ISMJ

International SportMed Journal

Original research article

The effects of an eight-week step-aerobic dance exercise programme on body composition parameters in middle-aged sedentary obese women

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Abstract

Background: Regular physical activity leads to significant changes in terms of the reduction of health-related risks. **Research question:**The purpose of this study was to investigate the effects of an eight-week step-aerobic dance exercise programme on weight loss and body composition parameters in middle-aged sedentary obese women. **Type of study:** This study comprised an eight-week randomised controlled trial. **Methods:** A total of 49 healthy sedentary obese women participated in this study voluntarily. They were randomly divided into two groups: those undertaking a step-aerobic dance exercise programme (n=29) and a control group (n=20). The subjects too part in a step-aerobic dance exercise programme for one hour per day, three days a week for eight weeks. The subjects' Body Mass Index (BMI), weight, waist circumference, waist-hip ratio, four-site skinfold thickness, fat percentage, basal metabolic rate and lean body mass were assessed before and after the completion of the step-aerobic dance exercise programme. **Results:** After the eight weeks of the step-aerobic dance exercise programme, significant differences were found in the subjects' weight, BMI, body composition parameters, waist-hip ratio (WHR), waist circumference (WC), fat percentage, lean body mass (LBM) and basal metabolic rate (BMR) in the experimental group ($p<0.05$). There were no significant differences in the control group after the experiment in terms of the same measures ($P>0.05$). **Conclusion:** The step aerobic dance programme proved to be a useful exercise modality for weight loss and in terms of body composition. There was a clear response to the eight-week step aerobic dance programme in terms of central obesity in sedentary obese Turkish women. **Keywords:** **s**tep exercises; aerobic dance; obese; body composition; weight loss

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Introduction

A sedentary lifestyle poses a threat to individuals' health because it can lead to an increase or progression in the risk of hypertension, obesity, muscle weakness, postural defects, diabetes and coronary heart disease (CHD) in middle-aged people[1]. The prevalence of obesity is continuing to rise in developing countries[2]. Obesity is known to be closely associated with some major health risk factors, such as CHD and certain metabolic disorders[3,4]. Waist circumference (WC), waist-hip ratio (WHR) and anthropometric index values are used extensively for the detection of central obesity[5,6]. In addition, abdominal obesity and the predication of obesity-related health risks were assessed by measuring WC[7,8]. BMI is also one of the most widely used indices of relative weight[9]**.** Generally, the evidence has shown that using WC with BMI in order to estimate health-related risks is better than using BMI alone[10,11].

Physical activity is a vital part of a comprehensive weight loss and weight control programme. As a result of physical activity, abdominal fat may decrease, cardiorespiratory fitness may increase, and weight loss in overweight and obese adults can be achieved[12]. Step aerobics has become gradually more popular in fitness and weight loss programmes[13]. Step aerobics is a combination of low-impact aerobic dance movements and step aerobics.

Step aerobics and aerobic dance have been combined with the purpose of achieving maximum aerobic effects. The choreography is repeated several times to music and uses different movements in an appropriate sequence. It is suitable for most groups, from beginners to advanced exercisers, and even top level athletes. It is also recommended by the ACSM (American College of Sport Medicine)[14] and Pollock et al.[15]. In order to improve cardiorespiratory endurance, control body weight and reduce the risk of premature chronic disease, an individual should perform 20 to 60 minutes of continuous or intermittent aerobic exercise at an intensity of between 50% and 85% of their maximal oxygen uptake (VO_2max), three to five days per week[13,14,15]. Olson et al. has mentioned that aerobic bench-step exercises provide sufficient cardiorespiratory demand to enhance aerobic fitness and promote weight loss in females[13].

Therefore the purpose of this study was to examine the effects of an eight-week step-aerobic dance exercise programme on weight loss, body mass, waist circumference and waist-hip ratio in sedentary obese women.

Methods

Sample

In this study, a total of 49 healthy sedentary obese Turkish women participated in the study. They had no previous experience of any sport/exercise and registered for the first time in a fitness centre, in Konya, Turkey. They were asked to maintain their usual diet and family behaviour for the duration of the exercise programme. The women were randomly divided into experimental and control groups respectively. The average age and height of the subjects were 41.55 ± 6.72years-old and 1.59 ± 7.19cm (n=29) for the experimental group and 37.00 ± 9.09years-old and 1.61 ± 6.34cm (n=20) for the control group.

All of the procedures of this study were approved by the Ethics Committee at the Faculty of Selcuklu Medical Sciences under protocol no. 280/2009 of Seljuk University in Konya, Turkey. The subjects were informed about the study, and written informed consent was obtained from all. The measurements were taken twice, before and after the completion of a step-aerobic exercise programme which was applied over a period of eight weeks, with one-hour step-aerobic exercise classes, three days per week. The control group did not participate in the step-aerobic exercise programme during the eight-week period. All measurements were recorded at baseline and immediately after the study.

Data collection

Height was measured to the nearest 0.1cm on a stadiometer when the participants were shoeless. Body weight was measured to the nearest 0.1kg using a pre-calibrated Tanita instrument (model TBF-305; Tanita, Arlington Heights, IL) electronic scale. BMI was calculated as weight in kilograms divided by height squared (kg/m^2) in metres. BMI was then categorised according to the recommendations of the World Health Organization:[16] below-normal weight (<18.5kg/m^2), normal weight (18.5–24.9kg/m^2), overweight (25.0–29.9kg/m^2), obese (30.0–39.9kg /m^2), and extremely obese (40kg/m^2).

The subjects were asked to breathe out for measurement of their WC, which was measured to the nearest 0.1cm at the iliac crest[17]. When viewed from the side, hip circumference was evaluated at the level of the maximum extension of the thigh, and waist-hip ratio (WHR) equals the waist circumference divided by the hip circumference; WC (cm)/height (m).

Skinfold thickness was determined from four skinfold sites measured with the Holtain skinfold calliper. These sites were the biceps (the anterior surface of the biceps, midway between the anterior auxiliary fold and the antecubital fossa), triceps (the vertical fold on the posterior midline of the upper arm, halfway between the acromion and olecranon process), subscapular (the fold on the diagonal line coming from the vertebral border to between 1- and 2cm from the inferior angle of the scapulae) and the suprailiac (the diagonal fold above the iliac crest with the anterior auxiliary line).

Interventions

Initially, the aim of the step-aerobic dance exercise programme was for the subjects to achieve a heart rate of 50-60% of the maximal heart rate for their age. The target then was to raise their heart rate to 70–80% of the maximal heart rate for their age. The step-aerobic dance exercise programme was performed by all of the subjects in the experimental group for the entire eight week period. The exercises were choreographed by a professional step-aerobic dance coach. The movements were simplified and made easy to learn, and required the use of both the upper and lower extremities and the back. Verbal and tactile prompts were given during each step-aerobic dance exercise class. The subjects in the experimental group participated in three 40-minute sessions per week for four weeks initially, followed by three 50-minute sessions per week for another four weeks. For the first four weeks, each session consisted of 10 minutes of warming up, 30 minutes of aerobic dancing with brief resting periods, followed by 10 minutes to cool down. For the following four weeks, step aerobics was added to the aerobic dance movements, and the sessions were lengthened from 40 to 50 minutes each, while the warming up and cooling down times remained the same for the eight weeks. The choreographed exercise programme consisted of stretching exercises, walking exercises and progressive step-aerobic movements. It was performed with music, and required the continuous use of extended arm movements and the involvement of the major muscle groups. The control group did not participate in the step-aerobic dance exercise programme during the eight-week period[18,19]. The outline of the step-aerobic dance exercise programme is shown in Table 1.

Table 1: Step-aerobic exercise programme format

Basic movements for aerobics	**Basic movements for step**	**Repetitions**
March	Basic step	8
Running	Wide step	8
Step touch	Tap up,tap down	8
Step touches fron and back	Knee lift	8
Double step touch	Leg curl	8
Grapevine	Leg opening side and back	8
Side to side	Kick	8
Knee lift	Knee lift and Leg curl repeater	8
Leg curl	Straddle up-down	8
Leg opening side and back	Turn step	8
Kick side and front	Turn travel	8
Lunge side and back	Over the top	8
Squat	Across the top	8
Slide	Corner to corner	8
Jumping jacks	Lunge	8
Jumping (knee to chest)	Reverse step	8

Statistical analysis

The statistical software program (SPSS version 15.0) was used for data analysis. Standard statistical methods were used for the calculation of means and standard deviation (SD). The Kolmogorov-Smirnov test was used to determine whether the dependent variables were normally distributed. The Levene test was used to determine whether or not there was homogeneity of variance. Analysis of covariance (ANCOVA) was 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 summarises the anthropometrical data of all subjects.

Table 2: Data summary for the experimental and control groups

Variables	**Experimental group (n=29)**	**Control group (n = 20)**
	M ± SD	**M ± SD**
Age (years)	41.55±6.72	37.00±9.09
Height (m)	1.59±7.19	1.61±6.34
Weight (kg)	85.97±9.60	84.50±10.18

As shown in Table 2, the mean (SD) age is 41.55 ± 6.72years, body height is 1.59 ± 7.19m, and weight is 85.97 ± 9.60kg for the experimental group. For the control group, the mean (SD) age is 37.00 ± 9.09years, body height is 1.61 ± 6.34m, and weight is 84.50 ± 10.18kg.

Table 3: Comparison of the experimental group and control groups at pre-test and post-test respectively

Variables			**Pre-test**			**Post-test**		
Groups		**n**	**Mean±SD**	**T**	**p**	**Mean±SD**	**T**	**p**
Weight (kg)	**Experimental group**	29	85.97±9.60	0.513	0.611	83.31±10.16	-0.495	0.623
	Control group	20	84.50±10.17			84.80±10.65		
Body mass index	**Experimental group**	29	33.99±3.89	1.777	0.082	32.93±3.96	0.521	0.605
	Control group	20	32.30±2.05			32.41±2.32		
Waist circumference	**Experimental group**	29	102.66±8.43	3.565	0.001*	96.38±8.16	0.838	0.406
	Control group	20	94.50±6.96			94.55±6.43		
Waist-hip ratio	**Experimental group**	29	0.85±0.06	-17.427	0.000*	0.82±0.05	-18.130	0.000*
	Control group	20	1.23±0.10			1.23±0.11		
Biceps	**Experimental group**	29	22.17±5.56	-0.577	0.567	19.90±4.95	-1.900	0.064
	Control group	20	23.30±8.15			23.45±8.15		
Triceps	**Experimental group**	29	31.03±5.23	1.140	0.260	27.59±4.94	-0.863	0.392
	Control group	20	29.00±7.28			29.10±7.35		
Supscapula	**Experimental group**	29	30.21±5.67	1.005	0.320	26.38±5.86	-1.259	0.214
	Control group	20	28.50±6.10			28,60±6,36		
Suprailiac	**Experimental group**	29	26.31±5.76	-0.598	0.553	23.69±5.70	-2.091	0.042*
	Control group	20	27.40±6.94			27.50±7.02		
Fat percentage	**Experimental group**	29	39.32±2.64	0.573	0.569	37.56±2.49	-1.557	0.126
	Control group	20	38.82±3.41			38.87±3.41		
Basal metabolic rate	**Experimental group**	29	1577.00±105.74	-0.337	0.738	1551.62±104.76	-1.153	0.255
	Control group	20	1588.44±131.41			1591.31±136.09		
Lean body mass	**Experimental group**	29	49.56±2.52	-0.269	0.789	48.75±2.62	-1.214	0.231
	Control group	20	49.80±3.64			49,86±3,80		
Metabolic rate	**Experimental group**	29	1590.35±55.39	-0.269	0.789	1572.41±57.69	-1.214	0.231
	Control group	20	1595.55±80.11			1596.86±83.50		
Hips circumference	**Experimental group**	29	122.17±8.05	2.701	0.010*	116.00±8.22	-0.042	0.967
	Control group	20	116.15±7.08			116.10±8.30		

In Table 3, a significant difference between the experimental and control groups was found only for the waist-hip ratio in the pre-test and post-test ($p<0.05$). There were no significant differences between the experimental and control groups for weight, body mass index, biceps, triceps, subscapula, fat percentage, basal metabolic rate, lean body mass, and metabolic rate pre-test and post-test ($p>0.05$) respectively.

Table 4: Comparison of the pre-test and post-test measurements with respect to experimental and control groups respectively

Groups	Variables	Pre-test Mean±SD	Post-test Mean±SD	T	p
Experimental Group (n=29)	**Weight**	85.97±9.60	83.31±10.16	4.687	0.000
	Body mass index	33.99±3.89	32.93±3.96	4.503	0.000
	Biceps	22.17±5.56	19.90±4.95	2.424	0.022
	Triceps	31.04±5.23	27.59±4.94	3.140	0.004
	Subscapula	30.21±5.67	26.38±5.86	3.449	0.002
	Fat percentage	39.32±2.64	37.56±2.49	3.435	0.002
	Basal metabolic rate	1577.00±105.74	1551.62±104.76	4.687	0.000
	Lean body mass	49.56±2.52	48.75±2.62	4.178	0.000
	Metabolic rate	1590.35±55.39	1572.41±57.69	4.178	0.000
Control Group (n=20)	**Weight**	84.50±10.17	84.80±10.65	-0.670	0.511
	Body mass index	32.30±2.05	32.41±2.32	-0.636	0.532
	Biceps	23.30±8.15	23.45±8.15	-1.831	0.083
	Triceps	29.00±7.28	29.10±7.36	-1.453	0.163
	Subscapula	28.50±6.10	28.60±6.36	-1.285	0.214
	Fat percentage	38.82±3.41	38.87±3.41	-3.043	0.007
	Basal metabolic rate	1588.44±131.41	1591.31±136.09	-0.670	0.511
	Lean body mass	49.80±3.64	49.86±3.79	-0.462	0.649
	Metabolic rate	1595.55±80.11	1596.86±83.50	-0.462	0.649

Significant differences were shown between pre-test and post-test for weight, body mass index, biceps, triceps, subscapula, fat percentage, basal metabolic rate lean body mass, and metabolic rate in the experimental group shown in Table 4 ($p<0.05$). However, no significant differences were found between pretest and posttest for weight, body mass index, biceps, triceps, subscapula, basal metabolic rate lean body mass, and metabolic rate in the control group ($p>0.05$). There was a significant difference only for fat percentage in control group (Table 4) ($p < 0.05$).

Table 5: ANCOVA results of the post-test corrected from the pre-test for the experimental and control groups respectively

Variables	Source of variance	Type III sum of Squares	Mean square	F	P
Waist circumference	**Covariate**	1876.29	1876.29	111.59	0.000
	Effect of experiment	207.35	207.35	12.33	0.001
Hip circumference	**Covariate**	2659.77	2659.77	227.40	0.000
	Effect of experiment	369.48	369.48	31.59	0.000
Waist-hip ratio	**Covariate**	0.22	0.22	149.92	0.000
	Effect of experiment	0.007	0.007	4.65	0.036
Suprailiac	**Covariate**	987.78	987.78	52.87	0.000
	Effect of experiment	109.05	109.05	5.84	0.000

There were statistically detected significant differences with covariance analyses in the effect of the step-aerobic dance exercise programme for waist circumference, hip circumference, waist-hip ratio and the suprailiac in the experimental and control groups respectively, indicating a positive effect from the step-aerobic dance exercise programme.(Table 5) ($p<0.05$).

Discussion

Regular physical activity leads to significant changes in terms of increased health-related fitness, and can reduce risk factors for developing a range of disabling medical conditions which occur in inactive people[20]. In general, exercise is beneficial for health and physical fitness, while a sedentary lifestyle has a negative effect on a person's well-being. The present study investigated the effects of an eight-week step-aerobic dance exercise programme in terms of the effect on weight loss, body mass index, waist circumference and waist-hip ratio in middle-aged sedentary obese women.

The exercise programme resulted in a mean weight loss of 2.66kg, a decrease in the subjects' BMI and a decrease in their total body fat percentage when compared to control group. Circumference measurements also showed that those of the step-aerobic dance group's were more significant than for the control group ($p< 0.05$). These results were similar to those found in the studies by McCord et al. and Carol et al respectively. They reported a reduction in body weight and fat composition after an eight- to 12-week step-aerobic exercise and dance programme[20,21].

According to the data, a significant difference was found between the pre- and post-test values for body weight, BMI, biceps, triceps, subscapula, fat percentage, basal metabolic rate and lean body mass in the experimental group ($p< 0.05$). In addition, there were no significant differences between the means of the pre- and post-tests body weight, BMI, biceps, triceps, subscapula, basal metabolic rate and lean body mass of the control group ($p> 0.05$), although there was a significant difference in the fat percentage of the control group. It was expected that there would be a significant difference in the body weight, body composition parameters and fat percentage by the end of the eight-week step-aerobic dance programme in the experimental group. A number of studies have mentioned that body weight and body composition changes as a result of physical training[23,24,25]. In addition, Akdur et al.[26] found that a step-aerobics group experienced greater weight loss, BMI decrease and total body fat percentage decrease when compared to a diet-only group. Circumference measurements also showed that decreases in the step-aerobic group were more significant than in the diet-only group[26]. These results are similar to the results of this present study. Thus t can be stated that a step-aerobic dance programme is an effective method of reducing body weight, BMI, biceps, triceps, subscapula, fat percentage, basal metabolic rate and lean body mass.

According to the results of the ANCOVA test, another important finding of this study was that four independent measures (WC, hips circumference, waist-hips ratio and suprailiac skinfolds) demonstrated a strong response to the effects of the step-aerobic dance exercise programme. There were improvements in all of these measures. Significant differences between the pretests and posttests for WC, hip circumference, waist-hips ratio and suprailiac skinfolds in the experimental group ($p<0.05$) were found. In addition, the absolute WC (>102 cm in men and >88 cm in women) and the waist–hip ratio (the circumference of the waist divided by that of the hips: >0.9 for men and >0.85 for women), were both used as measures of central obesity[27]. The eight-week step-aerobic dance programme was found to have an effect on central obesity.

Irwin et al.[27] reported that an increase in the duration (mins/week) of physical activity was significantly associated with a reduction in the subjects' total fat. Amano et al.[28] applied aerobic exercises in a three months series of 30 minute sessions on three days per week with obese subjects. They found a significant difference between the subjects' average weight, BMI, fat body percentage and lean body mass before and after training. While there was no significant difference in lean body mass, a significant difference was observed for all of the other variables[28]. In another study[29], it was found that a culturally-specific dance intervention significantly influenced the body fat and BMI of sedentary African-American women over an eight-week period. This difference was maintained at 18 weeks when compared to the participants who did not take part in the intervention[29]. Other dance studies have reported a decrease in the body fat and BMI of sedentary obese women who danced two to three times per week for 12 weeks[30].

As a result, WC and waist-hip ratio is very important for the detection of central obesity. The most important finding of the present study was that there was a clear response to the effects of the eight-week step-aerobic dance programme on central obesity. In addition, there was an important development in body composition values, BMI, the amount of weight change, lean body mass and the basal metabolic rate of sedentary middle-aged obese females. These positive changes in body composition were more pronounced following the implementation of the step-aerobic dance programme with obese middle-aged women in this study. Thus this research demonstrated that a step-aerobic dance programme is a useful exercise modality for weight loss and body composition in Turkish obese, sedentary middle-aged women.

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