

The effect of an 8-month exercise program on bone density and some physical characteristics in sedentary women

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Abstract

The aim of the study was to determine and evaluate the effect of an 8-month step-aerobic and run-walk exercise on bone density and some physical characteristics as weight, total fat mass, total fat percentile and lean mass at sedentary females. 14 sedentary females with mean age 37.4 voluntarily participated in the study. Subjects performed an exercise program lasted an hour three days a week for eight months. Exercise program consisted of 45/50- minute step-aerobic one day a week; 30- minute run/walk and 30- minute stretching two days a week. Total bone mineral density (BMD), total bone mineral content (BMC), T score, Z score, Total lean mass, total fat mass and total fat percentile values were diagnosed by dual X-ray absorptiometry (DXA) (Norland XR-46). Wilcoxon signed rank test was used for data evaluation and significance level alpha was set at 0.05. After the eight -month exercise program, it was found out that there was significant decrease in weight, BMI, and total fat mass ($p<0.05$). But the decreases in total fat percentile and lean mass were statically insignificant. Nevertheless the increasing in total BMD, T-score and Z-score were statically significant ($p<0.05$), while the decreases in total BMC value were statically insignificant. In conclusion the eight-month step-aerobic, run-walk and stretching exercises positively affected some anthropometric components as weight, BMI, and total fat mass. However the program didn't affect bone mineral content in a positive way. But the program provides a preventive effect on bone density. It is suggested that preparation of exercise programs with similar purpose should include resistance exercise forms as well.

Keywords: Bone density; exercise; sedentary females.

INTRODUCTION

So many researchers indicated the positive effect of exercise on general health (11,27). Moreover a lot of studies demonstrate exercise and physical activity positively effects bone mineral density (BMD) and body composition (32). Physical exercise can reduce clinical fracture incidence in postmenopausal women (24), though dedicated exercise protocols can positively affect fall risk (15), fall impact (16,36), and bone strength (29). Sedentary life style and some other factors as immobility and some diseases, affect negatively both BMD and body composition such as weight and fat percentile.

Osteoporosis is a condition related to ageing, and acute episodes of pain associated with osteoporosis can lead to periods of restricted mobility and cardiopulmonary dysfunction in the elderly (6). Osteoporosis is a silent progressive systemic disease characterized by low bone mass

and deterioration of bone tissue leading to bone fragility (10). Osteoporosis is a skeletal condition and is a primary cause for poor quality of life and increased medical expenses in those affected with this condition (2). The dramatic increase in osteoporosis over the last few decades may be explained by increasingly sedentary lifestyle. People who are less physically active during life are presumably to develop osteoporosis (23,24,26)

Physical activity throughout adulthood helps maintain bone density. Regular exercise decreases the rate of bone loses (21). Systemic physical activity also increases bone density and mass. The major factors for changes in the bone tissue are exercise intensity and load bearing. Increased bone density with high intensity exercise or increased load bearing is based on increases in calcium and hydroxyproline concentration in bones (35). It is difficult to determine precisely how much bone density is increased by physical activity; it is

known, however, that these gains are lost when physical activity is discontinued (22).

Lots of study demonstrated that exercise increased BMD and decreased body mass index (BMI) and fat percentile especially post-menopausal women. But it wasn't well documented combined step-aerobic and run and walk exercise program on body composition and BMD in premenopausal sedentary women. We aimed of the study to determine and evaluate the effect of eight-mount step-aerobic and run and walk exercises on bone density and some physical characteristics as weight, total fat mass, total fat percentile and lean mass at sedentary premenopausal woman.

METHODS & METHOD

Subjects

Initially 18 sedentary premenopausal women were included in the study, but 4 participants excluded from the study because of some personal reason. Totally 14 females with mean age 37.4 years voluntarily participated in the study. The study including criteria was healthy, non smokers, don't use any regular drugs and premenopausal women, Subjects performed an exercise program lasted an hour three days a week for eight months.

Exercise program

Exercise program consisted of 45/50- minute step aerobic one day a week; 30- minute run/walk and 30- minute stretching two days a week.

Data Collections

Total bone mineral density (BMD), total bone mineral content (BMC), T score, Z score, Total lean

mass, total fat mass and total fat percentile values were diagnosed by dual X-ray absorptiometry (DXA) Norland XR-46. The whole body DXA exams were acquired according to the procedures recommended by the manufacturer. All subjects changed into paper gowns and were asked to remove all jewelry and other personal effects that could interfere with the DXA result.

Statistical Analyses

The collecting data were evaluated SPSS program. Wilcoxon signed rank test was used for the comparison before and after exercise program values. Significance level alpha was set at 0.05.

RESULTS

After the exercise program, it was found out that there was significant decrease in weight ($p < 0.01$). BMI and total fat mass ($p < 0.05$) but the decreases in total fat percentile and total lean mass were not statically significant. Nevertheless, the increases in total BMD, T-score and Z-score were statically significant ($p < 0.05$), while the decreases in total BMC value were statically insignificant.

DISCUSSION

Aging period is prominent by the decreasing physiological and functional capabilities. This decline in function result the loss of muscular strength and related impaired functional mobility (7) and the loss of muscle strength and capability with aging leads to muscular dysfunction (3). Sedentary life style or lack of physical activity is one of the leading causes of preventable death worldwide (28). A sedentary lifestyle and lack of physical activity can contribute to risk factor. Fatness and osteoporosis is some of these factors.

Table 1. Comparison of anthropometric values before and after the exercise program.

Variables		Mean \pm SD	Z value	p
Weight (kg)	Before Exercise Program	70.85 \pm 11.50	-2.637	0.008**
	After Exercise Program	67.78 \pm 11.82		
BMI	Before Exercise Program	27.27 \pm 3.88	-2.341	0.019*
	After Exercise Program	26.08 \pm 4.61		
Total Fat (%)	Before Exercise Program	33.64 \pm 4.14	-1.265	0.206
	After Exercise Program	32.10 \pm 4.21		
Total Fat Mass (gr)	Before Exercise Program	24470.92 \pm 6578.62	-2.01	0.047*
	After Exercise Program	23020.42 \pm 6562.69		
Total Lean Mass (gr)	Before Exercise Program	44824.00 \pm 6264.73	-1.287	0.198
	After Exercise Program	44332.42 \pm 5715.59		

Table 2. Comparison of Bone Mineral values before and after the exercise program

Variables		Mean ±SD	Z value	p
Total BMD (g/cm ²)	Before Exercise Program	1.04±0.085	-2.281	0.023*
	After Exercise Program	1.07±0.086		
Total BMC (gr)	Before Exercise Program	2688.64±270.07	-0.220	0.826
	After Exercise Program	2690.64±279.30		
T score	Before Exercise Program	0.37±0.85	-2.198	0.028*
	After Exercise Program	0.59±0.08		
Z score	Before Exercise Program	1.18±.98	-2.292	0.022*
	After Exercise Program	1.41±.94		

*p<0.05 **p<0.01

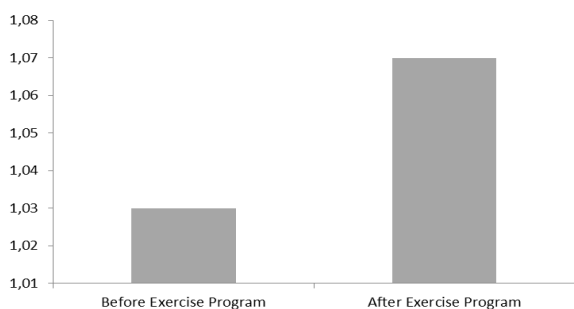


Figure 1. Total BMD (g/cm²).

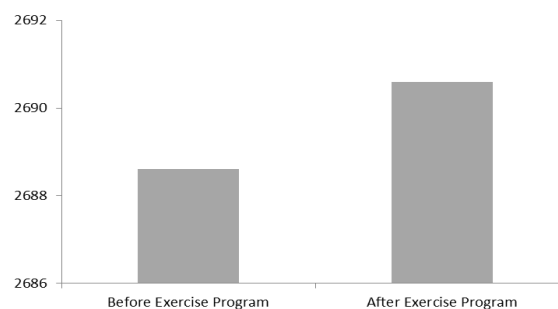


Figure 2. Total BMC (gr).

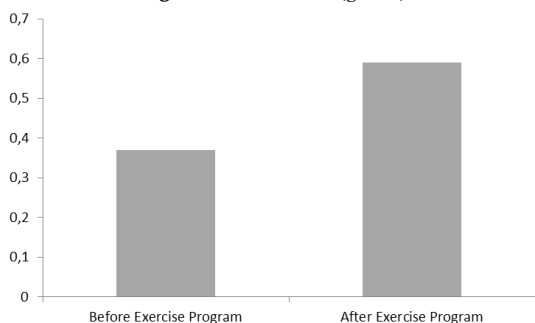


Figure 3. T score.

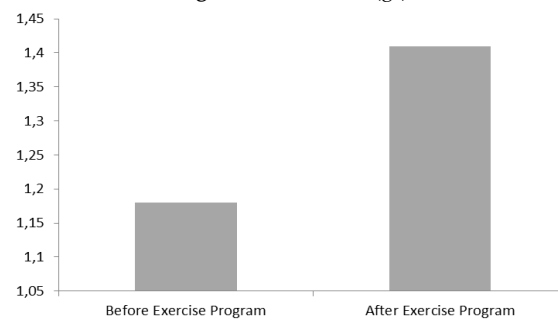


Figure 4. Z score.

Exercise has been recommended strongly by researchers for prevention of such disorders (14) and exercise can result in optimal improvement in body composition (19). In the literature different type of exercises recommended that different purpose. For instance aerobic exercise the more effective than resistance exercise on cardiopulmonary disorder (12). Conversely resistance exercises advised for bone and muscle fitness (4,10,18). In the study was applied combined with step-aerobic, stretching and run-walk exercise and examined it effect on body composition and bone structures.

Body fat percentile, BMI, weight and total fat mass provides important information about body composition and fatness. At the sometime total BMD, total BMC T-score and Z- sore provide

information about bone structure. Thus we determined these variables in this study.

Researchers used a manufacturer-supplied reference dataset of healthy young adult female BMD values and identified a Z-score (a score expressed in standard deviation units from a given mean of age-matched controls) <-2.0 as an equivalent of osteoporosis (13).

In this study the firs remarkable findings are significantly decrease (p<0.05) of weight and BMI after the combined exercise program. However total fat percentile changes were insignificant the decreases of the total fat mass was statically significant after the program. The decrease of total lean mass wasn't remarkable. In the study provided that combined exercise program positively affected some body component. There

have a lots of study indicated that favorable effect of exercise on body fat mass, weight and BMI (1,17,25).

After the combined exercise program total BMC values changes wasn't significant. But the increases of the total BMD, T score and Z score after the exercise was statically significant. Deng (10) reported that the 12 months combined with strengthening, aerobics and yoga exercise program reduced the rate of bone loss. Movaseghi & Sadeghi (30) reported that moderate multi-component exercise training positively effect on bone mineral density and bone mineral content in a female subject with osteoporosis. And they underline positive effects; regular and lifelong exercise training must be incorporated into peoples' life due to the chronic nature of bone loss in aging process. Another study reported that the above 12-week program improved fitness and bone density in HIV-infected treated subjects (5). Nambi (31) suggested that strength training program helps to increase bone mineral density in post-menopausal women with type 1 osteoporosis. Tartibian & Saei (34) suggested that adequate weight-bearing exercise was essential to build peek bone mass and reduce the risk of later fracture. Most previous intervention studies have suggested that regular exercise or physical activity might increase bone mass (8,20,23,24). Strain as a stimulus bone adaptation. Forces from muscle contraction and impact loading provoke compression, tension and torsion. The primary stimulus for bone activation is strain magnitude and degree of distortion. Activity such as gymnastic, bearing weight, rapid acceleration and involve strong muscle contraction most effectively bone mass (35).

Pre-menopausal osteoporosis is not uncommon. But the protection and enhancement of bone mineral density and content of premenopausal stage is important in terms of the healthier postmenopausal stage. Thus, when preparing an exercise program for women must be take into account bone health.

In conclusion the eight-month step-aerobic, run-walk and stretching exercises positively affected some anthropometric components as weight, BMI, and total fat mass. However the program didn't affect bone mineral contend in a positive way. But the program provides a preventive effect on bone density. It is suggested that preparation of exercise programs with similar

purpose should include resistance exercise forms as well.

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