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# The Effects of Aerobic Dance Exercise on Body Composition Changes Associated with Weight Change in Sedentary Women

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**ABSTRACT**

The purpose of this study was to assess the effects of aerobic dance exercise on body composition in sedentary overweight women. In this study, Total 55 adult sedentary women participated as volunteers. The age, height and weight averages of the subjects exercise and control group were respectively 35,10±9,12 years, 1,60±5,22 m and 68,55±6,73 kg (n=29) and 30,27±10,85 years, 1,59±5,53 cm and 61,25±8,38 kg (n=26). Body composition (via skinfolds caliper), waist hip ratio, waist circumference were measured and body fat percentage, Basal Metabolic Rate and Lean Body Mass were calculated at sedentary women. The measurements were taken twice as before and after aerobic-dance exercise being applied an 8-week series of one hour exercise three days per week. The control group did not participate in any physical activity during the six-week period. There were significant differences between pretest and posttest for weight, body mass index, waist circumference, waist hip ratio, metabolic and body composition parameters in exercise group ($p<0,05$). Besides there were significantly decreased body weight, Lean Body Mass, Basal Metabolic Rate and fat percentage ($p<0,05$). Furthermore, there were not significant differences between pretest and posttest for waist circumference, waist hip ratio, body composition parameters, Lean Body Mass, Basal Metabolic Rate, body weight and body fat percentage in control group($p>0,05$). As a result, it can be say that aerobic dance exercise at a moderate intensity and duration can improve physical fitness and can decrease body fat percentage, Lean Body Mass and Basal Metabolic Rate during weight loss.

**Key Words:** Aerobic-dance, exercise, body composition, weight loss

## INTRODUCTION

Sedentary lifestyle is threatening the health of every individual in every moment of life. In middle-aged and elderly people such lifestyle, encourages or increases the risk of obesity, muscle weakness, postural deficiencies, diabetes, hypertension and coronary heart disease. Thus, obesity is one of the main problems of sedentary lifestyle and requires intervention and treatment for it (26).

A regular physical activity causes important changes that it shows in the increase of health related fitness and in the decrease of the risk factors in many of developing medical conditions in inactive people (18).

There is mentioned that aerobic exercises are useful for both sedentary individuals and cardiac patients and research says that simple regular activity can be beneficial to health which is equivalent to a daily 20 minutes brisk walk (6). Besides, it stated that exercise develops of body composition, muscle strength; reduces of falls, diabetes and risk of coronary artery disease, joint pain, depression; increases of quality of life and extends life time by the (7).

The numbers of other studies have reported that measurement of waist circumference alone is used as a marker of abdominal fat distribution and health deterioration. There is recommended that Waist circumference should not exceed 88 cm for women. Waist/hip ratio is one of the important methods to identify obesity-related risk. Waist/hip ratio is >0.80 that it increases to be negatively affecting of the risk health (10).

The effect of aerobic exercises on body composition is investigated in many researches. Especially it is seen that in a regular and controlled exercise reduces of body fat and increases lean body weight which reported the number of studies increased day by day.

Banfi et al. (2) have reported that aerobic dance has demonstrated cardiovascular and metabolic benefits such as increased maximal oxygen consumption when it performed within a target heart rate of between 50 and 80% of the maximal heart rate (MHR) like of other forms of aerobic exercise.

Additionally, they have reported that physical activity is part of a comprehensive treatment of weight loss and weight control program. Because it

can contribute to that may increases cardio respiratory fitness, may decrease abdominal fat and may help with maintenance of weight loss in overweight and obese adults (23). Step aerobics-dance exercises have become gradually popular in fitness and weight loss programs (17).

Thus, The purpose of this study was to assess the effects of aerobic dance exercise being applied a 8-week series of one hour exercise three days per week on loss weight, body fat percentage and body composition parameters.

## MATERIAL AND METHODS

This study was undertaken on 55 healths sedentary overweight women participated as volunteers from Elite Sports Center in Konya in Turkey. The women were randomly divided into experimental and control groups. The age and height averages of the subjects of female experimental and control group were respectively 35,10±9,12 years for age, 1,60±5,22 m. for height (n=29) and 30,27±10,85 years for age, 1,59±5,53 m. for height (n=26).

All study procedures were approved by the Ethics Committee at the Faculty of Selcuklu Medical Sciences, Seljuk University in Konya in Turkey. Individuals were informed about study and written informed consent was obtained by all participants. The measurements were taken twice as before and after aerobic-dance exercise program being applied an 8-week series of one hour aerobic-dance exercise program three days per week. The control group did not participate in any activity aerobic-dance exercise program during the eight-week period.

Height was measured to the nearest 0.1 cm on a stadiometer with the participants shoeless. Body weight was measured to the nearest 0.1 kg using a pre-calibrated tanita electronic scale.

### Anthropometric Variables

Height was measured to the nearest 0.1 cm on a stadiometer with the participants shoeless. Body weight was measured to the nearest 0.1 kg using a pre-calibrated tanita electronic scale.

### Body composition

Body Mass Index (BMI) was calculated as weight in kilograms divided by the square of the height in meters. The BMI was then categorized according to the recommendations of the World Health Organization: below-normal weight (<18.5 kg/m$^2$), normal weight (18.5–24.9 kg/m$^2$), overweight (25.0–29.9 kg/m$^2$), and obesity (30.0–39.9 kg /m$^2$), and extreme obesity (40 kg/m$^2$)(25).

While the subjects were minimally respiration, waist circumference was measured from the nearest 0.1 cm at the iliac crest (15).When viewed from the side, hip circumference was evaluated at the level of maximum extension of the thigh and Waist Hip Ratio (WHR) was calculated as Waist Circumference (WC) (cm)/ Hip Circumference (HC) (cm).

Skinfold thickness was defined that a total of four skinfolds measured by using the Holtain skinfold calliper. Skinfolds involved that biceps (anterior surface of the biceps midway between the anterior auxiliary fold and the antecubital fossa), triceps (vertical fold on the posterior midline of the upper arm, halfway between the acromion and olecranon process), subscapular (fold on the diagonal line coming from the vertebral border to between 1 and 2 cm from the inferior angle of the scapulae) and suprailiac (diagonal fold above the iliac crest even with the anterior auxiliary line). Basal Metabolic Rate (BMR) and Lean Body Mass (LBM) were calculated at sedentary women.

### Aerobic-Dance Exercise Program

The study group in the aerobic-dance class were exercised thrice weekly for 8 weeks by an aerobic instructor targeting for a heart rate of 60-70% of maximal heart rate for the age. The intensity of aerobic-dance exercise program was determined by the Carvonen Method (8) and each exercise was performed according to target heart rate for each subject and heart rate was kept under control with the polar device. The exercise program consisted of aerobic-dance activities and other exercises accompanied by music. The exercise intervention was not limited with any nutrition restriction or modification. Aerobic dance is based on walking and step variations, knee bends, lunges (low impact aerobics), running, skipping and hopping (high impact) and their combination (low-high impact); this exercise was accompanied by the controlled movement of the arms. It was possible to perform a maximum of 24 training units in two months. Each training unit lasted for 60 minutes and consisted of 1) warming up and stretching, 2) aerobic part, 3) cool down and stretching. The initial and main part lasted for 40–45 minutes; warming up-stretching and cool down-stretching took 15 minutes. At the same time, the choreographed exercise program consisted of stretching exercises, walking exercises and progressive aerobic-dance movements. It was performed with music, and required the continuous use of extended arm movements and the involvement of major muscle groups. While the intensity of aerobic-dance exercise program was 65 % at the beginning, it was gradually increased to 85 % at the end of eighth week (20,11, 13). The control group did not participate in any activity aerobic dance exercise program during the eight-week period in two mounths (Table 1).

### Statistical Analysis

The SPSS statistical program (version 15.0) was used for data analysis. Standard statistical methods were used for the calculation of means and SD. The Kolmogorov-Smirnov test was used to determine if dependent variables were normally distributed. The Levene test was used to determine if there was homogeneity of variance. Analyses of covariance (ANCOVAs) were run on each of the dependent variables**.** For all analyses, the criterion for significance was set at an alpha level of $p< 0.05$.

## RESULTS

Table 2 shows subjects', the mean (SD) age is 35,10±9,12 (years), body height is 1,60±5,22 (m), weight is 68,55±6,73 (kg) for the experimental group, the mean (SD) age is 30,27±10,85 (years), body height is 1,59±5,53 (m), weight is 66,00±6,16 (kg) for the control group.

The means and comparisons for pre-exercise, post-exercise are presented in table 3 and Table 3 shows subjects' body weights, the loss of total body weight and percentage of body weight loss after exercise. Subjects' body weight loss was 7.3 kg after exercise. Significant differences was found between experimental and control group for Body weight (kg), Body mass index, Waist circumference, Waist-hip ratio, Biceps, Body fat percentage and Basal metabolic rate in the pretest and posttest ($p<0.05$). Also, we did not find significant differences between experimental and control group for triceps, subscapula, Iliac and lean body mass in the pretest and posttest (table 3) ($P>0.05$).

**Table 1.** Aerobic-Dance Exercise Program

| ***Basic Movements of Aerobic*** | ***Rep.*** |
|---|---|
| Marş | 8 |
| Running | 8 |
| Step touch | 8 |
| Step touches front and back | 8 |
| Double step touch | 8 |
| Grapevine | 8 |
| Side to side | 8 |
| Knee up/knee lift | 8 |
| Leg curl/hel lift | 8 |
| Leg opening side and back | 8 |
| Kick side and front | 8 |
| Lunge side and back | 8 |
| Squat | 8 |
| Slide | 8 |
| Jumping jacks | 8 |
| Jumping (knee by pulling, kicking, turning to) | 8 |

**Table 2.** Data summary for the experimental group and control group

| **Variables** | **Experimental group (n = 29)** | **Control group (n = 26)** |
|---|---|---|
| | **Mean ± SD** | **Mean ± SD** |
| Age (year) | 35,10±9,12 | 30,27±10,85 |
| Body height (m) | 1,60±5,22 | 1,59±5,53 |
| Body weight (kg) | 68,55±6,73 | 66,00±6,16 |

**Table 3.** Comparison of the experimental group and control groups with respect to pretest and posttest

| **Variables Groups** | | **Pre-test** | | | | **Post-test** | | |
|---|---|---|---|---|---|---|---|---|
| | | **N** | **Mean±SD** | **t** | **P** | **Mean±SD** | **t** | **P** |
| Body weight (kg) | Experimental group | 29 | 68,55±6,73 | 3,580 | 0,001 | 61,25±8,38 | 2,799 | 0,007 |
| | Control group | 26 | 66,00±6,16 | | | 60,86±7,44 | | |
| Body mass index | Experimental group | 29 | 26,58±2,26 | 3,112 | 0,003 | 25,59±2,03 | 2,298 | 0,026 |
| | Control group | 26 | 26,11±3,64 | | | 24,91±3,29 | | |
| Waist circumference | Experimental group | 29 | 86,58±7,07 | 5,549 | 0,000 | 74,08±9,57 | 2,401 | 0,020 |
| | Control group | 26 | 80,96±6,28 | | | 75,50±10,31 | | |
| Waist-hip ratio | Experimental group | 29 | 0,79±,057 | -4,020 | 0,000 | 0,77±,049 | -4,070 | 0,000 |
| | Control group | 26 | 1,02±0,31 | | | 1,01±0,31 | | |
| Biceps | Experimental group | 29 | 19,00±4,61 | 6,946 | 0,000 | 15,07±5,61 | 3,618 | 0,001 |
| | Control group | 26 | 10,85±4,03 | | | 10,38±3,68 | | |
| Triceps | Experimental group | 29 | 25,58±5,342 | 5,181 | 0,000 | 20,86±5,47 | 1,984 | 0,052 |
| | Control group | 26 | 17,19±6,66 | | | 17,58±6,79 | | |
| Supscapula | Experimental group | 29 | 24,00±6,07 | 3,751 | 0,000 | 19,41±5,60 | 1,633 | 0,108 |
| | Control group | 26 | 17,27±7,23 | | | 16,65±6,92 | | |
| Iliac | Experimental group | 29 | 20,31±4,42 | 4,167 | 0,000 | 17,59±4,92 | 1,543 | 0,129 |
| | Control group | 26 | 15,00±5,04 | | | 15,46±5,29 | | |
| Body fat percentage | Experimental group | 29 | 36,13±2,74 | 7,139 | 0,000 | 32,60±3,80 | 2,590 | 0,012 |
| | Control group | 26 | 29,44±4,13 | | | 29,77±4,29 | | |
| Basal metabolic rate | Experimental group | 29 | 1443,91±84,22 | 6,945 | 0,000 | 1401,62±88,96 | 5,180 | 0,000 |
| | Control group | 26 | 1236,28±134,29 | | | 1232,57±148,62 | | |
| Lean body mass | Experimental group | 29 | 44,61±3,05 | 3,233 | 0,002 | 42,99±3,01 | 1,696 | 0,096 |
| | Control group | 26 | 41,72±3,59 | | | 41,59±3,08 | | |

**Table 4.** Comparison of the pretest and posttest relative physical with respect to experimental and control groups

| Groups | Variables | Pretest | Posttest | t | P |
|---|---|---|---|---|---|
| | | Mean±SD | Mean±SD | | |
| Experimental Group (N=34) | Triceps | 25,59±5,34 | 20,86±5,47 | 11,149 | 0,000* |
| | Supscapula | 24,00±6,07 | 19,41±5,60 | 4,964 | 0,000* |
| | Iliac | 20,31±4,42 | 17,59±4,92 | 3,660 | 0,001* |
| | Lean body mass | 44,61±3,05 | 42,99±3,01 | 8,856 | 0,000* |
| Control Group (N=27) | Triceps | 17,19±6,66 | 17,58±6,79 | -0,860 | 0,398 |
| | Supscapula | 17,27±7,23 | 16,65±6,92 | 1,196 | 0,243 |
| | Iliac | 15,00±5,04 | 15,46±5,29 | -1,594 | 0,123 |
| | Lean body mass | 41,72±3,59 | 41,59±3,08 | 0,563 | 0,578 |

* P<0,05

**Table 5.** Descriptive statistics of the posttest points with respect to experimental group and control groups

| Groups | Variables | Mean±SD (s) | Estimate Marginal Means (s) |
|---|---|---|---|
| Experimental Group | Body weight (kg) | 66,00±6,16 | 63,00 |
| | Body mass index | 25,59±2,03 | 24,55 |
| | Waist circumference | 80,96±0,63 | 75,70 |
| | Waist-hip ratio | 0,77±0,05 | 0,88 |
| | Biceps | 15,07±5,61 | 12,09 |
| | Body Fat Percentage | 32,60±3,80 | 29,42 |
| | Basal metabolic rate | 1401,62±88,96 | 1296,56 |
| Control Group | Body weight (kg) | 60,86±7,44 | 64,20 |
| | Body mass index | 23,91±3,30 | 25,07 |
| | Waist circumference | 75,50±10,31 | 81,37 |
| | Waist-hip ratio | 1,01±0,31 | 0,89 |
| | Biceps | 10,38±3,68 | 13,71 |
| | Body Fat Percentage | 29,77±4,29 | 33,33 |
| | Basal metabolic rate | 1232,57±148,62 | 1349,74 |

**Table 6.** ANCOVA results of the posttest points corrected in pretest according to experimental and control groups

| Variables | Source of variance | Type III Sum of Squares | Mean Square | F | P |
|---|---|---|---|---|---|
| Body weight (kg) | Covariate | 2279,18 | 2279,18 | 696,82 | 0,000 |
| | Effect of Experiment | 15,93 | 15,93 | 4,87 | 0,032* |
| Body mass index | Covariate | 361,36 | 361,36 | 737,16 | 0,000 |
| | Effect of Experiment | 3,11 | 3,11 | 6,34 | 0,015* |
| Waist circumference | Covariate | 2923,21 | 2923,21 | 180,91 | 0,000 |
| | Effect of Experiment | 278,20 | 278,20 | 17,22 | 0,000* |
| Waist-hip ratio | Covariate | 2,36 | 2,36 | 1280,75 | 0,000 |
| | Effect of Experiment | 0,001 | 0,001 | 0,32 | 0,574 |
| Biceps | Covariate | 599,08 | 599,08 | 50,33 | 0,000 |
| | Effect of Experiment | 18,89 | 18,89 | 1,59 | 0,213 |
| Body Fat Percentage | Covariate | 648,41 | 648,44 | 154,92 | 0,000 |
| | Effect of Experiment | 107,23 | 107,23 | 25,62 | 0,000* |
| Basal metabolic rate | Covariate | 744032,04 | 744032,04 | 1300,01 | 0,000 |
| | Effect of Experiment | 20298,06 | 20298,06 | 35,47 | 0,000* |

*P<0, 05

As shown in table 4, we find significant differences between pretest and posttest for triceps, subscapula, and iliac and lean body mass in the experimental group ($p<0.05$). The triceps, subscapula, iliac and lean body mass in post-exercise was significantly lower than pre-exercise ($p<0.05$). On the other hand, There was no significant difference between pretest and posttest for triceps, subscapula, iliac and lean body mass in the control group ($P>0.05$).

As shown in table 5, it indicates descriptive statistics of posttest values according to experimental and control groups.

There were statistically detected significant differences with covariance analyses in effect of aerobic-dance exercise program for Body weight (kg), Body mass index, Waist Circumferences,

Waist-hip ratio, Biceps, Body Fat Percentage and Basal metabolic rate in the experimental and control groups ($p < 0.05$). On the other hand, it was shown that effect of aerobic-dance exercise program on Body weight (kg), Body mass index, Waist Circumferences, Waist-hip ratio, Biceps, Body Fat Percentage and Basal metabolic rate in the experimental group ($P<0.05$)(table 6).

## DISCUSSION

Weight reduction programs reduce the risk of coronary artery heart disease for women. A sedentary life is one of the most of the leading causes of obesity disease that is excessive increase in body weight. In many studies have reported that moderate intensity aerobic exercises reduces of body weight, body fat percentage and body mass index which is as regular for a long time (19).

We reported here the data were obtained from the randomized controlled study that investigated the effects of aerobic-dance exercise on body weight, body composition, and measures of central adiposity in overweight women. We believe the most important finding in the present study that was the clear reduction in the amount of weight change in overweight women. There were obtained in data from all parameters for aerobic-dance group and in aerobic-dance group was a significant decrease in body weight, body mass index, body fat percentage, waist circumference and basal metabolic rate after the exercise program ($p<0.05$). Besides aerobic-dance group had beter weight loss, decrease in body mass index and body fat percentage when compared to control group. Circumference measurements also showed that reductions in aerobic-dance group were more significant than control group ($p<0.05$). Mc Cord et al. (14), Carol et al. (3) and Nindi et al. (16) reported that they found a decrease in body weight and fat composition after the 8 to 12 week step aerobic exercise and dance program. These results were similar to with results of our study.

In another study performed at six week treadmill exercise on seven women who age average 21,0±0,8 years. There were found that reductions on body weight to 2.2%, body fat percentage of 1.3%, body mass index of 3.4% after the exercise program by the Szmedra and et all. (22). Amano et al. (1) applied aerobic exercise a 12 week series of 30 minutes and three days per week on obese female and male subjects. They found a significant decrease between an averages weight, body mass index, fat mass, fat body percentage and lean body mass after exercise program according to before exercise program. At the same time observed in this study that consistent the findings of the study of with literature.

We find significant differences on triceps, sub scapula and suprailiac from body composition parameters and lean body mass after the aerobic-dance program in this study($p<0.05$). Also, we did not find significant differences between pretest and posttest for triceps, sub scapula and suprailiac from body composition parameters and lean body mass in the control group ($P>0,05$). Furthermore, while other studies have reported that weight loss through the combination of diet and aerobic exercise results in significant loss of both body fat and LBM (9,5) we found that a significant decrease in lean body mass without any diet program.

Additionally as a result of the ANCOVA test statistically significant differences were found in pretest-posttest comparison on body weight, body mass index, waist circumference, body composition parameters, body fat percentage, basal metabolic rate and lean body mass in this study($p<0.05$). As shown in this study was a significant reduction in waist circumference and in waist-hip ratio. This situation also shows the decrease in central obesity. Waist circumference and waist-hip ratio is very important for the detection of central obesity. While central obesity can be evident only by looking at the bare body, at the same time central obesity is identified by taking waist and hip measurements. The absolute waist circumference (>102 centimeters (40 in) in men and >88 centimeters (35 in) in women) and the waist-hip ratio (>0.9 for men and >0.85 for women) are both used in order to determine of central obesity (27). Slentz et al. (21) found the effects of exercise training on body mass, body composition, and anthropometric and fat distribution variables. However, they did not found a change waist circumference and waist-hip ratio in the exercise group but increased in the control group in their studies. These results were not similar to with our study. We believed that aerobic-dance exercise program contributed to the weight loss and might be more effective for developments physical fitness and risk factors for coronary heart disease during weight reduction in sedentary overweight women. Besides, it seemed that eight week aerobic-dance exercise program had a positive effect on overweight women.

As a result, the major finding of the present study was that there was a clear answer to effect of eight weeks aerobic-dance exercises program in the amount of weight change and decreased in body mass index and body fat percentage, body composition parameters and lean body mass in overweight women. Besides, this study showed that reductions in central obesity due to a significant reductions in waist circumference and waist-hip ratio. The moderate intensity aerobic-dance exercise contributes to the reduction of central obesity with weight loss and consequently it may be effective in the development of health and may encourage a reduction the risk of obesity, muscle weakness,

postural deficiencies from health-related diseases in sedentary overweight women.

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## REFERENCES

1. Amano M, Kanda T, Maritani T. Exercise Training and Autonomic Nervous System Activity in *Obese Individuals. Med Sci Sport Exer* , 2001; 33(8): 1287-1291
2. Banfi G, Malavazos A, Iorio E, Dolci A, Doneda L, Verna R and Corsi MM. Plasma Oxidative Stress Biomarkers, Nitric Oxide and Heat Shock Protein 70 in Trained Elite Soccer Players. *Eur J Appl Physiol.* 2006; 96, 483-486
3. Carol EG, Julie S, McKinney MS, Richard A, Carleton MD. Is Aerobic Dance an Effective Alternative to Walk-Jog Exercise Training? *J Sports Med Phys Fitness* ,1992; 32: 136-141
4. Copeland BL, Franks, BD. Effects of Types and Intensities of Background Music on Treadmill Endurance. *J Sports Med Phys Fitness* .1991; 31, 100-103
5. Donnelly JE, Pronk NP, Jacobsen DJ, Pronk SJ, Jakicic JM. Effects of a Very-Low Calorie Diet and Physical-Training Regimens on Body Composition and Resting Metabolic Rate in Obese Females. *Am J Clin Nutr.* 1991; 54:56–61
6. Fatima R Aerobic Exercises: Their Cardiovascular and Other Benefits. *Pak J Med Sci* .2004; 20-3, 259-265
7. Freeman DJ, Norrie J, Sattar N, Neely RDG, Cobbe SM, Ford I, Isles C, Lorimer AR, Macfarlane PW, McKillop JH, Packard CJ, Shepherd J and Gaw A. Pravastatin and the Development of Diabetes mellitus: Evidence for a Protective Treatment Effect in the West of Scotland Coronary Prevention Study. *Circulation* . 2001; 103:357- 362
8. Fox EL, Bowers RW, Foss LM. Physiological Foundations of Physical Education and Sports. (Ed. Cerit M 1999), *Bağırgan Publish Ankara,Turkey*, 1988 ; 291-293
9. Hensen LC, Poole DC, Donahoe CP, Heber D. Effect of Exercise Training on Resting Energy Expenditure During Caloric Restriction. *Am J Clin Nutr.*. 1987; 46:893–899
10. Hoeger WK. Principles and Labs. 2nd Edition, West Publishing Company, *United States of America*, 1991; 189
11. Jakubec A, Stejskal P, Kováčová L, Elfmark M, Řehová I, Botek M, Petr M. Changes in Heart Rate Variability After A Six Month Long Aerobic Dance or Step-Dance Programme in Women 40–65 Years Old: The Influence of Dıfferent Degrees of Adherence, Intensıty and Initial Levels. *Acta Univ Palacki Olomuc Gymn.* 2008 ; 38, 2-35
12. Kehayias JJ. Reassessment of body mass indices. *Am J Clin Nutr.* 1997; 66: 904-910
13. Leelarungrayub D, Saidee K, Pothongsunun P, Pratanaphon S, YanKai A, Bloomer RJ. Six weeks of Aerobic Dance Exercise Improves Blood Oxidative Stress Status and Increases Interleukin-2 in Previously Sedentary Women. *J Bodyw Mov Ther.* 2010; 1-8
14. McCord P, Nicholas JC, Setterlund SJ. The Effects of Step Training With and Without Hand Weights. *J Sports Med Phys Fitness* .1993; 33:348-358
15. National Center for Health Statistics. Analytic and reporting guidelines: the Third National Health and Nutrition Examination Survey/ Centers for Disease Control and Prevention, NHANES III (1988-94). 1996; Hyattsville, Maryland
16. Nindi BC, Harman EA, Marx JO, Gotshalk LA. Regional Body Composition Changes in Women after 6 Months of Periodized Physical Training. *J Applied Physiol.* 2000; 88:2251-2259
17. Olson MS, Williford HN, Blessing DL, & Greathouse R. The Cardiovascular and Metabolic Effects of Bench Stepping Exercise in Females. *Med Sci Sports Exerc* .1991; 23(11), 1311-1318
18. Physical Activity Guidelines Advisory Committee Report. Energy Balance. *Physical Activity Guidelines Advisory Committee Report* , Washington, 2008; 4:263-265
19. Ponje GA EP, Janssen EME, Hermans J, Mersch J. Regular Physical Activity and Changes in Risk Factors for Coronary Heart Disease. A Nine Months Prospective Study. *Eur J Clin Chem Clin Biochem.*1989; 34: 477-483
20. Skelly WA, Darby LA, and Phillips K. Physiological and Biomechanical Responses to Three Different Landing Surfaces During Step Aerobics. *J Exer Physiol Online (ASEP).* 2003; 6-2
21. Slentz CA, Duscha BD, Johnson JL, Ketchum K, Aiken LB, Samsa GP, Houmard JA, Bales CW, Kraus WE. Effects of The Amount of Exercise on Body Weight, Body Composition, and Measures of Central Obesity. *Arch Intern Med* .2004; 164
22. Szmedra L, Lemura LM, Shearn WM. Exercise Tolerance, Body Composition and Blood Lipids in Obese African–American Woman Following Short–Term Training. *J Sport Med Phys Fitness.* 1998; 38:59 – 65
23. The Evidence Report. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. *Obese Res* .1998; 6 Suppl 2: 51–209
24. Williford HN, Scharff-Olson M, Blessing DL .The physiological effects of aerobic dance. *Sport Med* . 1989; 8, 335-345

25. WHO . Consultation on Obesity. Obesity*:* Preventing and Managing the Global Epidemic. WHO Tech Rep Geneva, Switzerland Series 894; 2000

26. WHO. Obesity: Priority and Managing the Global Epidemic. Report of a WHO consultation on obesity. WHO Tech Rep Geneva, Switzerland Series 894; 2004

27. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, McQueen M, Budaj A, Pais P, Varigos J, Lisheng L. on behalf of the INTERHEART investigators. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (The Interheart Study): case-control study. *Lancet*. 2004; 364(9437): 937–52