold for 5 seconds. Hip abductor: patients was positioned in sitting and both the hands behind the neck. The Patient was instructed to place the vinyl ball between the legs and wall and asked to press the ball in such a way that it bring his or her one leg outward

and hold for 5 seconds and other leg remained in constant position. Hip adductor: The patient was positioned same as for hip abductors and vinyl ball was placed between the knees and the patient was instructed to press the ball inwards with both the knees simultaneously and hold for 5 seconds. Ankle planter flexors : Position of the patient was long sitting position and the foot was facing towards the wall and patient was instructed to place the vinyl ball between the sole and the wall and press the vinyl ball against wall and hold for 5 seconds.

**Ankle dorsiflexors:** The patient was positioned in long sitting position and facing towards the wall. The Patient was instructed to place the vinyl ball between the dorsum of the foot and hand and press the vinyl ball by his or her right hand and try to dorsiflex the right ankle and hold for 5 seconds.

**Aerobic Exercise:** In this group exercises were divided into 3 components Warm up, Aerobic exercise, Cool down period. The warm up was gradual without causing fatigue or reducing energy stores and a 5-10 min of warm up session of stretching was given. After completion of warm up period of 5-10 min submaximal aerobic exercise program was given on treadmill. 4 sets of exercise were done by the patients with the rest interval of 1 minute. The total time duration of each set was 4 minute with a rest interval of 1 minute. After completion of aerobic exercise 5-10 min cool down session

with stretching were given to the patient. All the above exercises were repeated 3 days in a week and for a total of 6 weeks.

### **Data Analysis**

SPSS version 11.5 was used for data analysis. Paired t test was done for analyses the within the group (A and B) data. Independent t test was done to compare between the groups. The statistical significance was set at 0.05 at 95 % confidence level.

### **Results**

Within Group analysis of SF-36 using paired sample t-test was showed significant difference from Pre-intervention reading to Post-intervention reading, in both Group-A and Group B ( $p=0.001$ ). Similarly same test was done to compare the data for BMD within the group showed significant difference in both Within Group A and Group B

Independent t-test was done to compare effect of exercises for SF-36 and BMD between the Groups and showed no significant difference on pre and post intervention ( $p=0.106$ ), ( $p=0.267$ ) respectively.

### **Discussion**

Osteoporosis is a skeletal disorder characterized by compromised bone strength that results in an increased susceptibility to fracture. Because osteoporosis is seen mainly as a disease that affects women, men often go undiagnosed and untreated, yet men are

increasingly at risk for osteoporotic fractures. The clinical relevance of osteoporosis is the dramatic increase in risk of fracture. Therefore, much attention is focused on early prevention, detection, and treatment of osteoporosis. So the purpose of the present study was to compare the effects of aerobic exercise and progressive resisted exercise in osteoporotic patients. The results of the study indicated that there was more improvement of bone density in aerobic exercise when compared to isometric exercises (mean were compared between the groups) and found statistically significant for BMD. The study by Sievanen H *et al.*<sup>20</sup> supports our study. The reason behind this can be reduction in weight and increase in VO<sub>2</sub> max which is not possible by isometric exercises. Supporting our study by Natalie E. Silverman reported that aerobic training is associated with either maintenance or improvement of BMD in postmenopausal women, whereas weight loss diets are often associated with a decrease in BMD. Moreover, weight loss that occurs during an exercise treatment is associated with either the prevention of loss or an improvement in BMD the heterogeneity of the participant in this small sample size can be responsible for the lack of significance statistically<sup>21</sup>.

The results in our study showed that aerobic was more effective than PRE in improving quality of life in osteoporotic patients. The probable reason can be that generalized physical activity induces a mechanical load on bone tissues and to

withstand the rigor of various functional activities, bone tissue rapidly accommodates changes in its micro-environment. Supporting our study Pei-Yang depicted that high intensity training in contrast to traditional pharmacological and nutritional approaches for improving bone density<sup>13</sup>.

These findings support previous literature about the role of aerobic exercises in improving quality of life and BMD in osteoporotic patients. The findings also show that all the patients showed improvement in the BMD, irrespective of their values prior to treatment. There was an improvement in quality of life of all the patients.

Limitations of our study was the lack of follow up for long term that the persistent effect of the improvement and further changes in bone loss was not revealed and the sample size is relatively small for short duration of study period.

Future Research can be done on Follow up and long term effect of training on bone loss and changes in these parameter following withdrawal from the training program can be done and a larger training period that training intensity be adjusted to make a more definite conclusion.

### **Conclusion**

The conclusion of the study reveals that the aerobic exercises are more effective in comparison with progressive resisted exercise.

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