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ORIGINAL ARTICLE

EFFECTIVENESS OF PROGRESSIVE RESISTED EXERCISES AMONG WOMEN ON BONE MINERAL DENSITY

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ABSTRACT

Background of the study: Osteoporosis is reduced density of bone due to vitamin D deficiency, which can be prone for bone fracture. Bone mineral density (BMD) has to be checked routinely to screen out its deficiency. Osteoporotic fractures in India occur commonly in both sexes, and many occur at a younger age. Objectives of the study are to find the status of BMD among women using calcaneal ultrasound bone densitometer (QUS) and the effect of progressive resisted exercises (PRE) on BMD. **Methodology:** It is an Experimental study, the study was conducted among women, of "Bone Mineral Density Free Camp" organized at the ACS Medical College and hospital, Chennai. A total of 270 subjects (women) were screened by using Calcaneal Ultrasound Heel bone densitometer (QUS), out of which 66 subjects were detected with Osteoporosis. They were randomly assigned into Group A (Calcium supplements +Progressive Resistance Exercises) and Group B (Calcium supplements) by Randomized Control Trial (RCT) method. The duration of this study was three months. **Results:** The study has reported there is a significant difference after post test t-score measurements between group A and group B. The mean of Group A was higher than that of Group B. **Conclusion:** This study has recommended doing resistance exercises to prevent growing Osteoporosis among women. Calcaneal Ultrasound measurement could be a useful tool to asses BMD.

Keywords: Osteoporosis, Bone mineral density, Progressive resisted exercises, Calcaneal Quantitative Ultrasound Densitometer.

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INTRODUCTION

Osteoporosis is a foremost cause of bone related health issues, which can lead to skeletal abnormalities including morbidity and socio economic troubles¹. By 5th decades of life it is reported as most women are affected with osteoporosis. Early detection and treatment with adequate supplement is important to avoid complication of low bone mineral density^{2,3}.

Currently the most widely used tool is Dual energy X-ray absorptiometry, which can measure density of skeleton both appendicular and axial, but portable ultrasound is most cost effective. It can measure the bone density more accurately with more cost effective and radiation free screening test^{4,5}.

Quantitative Ultrasound (QUS) is the commonest device used to measure bone density. Bone density measurement sites include vertebra, hip, forearm and calcanium. QUS can rule out osteopenia of bone at any age of population^{6,7}.

Lack of exercises has been found to significantly associate with lower BMD in Indian women. Hormonal therapy is assumed to be helpful to prevent loss of bone density, which can leads to osteoporosis. Different exercise program has proved effect on bone absorption and prevent osteopenia. Best exercise program to prevent osteoporosis need to be developed. Adequate levels of estrogen, calcium intake, and vitamin D are essential along with exercise program to get best effect on prevention of osteoporosis^{8,9,10}.

Objectives of the study were to find out the status of BMD among women using calcaneal ultrasound bone densitometer (QUS) and to

find the effect of progressive resisted exercises (PRE) on the level of BMD.

METHODOLOGY

This is a comparative experimental study conducted by a camp based approach to screen out bone mineral deficiency. Free health check-up camps were organized in ACS Medical College and hospital, Velappanchavadi, Chennai. Total 66 patients were participated in this study. The study was conducted for 3 months. Each week consist of 2 sessions per week.

Inclusion Criteria of the study were female subjects with age of above 35 years, subjects with osteoporosis. Exclusion Criteria were Systemic disease like renal disease and hepatic disorders, Rheumatoid arthritis, Endocrine disorders, Chronic medications of steroid and hormonal drugs, Impaired skin sensation, Any malignancy / infections, Metal implants, Poor hysterectomy and Known osteoporosis under treatment.

Materials used were treatment couch, towel, Chair, Stop watch, Sand bags and Assessment sheet. Outcome measured was bone mineral density by Quantitative Calcaneal Ultrasound (QUS) Bone densitometer.

Method: Based on the selection criteria 66 patients were randomly selected. Group A(n=33) Progressive Resisted Exercises for 30-45mins per session of twice per week for 3 months and Calcium Citrate supplements twice a day (800mg). Group B (n=33) Calcium Citrate supplements twice a day alone (800 mg).

Procedure: The subjects were selected based on inclusion and exclusion criteria. All the

patients underwent pre-test assessment for Calcaneal Ultrasound on BMD. They were randomly assigned into two groups (Group A Progressive resisted exercises and calcium supplements) & (Group B calcium supplements only). Written informed consent was taken.

Menstrual history, systemic illness, height and weight were checked before measure the bone mineral density. BMD was measured in Calcaneus (heel bone) ultrasound bone densitometer. QUS device used to measure BMD values in term of specific T-score criteria. T-score of -1.0 or higher considered as normal and Osteopenia is defined when the score is between 1.0 and 2.5, Osteoporosis is defined as 2.5 or more.

Group-A

Exercises interventions:

Progressive resisted exercises and calcium supplements: Exercise protocol (Lora M,

Giangregorio et al): Week-1 (elimination of gravity), Hip Extension 3X8 AT 10 % , Knee Extension 3X8 AT 10 %, Back Extension 3X8 AT 10%, 1RM, Abdominal Flexion 3X8 AT 10%, all exercise at 1RM, for week- 2 to 6 weeks 2 sets of 8-10 Repetitions At 1RM (against gravity).

Sit to stand or Squat, Wall Squat Combine with Lateral Pull, Squats to touch chairs- arms folded, Squat without touching chair, Standing Hip, extension and abduction 10 repetitions, progress to abduction. Perform these exercises and add resistance progress by sand bag. Lunge 1 walking lunge; alternating legs, week-8 to 12 weeks (resistance against gravity), and the progression will be 15 repetitions at 60 to 80 % of 1RM.

Data analysis: The data were collected and analysed using both descriptive and inferential statistics .

#BMD	#Group A		#Group B		t-test	df	Significance
	Mean	S.D	Mean	S.D			
Pre test	-2.73	.137	-2.72	.095	-.260	64	.796*
Post test	-2.38	.315	-2.55	.105	2.94	64	.005**

#GROUP A – Progressive resisted exercise and calcium supplement, # Group B – calcium supplements alone (*- P > 0.05), (**- P ≤ 0.05)

Table -1 Comparison of bone mass density (BMD) test between group -A and group -B in pre and post test

This table shows that there is no significant difference in pre-test values of the BMD

between Group A & Group B and statistically significant difference in post-test values of the BMD between Group A & Group B

#BMD	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	-2.73	.137	-2.38	.315	-8.54	.000***
GROUP- B	-2.72	.095	-2.55	.105	-12.72	.000***

#Group A – progressive resisted exercise and calcium supplement, # Group B – calcium supplements alone (***- $p \leq 0.001$)

Table 2: Comparison of bone mass density (BMD) test values within Group-A & Group-B between pre & post test values

Based on the BMD values, it shows that there is a statistically significant difference between the pre- test and post -test values within Group-A and Group-B.

RESULTS

On comparing the mean values of Group A & Group B on Bone Mass Density (BMD) test values, it shows significant increase in the post test mean values but (Group A- Progressive Resistance exercises and Calcium supplement) shows (-2.38) which has the higher mean value is effective than (Group B-Calcium Supplement alone) (-2.55) at $P \leq 0.05$. Hence Null Hypothesis is rejected.

On comparing Pretest and Posttest within Group A & Group B on Bone Mass Density (BMD) Test Values shows significant difference in Mean values at $P \leq 0.001$

DISCUSSION

This present study was based on camp conducted in ACS medical college and hospital, Chennai. The aim of the study was to evaluate

bone mineral density. The study reported the role of progressive resistance exercises in association with BMD. Women of 5th decade found more vulnerable for osteoporosis and bone fracture, so need to take more measures to prevent disability.

Osteoporotic changes are common among aged women than men. This has been reported as the mineral bone density is decrease with increase of age. Above 50 year are shown more prone for osteoporosis over 36.4% of women population. Fewer symptoms in early stage make the people to be less aware about low bone mineral density. Later stage with bone fracture leads the patients to measure bone density, by the time they would have developed osteoporosis. As BMD screening is not done routinely turns up the patients with fractures^{11, 12}.

Bone osteoblastic activity suppresses in both elderly male and female, it is common in women with aging. Estrogen withdrawal in aged people suppresses osteoblastic activity and enhances osteoclastic activity. Low BMD increases with age in both the sexes, so

prevention of deficiency in BMD is essential to avoid complications. Timely intervention with proper nutrition and exercise can improve bone density and can prevent the progression of the condition^{13, 14, 15}.

In addition Progressive resistance exercises are found to be more effective in recent researches. Hence, for the women to be normal, she must be enrolled in effective exercises, adequate calcium intake along with their routine physical activities, despite the availability of gym with efficient friendly atmosphere for women is rarely found in India. To overcome these difficulties and to enroll women in exercise session and to educate them, home based Progressive resistance exercise protocols are intervened^{16, 17, 18}.

Ethical Clearance: Ethical clearance has obtained from Faculty of Physiotherapy, DR.MGR. Educational and Research Institute, Chennai to conduct this study with reference number: IV B-051/ PHSIO/IRB/2017-18 dated 08/01/2018.

Conflict of interest: The author reported no conflict of interest to conduct and publish this article.

Funding: The researchers had self financial support to conduct this research.

CONCLUSION

The present study demonstrates that there is positive significant relation between Bone Mineral Density and Progressive Resistance Exercises among women. Hence, Progressive Resistance Exercises is an important determinate factor of Bone Mineral Density among women. Thus, more sensitive methods

are recommended at this stage for formulating policy regarding preventive interventions. Through this study, we concluded that risk of Osteoporosis among women should be targeted for Resistance exercises to prevent growing increase of the condition and its complications.

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