A COMPARISON OF THE EFFECTS OF STEP AEROBICS AND AEROBIC DANCING ON SELECTED PHYSIOLOGICAL PARAMETERS OF COLLEGE-AGED FEMALES

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

AYŞE KİN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF
MASTER OF SCIENCE
IN
THE DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS

JUNE 1996

Approval of the Graduate School of Social Sciences

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ABSTRACT

A COMPARISON OF THE EFFECTS OF STEP AEROBICS AND AEROBIC DANCING ON SELECTED PHYSIOLOGICAL PARAMETERS OF COLLEGE-AGED FEMALES

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June 1996, 47 pages.

The purpose of this study was to compare the selected physiological parameters of step aerobics and aerobic dancing after 8 weeks of training. 48 sedentary female subjects voluntarily participated in this study and were randomly assigned to one of the three groups as step aerobics group (n=16), aerobic dancing group (n=16) and control group (n=16). Both step aerobics and aerobic dancing groups participated in training sessions of 45 min. per day, 3 days per week for 8 weeks with 60-70 % of their heart rate reserve. The control group did not participate in any regular physical activity. Body composition, leg circumference, flexibility, muscular endurance, maximal oxygen consumption (VO_2 max.) and blood lipids and lipoproteins were determined before and after the 8 weeks of training. One-Way ANOVA and Tukey-HSD were used to evaluate the effects of training. Results indicated no significant changes in body weight, thigh circumference, triglyceride levels and LDL-C levels. In body fat percent both step aerobics and aerobic dancing groups showed significant decreases ($p < .05$). In addition both experimental groups showed significant increases in sit-up and VO_2 max. ($p < .05$). On the other hand, only step aerobics group showed significant decreases in fat weight, calf circumference and total cholesterol levels ($p < .05$). Step aerobics also showed significant increases in lean body weight, flexibility and HDL-C levels ($p < .05$). However both experimental groups were not significantly different from each other.

The control group demonstrated no significant change in any of the measured variable. As a conclusion, step aerobics and aerobic dancing were not different from each other in promoting physical fitness however 8 weeks of step aerobics training appeared to be more effective in improving physical fitness.

Key Words: Physical fitness, step aerobics, aerobic dancing, physiological parameters.

Science Code: 224.19.01

ÖZ

STEP VE AEROBİK DANSIN ÜNİVERSİTELİ BAYANLARIN FİZYOLOJİK PARAMETRELERİNE ETKİSİNİN KARŞILAŞTIRILMASI

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Bu çalışmada, 8 haftalık step ve aerobik dans uygulamasının fizyolojik parametreler üzerine olan etkisi karşılaştırılmıştır. 48 sedanter bayan üniversite öğrencisi gönüllü olarak olarak bu çalışmaya katılmış ve rastgele yöntemiyle üç gruba -.step grubu (n=16), aerobik dans grubu (n=16) ve kontrol grubu (n=16)- ayrılmışlardır. Step ve aerobik dans grupları maksimum kalp atımlarının % 60 -70' inde haftada 3 gün , günde 45 dakika olmak üzere 8 haftalık antrenmana katılmışlardır. Bu antrenman süresince kontrol grubu hiçbir fiziksel aktiviteye katılmamışdır. Deneklerin vücut komposizyonu, bacak çevresi, esnekliği, kas dayanıklılığı, maksimal oksijen tüketimi (VO_2 max.) ve bazı kan lipid ve lipoprotein değerleri , 8 haftalık antrenman öncesi ve sonrası ölçülmüştür. Tek-Yönlü Varyans Analizi ve Tukey-HSD istatistiksel yöntemleri verilerin değerlendirilmesinde kullanılmıştır. Vücut ağırlğında, uyluk çevresinde, trigliserid ve LDL-C seviyelerinde üç grup arasında anlamlı bir fark bulunamamıştır. Vücut yağ yüzdesinde ise hem step hem de aerobik dans grupları istatistiksel açıdan anlamlı bir düşüş göstermişlerdir ($p < .05$). Ayrıca her iki grup da mekikte ve VO_2 max. değerlerinde anlamlı artışlar göstermişlerdir ($p < .05$). Bunların yanında step grubu yağ ağırlığında, baldır çevresinde ve total kolesterol seviyesinde anlamlı düşüş, yağsız vücut ağırlığında, esneklikte ve HDL-C seviyesinde ise anlamlı artışlar göstermiştir ($p < .05$). Ancak bu çalışma step ve aerobik dans grupları arasında anlamlı farklılıklar bulamamıştır. Yine

kontrol grubunda da 8 hafta sonunda herhangi bir değişkende anlamlı bir fark bulunamamıştır. Sonuç olarak bu çalışma step ve aerobik dansın kişilerin fiziksel uygunluğunu geliştirilmesinde birbirinden farklı olmadığını ancak 8 haftalık step antrenmanının fiziksel uygunluğu geliştirmede daha etkili olduğunu göstermiştir.

Anahtar Kelimeler: Fiziksel uygunluk, step, aerobik dans, fizyolojik parametreler.

Bilim Dalı Sayısal Kodu: 224.19.01

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Assoc. Prof. Dr. Fehmi Tuncel for his advises and guidance throughout this study.

Thanks go to other examining committee members, Assoc. Prof. Dr. Feza Korkusuz and Assoc. Prof. Dr. Caner Açıkada, for their suggestions and comments.

I would also like to thank to Dr. Nusret Taheri who helped in the blood analysis.

My special thanks go to Nazan Koşar for her valuable help throughout the tests, Hülya Aşçı for her valuable help during the construction of this thesis and A. Timur Atalay for his patience and encouragement.

Finally, special thanks go to the instructors who helped in the training period and all of the subjects who volunteered to participate in this study.

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CHAPTER I
INTRODUCTION

Modern technology have enabled individuals to move to a more sedentary life. For instance cars and buses are preferred to walking and elevators and escalators are preferred to climbing the stairs. As a result individuals are becoming physically inactive and this physical inactivity can lead to many diseases like coronary heart disease (CHD), hypertension, hyperlipidemia, obesity and musculoskeletal diseases. All of these diseases are termed as hypokinetic diseases because they result from lack of movement (Heyward, 1991).

It is known that exercise, when performed regularly, protects against the development and progression of these diseases because regular exercise helps in the development of physical fitness of an individual. Physical fitness is the ability of an individual to perform occupational, recreational and daily activities without becoming unduly fatigued (Heyward, 1991). Regular exercise helps in the development of health related components of the physical fitness. Health related components of physical fitness are cardiovascular endurance, muscular strength, muscular endurance, body composition, flexibility and neuromuscular relaxation (ACSM, 1991; Heyward, 1991; McGlynn, 1992; Pollock et al., 1978).

Cardiorespiratory endurance is the ability of the heart, lungs and the circulatory system to supply adequate oxygen and nutrients to working muscles efficiently (Heyward, 1991). Improved cardiorespiratory endurance is the most important benefit of regular exercise because it plays a vital role in the prevention of hypokinetic diseases like coronary heart disease and hypertension.

Muscular strength is the force or tension a muscle or a muscle group can exert against a resistance in one maximal effort (Fox et al. 1989). Through regular exercise muscular strength can be improved and this will help in the prevention of many musculoskeletal diseases like low-back pain.

Muscular endurance on the other hand, is the ability of a muscle to maintain a continuous contraction or to repeatedly contract over a period of time (McGlynn, 1992). Improved muscular endurance will also lead to a more efficiently working muscular system.

Body composition refers to the proportion of body fat to lean body tissue (McGlynn, 1992). Excessive amount of body fat will lead to a gain in body weight and therefore to obesity which is another form of hypokinetic disease. Obesity is related to a number of diseases including diabetes, coronary heart disease, psychological disturbances, kidney disease, hypertension, stroke, liver ailments and mechanical difficulties like back and foot problems (Fox et al. 1989). Regular exercise when supported with proper nutrition will lead to a decrease in body fat and therefore to a decrease in body weight and will reduce the probability of these diseases.

Flexibility is the ability to move a joint through its complete range of motion (Heyward, 1991). A decreased range of motion may limit proper movement and lead to insufficient movement as well as to the possibility of injury to ligaments and tendons (McGlynn, 1992). Regular exercise improves the range of motion of a joint and therefore the flexibility of an individual.

On the other hand regular exercise should have a standardized quantity and quality in order to develop these components of physical fitness. ACSM (1990), has made following recommendations for the quantity and quality of exercise for developing and maintaining cardiorespiratory fitness, muscular strength, muscular endurance, body composition, and flexibility: The frequency of the exercise should be between 3-5 days per week, the intensity of exercise should either be between 60-90 % of maximum heart rate (max HR) or 50-85 % of maximum oxygen uptake (max VO_2) or maximum heart rate reserve (max HRR), the duration of training should be between 20-60 min of continuous activity, the mode of activity should be any activity that uses large muscle groups and can be maintained continuously and is rhythmical and aerobic in nature.

For the purpose of improving physical fitness and in order to attract the interest of individuals, many different physical fitness programs have been developed . Two of the most popular of these physical fitness programs are aerobic dancing and step aerobics. These two programs are popular because both use enjoyable exercise to music and selected exercise routines are easy for everyone.

Aerobic dancing is a choreographed routine of movements from various types of dance combined with other rhythmic movements like hopping, skipping, jumping and stretching, continuously performed to music (Dowdy et al. 1985). Many studies have showed that aerobic dancing is a good way of developing physical fitness when performed at intensity, duration and frequency recommended by ACSM (1990). A typical aerobic dance session includes a 7-10 min of warm up which includes stretching and calisthenics, 20-30 min of aerobic dancing at the target heart rate intensity and a 10 min of cool down activities that includes again stretching and calisthenics-type exercises (Eickhoff et al. 1983; Clearly et al. 1984; Dowdy et al. 1985; Williford et al. 1988; Heyward, 1991; Garber et al. 1992). When performed at the recommended quality and quantity of ACSM (1990) for about 8-10 weeks , aerobic dancing is found to be an effective way of promoting physical fitness (Eickhoff et al. 1983; Milburn and Butts 1983; Clearly et al. 1984; Dowdy et al. 1985; Williford et al. 1988; Heyward, 1991; Garber et al. 1992). During the aerobic dancing session the heart rate should be monitored 5-6 times to ensure that heart rate stays within the target zone (Russell, 1983).

Step aerobics or step training is a modification of aerobic dance movements using a stepping bench (Kravitz et al. 1993). A variety of choreographed steps on and off single benches are performed to the cadence of steadily paced music arrangements while following a group leader (Scharff Olson et al. 1991). The height of the benches is 10.2 cm for the beginners and then can be incremented to 20.3 cm, 25.4 cm and 30.5 cm (Scharff Olson et al. 1992; Stanforth et al. 1993; Kravitz et al. 1993). Step aerobics is rather a new physical fitness program when compared with aerobic dancing and as a result there is very little research concerning its physiological effects. These few studies have shown that step aerobics is an effective way of promoting physical fitness when performed at recommended intensity, duration and frequency by

ACSM (1990) (Scharff Olson et al. 1992; Kravitz et al. 1993; Stanforth et al. 1993). A typical step training session includes 7-10 min of warm up exercises with stretching and calisthenics followed by a 30 min of step training and end with a 10 min of cool down with stretching exercises (Kravitz et al 1993).

Although these two fitness programs look similar in terms of the duration of activities, they are different in nature. Then their effectiveness on the physical fitness should be different accordingly. It is then the purpose of this study to compare the effects of these two programs on selected physiological parameters.

1.1 Statement of the Problem

The purpose of this study was to compare the effects of step aerobics and aerobic dancing on selected physiological parameters of college-aged females.

1.2 Limitations

1. The subjects were sedentary female students of Middle East Technical University, who volunteered to participate in this study.

2. The subjects were between the ages of 18-28 years.

3. The subjects attended to either step aerobics or aerobic dancing classes 3 days per week for at least 8 weeks.

4. All testing procedures were performed one week prior to and after the treatment period.

5. Subjects' diet was not controlled.

1.3 Assumptions

1. The subjects gave their best effort during the test days.

1.4 Null Hypothesis

1. There would be no significant difference in the body composition between the treatment groups and the control group.

2. There would be no significant difference in the muscular endurance between the treatment groups and the control group.

3. There would be no significant difference in the flexibility between the treatment groups and the control group.

4. There would be no significant difference in the maximum oxygen uptake (max. VO_2) between the treatment groups and the control group

5. There would be no significant difference in the total cholesterol levels between the treatment groups and the control group.

6. There would be no significant difference in the triglyceride levels between the treatment groups and the control group.

7. There would be no significant difference in the HDL-C levels between the treatment groups and the control group.

8. There would be no significant difference in the LDL-C levels between the treatment groups and the control group.

1.5 Significance of the Study

With the increasing trend toward the development of physical fitness, many different fitness programs have been developed. Two of the most popular of these programs are step aerobics and aerobic dancing. There are many studies about the physiological effects of aerobic dancing but on the other hand there is very limited research about step aerobics. The studies have shown that these two programs are effective in the development of cardiorespiratory endurance, body composition and muscular strength however the other components of physical fitness have not been studied. Also no study has been established to compare the effects of these two programs on each of the components of physical fitness. Then the purpose of this study is to compare the effects of these two programs on selected physiological parameters. With the results of this study, individuals who want to participate in a program for the development of physical fitness will choose the best program according to the component that is wanted to be developed.

CHAPTER II

REVIEW OF LITERATURE

Aerobic dancing and step aerobics are two of the most popular fitness programs that improve health related components of physical fitness. Many different studies have investigated the effects on selected physiological parameters of these two programs separately.

Step Aerobics Studies

Olson et al. (1991) investigated the acute cardiovascular and metabolic responses to 20 min. continuous bouts of choreographed bench stepping exercise in 10 healthy females. Four frequently used bench heights were employed in a cross-over design: 15.2 cm, 20.3 cm, 25.4 cm and 30.5 cm. The subjects' maximum oxygen uptake and exercise heart rate responses were collected. Oxygen uptake responses were significantly more pronounced in direct relationship to the bench height: Greatest at bench height of 30.5 cm and least at 15.2 cm. No difference was revealed for heart rate responses. This study has demonstrated that aerobic bench stepping is an exercise modality that provides sufficient cardiovascular demand for enhancing aerobic fitness and promoting weight loss in females.

Velasquez and Wilmore (1991) investigated the changes in the cardiorespiratory fitness and body composition after a 12 week bench step training program. 23 untrained women between the ages of 18-33 randomly assigned to either experimental or control group. Subjects completed graded treadmill test and their resting heart rate (HR rest), maximum oxygen uptake (max VO_2) and body composition was determined before and after 12 weeks bench step training. Each bench step session consisted of 30 min. aerobic training portion, 3 days per week at an intensity of 70-85 % of maximum heart rate reserve (max HRR). Results showed that the exercise group significantly increased treadmill max. VO_2 about 16.3 % and maximum ventilation (VE max) about 11.5 % and decreased resting heart rate about

10.4 %. Also submaximal heart rate decreased at four standard work rates during the bench step training. With the exception of VE max, the control group improved in these measures as well. With respect to body composition, there were no significant changes in any of the variables measured. In conclusion they stated that, a typical bench step program, if practiced regularly, can provide cardiorespiratory fitness.

Stanforth, Stanforth and Velasquez (1993) examined the aerobic requirement of bench stepping in 28 females. The subjects participated in bench aerobics classes at least 3 days per week for minimum of 8 weeks. Bench stepping sessions include four 5 min. bouts of exercises at bench heights of 15.2 cm, 20.4, 25.4 cm and 30.5 cm. During these sessions the subjects performed the exercises with hands on hips at 30 and 32 step cycles per minute. Also subjects completed one graded treadmill test to volitional fatigue. Results of this study revealed that maximum oxygen uptake was significantly different between each bench height and stepping rate with no significant interaction between bench height and stepping rate. The heart rate response during bench stepping and treadmill test was similar.

Kravitz, Cisar, Christensen and Setterlund (1993) examined the longitudinal effects of step training with and without handweights on aerobic work indices, body composition, body build and muscular strength. 24 college-aged females volunteered as subjects for the 8 weeks step training study. The step training consisted of 3 training sessions per week for 8 weeks with the same instructor. Each session lasted 50 min and began with a 7-9 min warm-up followed by 30 min period of step training. A 4 min abdominal workout followed the 30 min period step training and each session ended with a 5 min cool-down. The subjects used a 15.2 cm step or bench for the first 3 weeks and progressed to a 20.3 cm step for weeks 4-8 of the step training. The stepping cadence during the 30 min of step training ranged from 120 to 126 beats per min. The study involved pre- and post- laboratory testing consisting of the following : An incremental treadmill test for aerobic indices which included VO_2 max, max HR, ventilatory threshold oxygen uptake rate (VT-VO_2) and ventilatory threshold heart rate (VT-HR); hydrostatic weighing for determination of body composition which included body fat %, fat mass and lean body mass; anthropometric measurements for

determination of body build characteristics as endomorphic, mesomorphic and ectomorphic somatotype rating; isokinetic strength testing at 60° sec for determination of flexion and extension strength of the arm at the shoulder joint, forearm at the elbow joint and leg at the knee joint and concentric leg press for determination of overall lower body strength. Overall significant improvements had been observed in both groups.

Aerobic Dancing Studies

Eickhoff, Thorland and Ansorge (1983) examined if the aerobic dancing of sufficient intensity, duration and frequency could promote changes in physiological as well as psychological profiles. 39 females, 20 as experimental and 19 as control group, between the ages of 19-36 volunteered and participated in a 10 weeks aerobic dance class 3 days per week. Each class period was approximately 50 min in duration, consisting of 10 min. warm-up followed by a 30 min of aerobic dancing and ended with a 10 min of cool down activities. During the first 4 weeks, duration of actual dancing time was progressively increased. By the start of the 5 th week total dance duration time was 30 min. Age related target heart rate ranges were used to determine the intensity. Cardiovascular responses as resting heart rate, exercise heart rate and body composition measured by skinfold method were determined before, during and after the aerobic dancing. Significant changes have been observed in experimental group when compared with the control group.

Milburn and Butts (1983) compared the physiological alterations that occurred in college females after a 7 week aerobic dance and jogging training program. 46 females, 15 in aerobic dance, 19 in jogging and 12 in control group, participated in this study. Experimental groups exercised for 30 min per day, 4 days per week for 7 weeks. An 8-10 min warm-up preceded by 30 min training session for each experimental group. Training heart rate was 75 % of max HR. For the jogging group heart rate was monitored and recorded after every mile and at the end of the 30 min. exercise session. The dancers heart rate was monitored at minutes 10, 20 and 30 of class and immediately following the completion of a dance routine. All subjects were given a pre- and post- max VO_2 treadmill test. Both experimental groups significantly increased their max VO_2, VE max, maximal treadmill running times and

significantly decreased their max HR as a result of training. The control group showed no significant changes in any of the variables measured. It was concluded that both aerobic dance and jogging were equally effective exercise modalities for improving cardiorespiratory endurance when performed at similar intensities, frequencies and durations. As a result, no significant differences were found in the amount of the actual improvement between these two groups as a result of mode of training.

Clearly, Moffatt and Knutzen (1984) studied and compared the effects of a two- and three-day-per week aerobic dance program on maximum oxygen uptake (max VO_2). 21 female college students , 7 in two days per week group, 7 in three days per week group and 7 in the control group volunteered to participate in the study. Training was conducted two or three times weekly for a total of 10 weeks. Training sessions of each group were identical and consisted of 10-15 min of warm-up calisthenics followed by continuous aerobic dance to music and were concluded with 5-10 min of cool-down activities. Aerobic dance began with 15 min of continuous dance routines and progressively increased to 30 min by the 6 th week of training. The training intensity was set at level of 75 % max HR. Results showed significant differences between groups for max. VO_2, VE max and treadmill time to exhaustion. No significant changes were seen for maximal heart rate as a result of aerobic dance training. This study supported the contention that aerobic dance provides a useful means of enhancing cardiovascular fitness in college aged females as indicated by max VO_2 improvements. For a significant benefit, aerobic dance training should be conducted at least three days per week.

Blyth and Goslin (1985) studied the cardiorespiratory effects of 30 min. aerobic dance. 12 females participated in two tests. A preliminary discontinuous max VO_2 test on a treadmill for determination of the HR-VO_2 relationship and a 30 min aerobic dance test were also performed for the determination of the HR-VO_2 relationship. Aerobic dance test consisted of a 5 min warm-up followed by a 20 min of aerobic dance and ended with a 5 min of cool down activities. During the aerobic dance tests the exercise heart rate was not significantly different from the desired target heart rate for 16.3 $\pm$ 6.4 min. The subjects were also exercising at a level which

was significantly higher than Karvonen's Target Heart Rate of 74.2 ± 1.1 % HR max. It was found, within the limits of this study, that the acute responses to an enhanced aerobic dance class indicated sufficient intensity and duration to promote probable long-term, training adaptations of the cardiorespiratory system.

Dowdy, Cureton, DuVal and Ouzts (1985) examined the effects of aerobic dance on physical work capacity, cardiovascular function and body composition of middle-aged women. 28 sedentary females between the ages of 25-44 randomly assigned to either experimental or control group. Max. VO_2, HR submaximal treadmill walking, resting HR and blood pressure and body composition were determined before and after a 10-week aerobic dance program. During the 10 weeks treatment period the experimental subjects participated in 45 min of aerobic dance session at 70-85 % of the HRR, 3 days per week, whereas the control group did not participate in any regular strenuous physical activity. Each dance session consisted of 7 min of warm-up, 30 min of conditioning dance routines and 8 min of cool down dancing. After the treatment, max VO_2 increased more in the experimental group than in the control group, changes in the HR responses during submaximal treadmill test were greater in the experimental group. Also resting HR decreased significantly in the experimental group but did not change in the control group. Changes in resting systolic and diastolic blood pressures and changes in the body composition were not significantly different in both groups. It was concluded that aerobic dance performed for 30-45 min, 3 days per week over a 10 weeks period of time significantly increases physical work capacity and cardiovascular function but without a dietary control, does not alter body composition in sedentary young middle-aged women.

Blessing, Wilson, Puckett and Ford (1987) examined the changes in maximum oxygen uptake (max VO_2) and body composition following 8 weeks of aerobic dance with and without hand-held weighs. 28 college females volunteered and were given a preoxygen and post oxygen uptake treadmill test. Body composition was measured by taking the sum of five skinfold sites and determining the percent change following training. Aerobic dance session consisted of 5 min of warm-up, 45 min of aerobic dance and 5 min cool-down activities. Exercise intensity was set to 70-85 %

of age predicted maximum heart rate. No significant changes existed for max VO_2 and body composition between two groups after 8 weeks of training. However both groups improved their maximum oxygen uptake (max VO_2).

In the study of Williford, Blessing, Barksdale and Smith (1988) the effects of 10 weeks long aerobic dance training on plasma lipid and lipoprotein levels, cardiovascular function and body composition was examined. 10 untrained females with mean age of 23 made up the experimental group and 8 untrained females with mean age of 26 made up the control group of this study. Subjects fasted for 12-14 hrs for the collection of pre- and post- training blood samples for determination of tryglycerides (TG), total cholesterol (TC), high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) levels. Also pre- and post- max VO_2 was determined from a maximal treadmill test by Bruce Protocol and body composition was determined by hydrostatic weighing method. The training sessions for the aerobic group consisted of 5-10 min of warm-up and stretching, 30 min of aerobic dance at 60-90 % of HRR, concluded with a 7-min cool-down period. Training was conducted 3 days per week for 10 weeks. After the treatment, TG, TC, HDL-C, LDL-C, CHOL/HDL-C and CHOL/LDL-C did not change for either the experimental or control groups. Changes in the max VO_2 were significantly greater in the experimental group than in the control group. Also this was same for the time on a continuous grade incremented treadmill test. Body composition did not change significantly in either group. It was concluded from this study that 10 weeks of aerobic dancing can significantly improve cardiovascular fitness independent of changes in serum lipids, lipoproteins and body composition.

Schraff-Olson, Williford and Smith (1992) have studied the relationship between heart rate and oxygen consumption for aerobic dance exercise. 11 females with mean age of 33.47 $\pm$ 4.87 who currently engaged in various aerobic dance programs completed 20 min of aerobic dance with continuous monitoring of heart rate and oxygen consumption. Maximal treadmill testing was performed in Bruce Protocol and seven days after the treadmill test, subjects performed aerobic dance test with continuous monitoring of the selected physiological responses every 15 sec.

These physiological responses were heart rates, ventilatory rates, metabolic responses as VO_2 max, RER and RPE. The results showed that for aerobic dance to produce a response in excess of 50 % of max VO_2, the target HR must be approximately 80 % of the age-predicted max HR or greater. The maximum HRR method was also found to underestimate the actual oxygen consumption. With the Karvonen method the target HR must approximately be 65 % of max HRR in order to elicit a VO_2 response which is representative of 50 % of max. VO_2. These data support recent research which illustrates that target HR prescriptions derived from treadmill testing may fail to accurately place aerobic dance participants in the recommended training zone.

McCord, Nichols and Patterson (1989) investigated the effects of a 12 week program of low impact aerobic dance conditioning on max VO_2, submaximal HR and body composition of college-aged women. 16 women exercised 3 days per week for 12 weeks with approximately 45 minutes per session at 75-85 % of their HRR. All testings were conducted within one week pre- and post- training. Each session started with a 5-10 min of warm-up segment followed by 30-35 min of low impact aerobic exercise. A 5-10 min of cool down period followed each phase. Each subject was given her own training range initially on 70-75 % of their max HRR. After about 2 weeks of adjustment, subjects performed the training HR equal to 75-85 % of their pretest max HRR. A small but significant increases had been observed in max VO_2. Submaximal HR at min 2-3, 3-4 and 4-5 of the graded exercise test decreased significantly. Body fat showed a significant decrease with no change in the body weight. Low impact aerobic dance is found to be as effective as other endurance training sessions in improving cardiovascular fitness and decreasing body fat.

Garber, McKinney and Carleton (1992) examined the physiological effects of 8 weeks long aerobic dance program and compared these effects with that of a walk-jog training program. 35 male and female University employees between the ages of 24-48 were randomly assigned to an aerobic dance program, walk-jog program and sedentary control group. Each subject was given a treadmill test before and after the training sessions. Each experimental group met for 50 min on 3 days per week for 8 weeks. With 10 min of warm-up and stretching, 15-25 min of aerobic activity, 10-15

min of calisthenics and a 5 min of cool-down continued. Exercise intensity was set at the HR corresponding to 60-80 % of the peak oxygen uptake measured during the first exercise test. Subjects recorded their radial pulses and RPE several times during the exercise session. Significant increases in max VO_2 was observed in both experimental groups while no significant changes was observed in the control group. Peak HR decreased significantly in the experimental group but unchanged in the control group. Body composition, peak respiratory ratio and peak minute ventilation remained the same for both groups. As a result, aerobic dance program was found to show similar improvements in aerobic power as walk-jog program. Thus an aerobic dance program is an effective alternative to a traditional walk-jog training regime.

Berry, Camala, Berry and Davis (1992) compared the hemodynamic and sympathetic nervous system activity responses during aerobic dance and treadmill running to see whether various forms of arm exercises produce any different changes in the heart rate. Nine healthy females exercised at approximately 50 % of their VO_2 max. during each of the following exercise trails. Aerobic dance where the arms were used extensively overhead (ABOVE), aerobic dance where the arms were kept below the shoulders (BELOW) and treadmill running (TR). First subjects completed a treadmill test for the determination of VO_2 max. During submaximal exercise trials, gas exchange variables were continuously measured. HRs were measured every minute. Blood pressures were taken at minutes 7 and 17 while cardiac output determinations were made at min. 8 and 18. Blood samples were drawn at the completion of the rest period prior to the start of the exercise routine and immediately following the completion of the exercise routines. Mean HR values during the ABOVE, BELOW and TR trials were 136 beat/min. for all three trials. Mean VO_2 max. values during the ABOVE, BELOW and TR trials were 1.48, 1.51 and 1.47 l/min respectively and were not significantly different. Mean CQ for the ABOVE, BELOW and TR were 13.5, 14.0 and 13.0 l/min respectively and were not statistically different. Post exercise blood lactate and norepinephrine values were not significantly different among three trials. These results suggest a similar relationship between HR and VO_2 max. during low intensity aerobic dance and running and do not support the contention that the use of the arms overhead during the aerobic dance exercise elicits

a disproportionally greater increase in HR as compared with running. Additionally these results demonstrate similar cardiovascular and sympathetic nervous system responses between aerobic dance exercise and running.

Bell and Bassey (1994) compared the relation between oxygen uptake and heart rate during different styles of aerobic dance and a traditional step test in ten healthy women. Dance was choreographed into progressively more energetic sequences typical of community classes, and videotaped. Oxygen uptake was assessed using a respirometer carried on in a back-pack. Each of the two tests (dance and step) took 15-20 min. and measurements were made in randomized balanced order on the same day. The mean oxygen costs of dance ranged from 1.29 $l.min^{-1}$ for low impact style to 1.83 $l.min^{-1}$ for high impact style with arm work; mean heart rates were 135 and 174 beats. min^{-1} respectively. Low impact dance raised heart rates above 60 % of predicted maximum and so would provide training; during high impact dance recorded heart rates sometimes exceeded recommended safe limits. The addition of arm work significantly increased heart rates heart rates in both high and low impact dance but oxygen pulses for each style of dance were compared no significant differences attributable to arm work were found. Moreover calculated differences between oxygen uptakes in stepping and dance at the same heart rates were not significant for any of the four styles. Analysis of variance confirmed that neither arm work nor contributed significantly to the differences, so there was no evidence these forms of dance change the normal relation between heart rate and oxygen uptake found in dynamic activities with large muscle groups such as stepping.

Russel (1983) examined a typical aerobic dance program, conducted in an actual field setting, to see if aerobic dance was doing the students justice, despite a variety of instructors, teaching methodologies and possible time constraints. Three groups of college-ages female subjects each divided into pretest-posttest group and a posttest only group were examined Experimental subjects, randomly selected from two instructors' aerobic dance classes, either trained twice a week for 40 minutes over a 9 -10 week period or participated in comparable additional aerobic activities outside of the class, as well as the aforementioned training. Prior to commencement of the

aerobic dance program the pretest portion of each group participated in Astrand-Rhyming Submaximal Bicycle Ergometer test which determined their initial cardiovascular fitness level. After conclusion of the 9-10 weeks of aerobic dance program all subjects were posttested. After steady state exercise was obtained, each subjects' heart rate response to submaximal exercise at a fixed workload was recorded. Results indicated no significant differences among three groups so as a conclusion this study failed to prove that aerobic dance training improve cardiovascular fitness.

CHAPTER III

METHODS AND PROCEDURES

Measurement of the selected physiological parameters was performed at the Human Performance Laboratory of Physical Education and Sports Department at the Middle East Technical University and the blood samples were taken for the analysis of blood lipids and lipoproteins at the Medical Center Laboratory of the Middle East Technical University.

3.1 Selection of the Subjects

The subjects of this study were 60 sedentary female college students of Middle East Technical University. They were between the ages of 19-28 and they participated in this study on a volunteer basis. They were randomly assigned to one of the three groups as step aerobics (n=20), aerobic dancing group (n=20) and control group (n=20).

3.2 Research Design

This study was experimental in nature. The following steps were taken to insure a high degree of internal validity:

All testings were standardized. All subjects were sedentary. Although voluntarily selected, the subjects were randomly assigned to each group. Pre-tests were conducted one week prior to the training. Post-tests were conducted one week following the end of the training. The training was performed 3 days per week for 8 weeks. Each training session lasted about 45 minutes. To eliminate any other effect, the subjects were asked not to participate in any other physical activity during the study.

This study might be generalizable only to college-aged female population who want to participate in either step aerobics or aerobic dancing courses for about 8 weeks.

3.3 Methods

Both step aerobics and aerobic dancing group participated in sessions of 45 minutes per day, 3 days per week for 8 weeks. Each session started with a 5-7 min. of warm-up, continuing with either step aerobics or aerobic dancing for 20 min. at their individual target heart rate zone which was determined according to the ACSMs' guidelines (60 - 70 % of Heart Rate Reserve). The Heart Rate Reserve (HRR) was determined by Karvonen formula (Bompa, 1994) :

Maximal Heart Rate : 220 - Age

Heart Rate Reserve = Maximal Heart Rate -Resting Heart Rate

(HRR) (HR max) (HR rest)

Target Heart Rate = (60-70 % × HRR) + HR rest

The music for exercise session was selected by the instructor and the subjects kept up with the rhythm of the music to ensure that their individual heart rate was at 60 - 70 % of their heart rate reserve. In order to obtain this goal, the subjects' heart rates were monitored 3 times by pulse method from the carotid artery by each subject to ensure that heart rate stayed within the target zone, one time after the warm-up, one time after the training session and one time after the cool down. During the 8 weeks of training period the mean heart rates were calculated and it was 157 ± 1.41 bpm for the step aerobics group and 158 ± 1.35 bpm for the aerobic dancing group. After the training session, the subjects completed 10 min. of floor exercises for legs and abdomen and 5 min. of cool-down exercises. The control group received no treatment and did not participate in any regular physical activity during the 8 weeks period.

3.4 Testing Procedures

All subject groups of this study were tested one week prior to and one week following the 8 weeks of the training. Prior to testing each subject received a written informed consent (Appendix A) after the explanation of the testing procedure of this study. The results of the tests were recorded on the subjects information sheet (Appendix B). The testing procedure were as follows:

Subjects' body weight were measured in kilograms by using a calibrated platform scale (Nanbaskül A.S) and their height were measured in centimeters with a scale-mounted anthropometer which was located on the platformscale.

Skinfold method was used for the determination of the body fat percentage. Skinfold measurements were taken from four sites as triceps, suprailiac, abdomen and thigh by using skinfold caliper (Holtain Ltd). Each site was marked visually so that consequent trials of measurement was taken at the identical site. The trials were repeated until the same readings obtained. All measurements were taken on the right side of the body when the subject was standing in erect position with her arms at her side. Sum of skinfolds were taken and body fat percent was determined by YMCA's Percent Fat Estimates Table (Golding, 1989).

Leg circumference was measured from thigh and calf muscles by using a tape line. Thigh circumference was measured same as the skinfold measurement as midway between the inguinal crease and proximal border of patella and calf circumference was measured at the maximum circumference of the calf with the subject standing feet spread 20 cm. apart and weight evenly distributed (Heyward, 1991).

Flexibility was determined by the sit and reach test by using a sit and reach box. The subject sat on the floor with legs fully extended and bottom of feet against the sit and reach box and extended the arms forward without moving the trunk. Then the distance between the tips of hands to the edge of the box was measured. The subject then reached forward and slid her fingers along the stick while keeping the

knees extended. When the subject came to final position, the distance was measured. Two trials were taken and the best was regarded as the flexibility distance.

For the measurement of the muscular endurance the subjects performed sit-up for one minute. The knees were kept flexed and the feet rested on the floor. The hands were under the neck and the subject touched her elbow to the knees.

Cardiovascular fitness was determined by maximum oxygen consumption (max. VO_2) and this was estimated by an indirect method when the subject walked/run on a treadmill (Quinton, Model Q65) by using Bruce Protocol. During the treadmill test, blood pressure and heart rate were monitored and recorded in 3 min. intervals for the purpose of controlling the subjects. VO_2 max. values for women were calculated with following formula given by Rogers (1990) for the Bruce protocol:

$$(3.62 \times \text{min.}) + 3.91$$

Blood samples were drawn by a registered nurse and analyzed by a technician in the Medical Center Laboratory at Middle East Technical University. Approximately 5 ml of blood was drawn in a standardized form from the antecubital vein. Coobas Mira Plus (Roche) was used to analyze total cholesterol, triglycerides, HDL-C and LDL-C levels.

3.4 Treatment of the Data

The means and standard deviations were calculated for the measured variables. Percent difference was computed as follows to determine the percentage of improvement :

$$\frac{\text{Pre-test score - Post-test score}}{\text{Pre-test score}} \times 100$$

Gained scores which was the difference between post- and pre-test was computed and oneway ANOVA was used to compare the gained scores of three

groups. Tukey-HSD test was used to test in which group the significant difference occurred. The level of the significance was set at $p < 0.05$ and SPSS computer software was used for the statistical analysis.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to compare the selected physiological parameters of step aerobics and aerobic dancing after an 8 weeks of training. A total of 60 sedentary subjects volunteered to participate in this study and were randomly and equally assigned to one of the three groups: Step Aerobics group, Aerobic Dancing group and the Control group. The subjects who did not complete 85 % of training period was not taken to post-test measurements and were excluded from the study. Therefore 48 subjects completed more than 85 % of training period, leaving 16 in step aerobics group, 16 in aerobic dancing group and 16 in control group.

Subjects were tested prior to and after the 8 weeks of training. Means and standard deviations of pre-test are given in table 1.

Table 1: Means and Standard Deviations in Pre-Test

	Step Aerobics Group (N=16)	Aerobic Dance Group(N=16)	Control Group(N=16)
Variable	Pre-Test	Pre-Test	Pre-Test
Age (yr)	21.88 ± 2.16	20.23 ± 0.16	21.88 ± 1.82
Height (cm)	164.25 ± 5.27	164.54 ± 5.08	162.69 ± 4.47
Body Weight (kg)	56.50 ± 5.13	55.54 ± 5.12	56.62± 5.21
Body Fat (%)	20.58 ±3.45	20.08 ± 3.04	18.71 ± 4.55
Fat Weight (kg)	11.79 ± 2.53	11.02 ± 1.77	10.69 ± 3.42
Lean Body W. (kg)	44.72 ± 4.02	44.52 ± 4.64	45.89 ± 3.30
Sit-Up (/min.)	22.13 ± 6.89	22.62 ± 8.23	24.25 ± 5.91
Sit and Reach (cm)	23.25 ± 7.83	30.15 ± 8.65	26.31 ± 7.60
VO_2 max.($ml/kg^{-1}.min^{-1}$)	30.93 ± 2.95	30.41± 2.72	31.66 ± 4.80
TC (ml/dl)	166.53 ± 31.92	160.00 ± 22.08	160.38 ± 34.81
TRIG (ml/dl)	96.40 ± 33.33	103.42 ± 21.46	83.00 ± 22.77
HDL-C (ml/dl)	38.47 ± 3.64	38.50 ± 5.22	36.62 ± 4.01
LDL-C (ml/dl)	80.53 ± 10.89	79.75 ± 9.14	78.15 ± 12.16

Means and standard deviations of post-test are given in table 2.

Table 2: Means and Standard Deviations in the Post-Tests

	Step Aerobics Group (N=16)	Aerobic Dance Group(N=16)	Control Group(N=16)
Variable	Post-Test	Post-Test	Post-Test
Age (yr)	21.88 ± 2.16	20.23 ± 0.16	21.88 ± 1.82
Height (cm)	164.25 ± 5.27	164.54 ± 5.08	162.69 ± 4.47
Body Weight (kg)	56.81 ± 4.84	55.62 ± 5.47	57.13± 5.37
Body Fat (%)	18.23 ± 3.04	19.22 ± 3.03	20.17 ± 5.11
Fat Weight (kg)	10.45 ± 2.42	10.72 ± 2.11	12.32 ± 5.27
Lean Body W. (kg)	46.06 ± 2.94	44.90 ± 4.52	44.81 ± 4.12
Sit-Up (/min.)	27.31 ± 4.63	26.69 ± 5.93	23.44 ± 6.12
Sit and Reach (cm)	25.69 ± 7.94	31.43 ± 8.25	25.94 ± 7.43
VO_2 max.($ml/kg^{-1}.min^{-1}$)	34.41± 1.89	32.89 ± 1.99	31.09 ± 3.67
TC (ml/dl)	126.73 ± 25.38	131.83 ± 22.68	143.92 ± 34.33
TRIG (ml/dl)	68.67 ± 17.24	81.17 ± 16.34	76.69 ± 29.51
HDL-C (ml/dl)	44.93 ± 8.32	40.25 ± 6.35	37.54 ± 7.01
LDL-C (ml/dl)	71.00 ± 5.78	72.17 ± 6.31	75.46 ± 10.51

For the control group mean age was 21.88 ± 1.82 yrs and mean height was 162.69 ± 4.47 cm at the pre- and post tests . The mean body weight at pre- and post-tests was 56.62 ± 5.21 kg and 57.13 ± 5.37 kg. The mean percent body fat at the pre-test was 18.71 ± 4.55 % and at the post-test it was 20.17 ± 5.11 %. Mean fat weight at the pre-test was 10.69 ± 3.42 kg and at the post test it was 12.32 ± 5.27 kg. The mean lean body weight at the pre- and post-tests were 45.89 ± 3.30 kg and 44.81 ± 4.12 kg respectively. The mean sit-up value at the pre-test was 24.25 ± 5.91 per min. and at the post-test was 23.44 ± 6.12 per min. In sit and reach test, mean values was 26.31 ± 7.60 cm for the pre-test and 25.94 ± 7.43 cm for the post-test. The mean VO_2 max. values was 31.66 ± 4.80 $ml/kg^{-1}.min^{-1}$ at the pre-test and 31.09 ± 3.67 $ml/kg^{-1}.min^{-1}$ at the post-test. The mean total cholesterol levels were 160.38 ± 34.81 mg/dl at the pre-test and 143.92 ± 34.33 mg/dl at the post test. The mean triglyceride levels at the pre- and post-tests were 83.00 ± 22.77 mg/dl and 76.69 ± 29.51 mg/dl respectively. In HDL-C levels, mean values at the pre test was 36.62 ± 4.01 mg/dl and at the post test it was 37.54 ± 7.01 mg/dl . The mean LDL-C levels at the pre-test was 78.15 ± 12.16 mg/dl and at the post test it was 75.46 ± 10.51 mg/dl.

For the step aerobics group, mean age was 21.88 ± 2.16 yrs and mean height was 164.25 ± 5.27 cm at the pre- and post-tests. Mean body weight at the pre-test was 56.50 ± 5.13 kg and at the post test it was 56.81 ± 4.84 kg. In body fat percent , mean values at the pre- and post-tests were 20.58 ± 3.45 % and 18.23 ± 3.04 % respectively. The mean fat weight values was 11.79 ± 2.53 kg at the pre test and 10.45 ± 2.42 kg at the post test. The mean lean body weight values at the pre-test was 44.72 ± 4.02 kg and at the post-test it was 46.06 ± 2.94 kg. The mean sit-up values at the pre-test was 22.13 ± 6.89 per min. and at the post-test it was 27.31 ± 4.63 per min. The mean sit and reach values at the pre- and post-tests were 23.25 ± 7.83 cm and 25.69 ± 7.94 cm respectively. Mean VO_2 max. values at the pre- and post-tests were 30.93 ± 2.95 $ml/kg^{-1}.min^{-1}$ and 34.41 ± 1.89 $ml/kg^{-1}.min^{-1}$ respectively. Mean total cholesterol levels at the pre-test was 166.53 ± 31.92 mg/dl and at the post-test it was 126.73 ± 25.38 mg/dl. Mean triglyceride levels at pre- and post-tests were 96.40 ± 33.33 mg/dl and 68.67 ± 17.24 mg/dl respectively. Mean HDL-C levels at the pre-test was 38.47 ± 3.64 mg/dl and at the post-test it was 44.93 ± 8.32 mg/dl. Mean LDL-C levels at the pre- and post- tests were 80.53 ± 10.89 mg/dl and 71.00 ± 5.78 mg/dl respectively.

For the aerobic dance group, mean age was 20.23 ± 0.16 yrs and mean height was 164.54 ± 5.08 cm at pre- and post-tests. Mean body weight at the pre-test was 55.54 ± 5.12 kg and at the post-test it was 55.62 ± 5.47 kg. Mean body fat percent at the pre-test was 20.08 ± 3.04 % and at the post test it was 19.22 ± 3.03 %. Mean fat weight of the aerobic dancing group at pre- and post-tests were 11.02 ± 1.77 kg and 10.72 ± 2.11 kg respectively. Mean lean body weight was 44.52 ± 4.64 kg at the pre-test and 44.90 ± 4.52 kg at the post test For the aerobic dancing group, mean pre- and post-sit-up values were 22.62 ± 8.23 per min and 26.69 ± 5.93 per min. respectively. In sit and reach test, mean pre- and post-test values were 30.15 ± 8.65 cm and 31.43 ± 8.25 cm respectively. Mean VO_2 max. values of the aerobic dancing group at the pre-test was 30.41 ± 2.72 $ml/kg^{-1}.min^{-1}$ and at the post-test it was 32.89 ± 1.99 $ml/kg^{-1}.min^{-1}$. The mean cholesterol levels was 160.00 ± 22.08 mg/dl at the pre-test and 131.83 ± 22.68 mg/dl at the post-test. Mean triglyceride levels of the

aerobic dancing group at the pre-test was 103.42 ±21.46 mg/dl and at the post-test it was 81.17 ± 16.34 mg/dl . Mean HDL-C levels at pre an post tests were 38.50 ± 5.22 mg/dl and 40.25 ± 3.35 mg/dl. Mean LDL-C levels of aerobic dancing group was 79.75 ± 9.14 mg/dl at the pre-test and 72.17 ± 6.31 mg/dl at the post test.

To test if any significant difference exits among three group, one-way ANOVA was used. First of all, gained scores which is the difference between post- and pre-test, was computed and used in one-way ANOVA. These scores were used to see which group improved more than other.

One-way ANOVA revealed that there were no significant differences in body weight, triglycerides and LDL-C. On the other hand it also revealed that there were significant differences in body fat percent, fat weight, lean body weight, sit-up, sit and reach, VO_2 max., cholesterol and HDL-C among three group at the significance level of $p<.05$. In order to determine in which group the significance occurred, groups were compared with each other by Tukey-HSD test.

Table 3: One-Way ANOVA Values for Body Weight.

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	1.434	.717	.392	.678
Within Groups	45	82.361	1.830		
Total	47	83.795			

As can be seen from the table there were no significant differences among three group in body weight (Table 3).

Table 4 : One-Way ANOVA values for Body Fat Percent

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	118.09	59.04	8.06	.001*
Within Groups	45	329.51	7.32		
Total	47	447.59			

(*) Significantly different ($p< .05$)

It is seen in the table that there were significant difference among the gained scores of three group in body fat percent at p< .05 (Table 4).

Table 5: Tukey-HSD test results of three groups in Body Fat Percent

N	Mean	Groups	Step .Grp.	Aerobics Grp	Control Grp
16	-2.36	Step .Grp.	-	-	-
16	- .86	Aerobics Grp	-	-	-
16	1.46	Control Grp	*	*	-

(*) Denotes pairs of groups significantly different at p< .05.

In body fat percent, the means of gained scores were -2.36 % for the step aerobics group, -.86 % for the aerobic dancing group and 1.46 % for the control group. Results of Tukey-HSD test indicated significant differences between control group and step aerobics group, control group and aerobic dancing group (Table 5).

Table 6: One-Way ANOVA values for Fat Weight

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	73.01	36.51	6.59	.003*
Within Groups	45	249.19	5.54		
Total	47	322.21			

(*) Significantly different (p< .05).

There were significant differences among the gained scores of three groups in fat weight at p< .05 (Table 6).

Table 7: Tukey-HSD test results of three groups in Fat Weight.

N	Mean	Groups	Step Grp.	Aerobics Grp	Control Grp
16	-1.34	Step Grp.	-	-	-
16	- .30	Aerobics Grp	-	-	-
16	1.64	Control Grp	*	-	-

(*) Denotes pairs of groups significantly different at p< .05.

In fat weight, the means of gained scores were -1.34 kg for the step aerobics group, -.30 for the aerobics dancing group and 1.64 kg for the control group. Tukey-HSD test results indicated that there were significant differences between control group and step aerobics group (Table 7).

Table 8: One-Way ANOVA values for Lean Body Weight.

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	47.51	23.76	5.14	.009*
Within Groups	45	208.09	4.62		
Total	47	255.60			

(*) Significantly different ($p < .05$).

As can be seen from the table, there were significant differences among the gained scores of three groups in lean body weight at $p < .05$ level (Table 8).

Table 9: Tukey-HSD test results of three groups in Lean Body Weight.

N	Mean	Groups	Control Grp	Aerobics Grp	Step Grp.
16	-1.08	Control Grp	-	-	-
16	.39	Aerobics Grp	-	-	-
16	1.34	Step Grp.	*	-	-

(*) Denotes pairs of groups significantly different at $p < .05$.

In lean body weight, the means of gained scores were -1.08 kg for the control group, .39 kg for the aerobic dancing group and 1.34 kg for the step aerobics group. Tukey-HSD test results showed that there was significant differences between control group and step aerobics group (Table 9).

There are very few studies about step aerobics in the literature and their results are inconsistent with each other.

In a study by Velazquez and Wilmore (1991) no significant differences were found in terms of body composition after 12 weeks of step aerobics training and this

result is inconsistent with the results of the present study. On the other hand, Kravitz et. al. (1993) examined the effects of 8 weeks of step aerobics training on some physiological parameters and found no change in the body weight, 8 % decrease in body fat percent , 9 % decrease in fat weight and a very small and insignificant increase in lean body weight. With the exception of changes in lean body weight, this study is consistent with the findings of the present study in that in the present study body weight showed no significant change, body fat percent and fat weight decreased about 11 % and lean body weight increased about 3 %.

According to ACSM (1990), endurance type of exercises that includes 20-60 min. of continuous exercise performed 3 days per week shows reductions in body weight, body fat t percent and fat weight while lean body weight remains constant or increases. In the present study no change in the body weight was probably due to a 3 % increase in lean body weight of the step aerobics group.

Some studies related with aerobic dance training (Milburn and Butts 1983, Garber et. al. 1992 and Clearly et. al. 1984) indicated no significant change in terms of body weight of the subjects after 7, 8 and 10 weeks of aerobic dance training as in the case of the present study.

Results of the studies of Dowdy et. al. (1985), Parker et. al. (1989), Blessing et. al. (1987) and Williford et. al. (1988) indicated no significant differences in body weight, body fat percent, fat weight and lean body weight of the aerobic dancing subjects. The duration of aerobic dance training was 8 weeks for the first three studies and 10 weeks for the last study. Except for the body fat percent, these studies have similar findings as in the present study. Aerobic dance group showed 4 % significant decrease in body fat percent as a result of 8 weeks of training.

On the other hand, Mc Cord et. al. (1989) found no significant change in body weight but did found a significant decrease in body fat percent and fat weight with a significant increase in lean body weight at the end of 12 weeks of aerobic dance training. This inconsistent finding might have resulted from increased duration of training when compared with the present study.

Table 10: One-Way ANOVA values for Thigh Circumference

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	12.144	6.072	1.478	.239
Within Groups	45	184.786	4.106		
Total	47	196.929			

As can be seen from the table, there were no significant difference among three group (Table 10).

Table 11: One-Way ANOVA values for Calf Circumference

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	6.133	3.067	3.402	.042*
Within Groups	45	40.567	.902		
Total	47	46.701			

(*) Significantly different (p< .05).

As can be seen from the table, there were significant differences among the gained scores of three group in calf circumference (Table 11).

Table 12: Tukey-HSD test results of three groups in Calf Circumference

N	Mean	Groups	Step Grp.	Aerobics Grp	Control Grp
16	-.563	Step Grp	-	-	-
16	-.153	Aerobics Grp	-	-	-
16	.313	Control Grp	*	-	-

(*) Denotes pairs of groups significantly different at p< .05.

In calf circumference, the mean of gained scores was -.563 cm for the step aerobics group, -.153 cm for the aerobic dancing group and .313 cm for the control group. Tukey-HSD revealed that there was significant difference between step aerobics group and the control group (Table 12).

Women preferring aerobic dance as a means of improving fitness, usually believes that step aerobics increases leg circumference as a result of muscle hypertrophy. However the result of the present study indicated no significant change in thigh circumference and a significant decrease in calf circumference of the step aerobics group when compared with the control group.

Table 13: One-Way ANOVA values for Sit-Up.

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	326.026	163.013	10.886	.0001*
Within Groups	45	673.798	14.973		
Total	47	999.825			

(*) Significantly different ($p < .05$).

There were significant differences among the gained scores of three groups in sit-up at $p < .05$ level (Table 13).

Table 14: Tukey-HSD test results of three groups in Sit-Up

N	Mean	Groups	Control Grp	Aerobics Grp	Step Grp.
16	-.813	Control Grp	-	-	-
16	4.076	Aerobics Grp	*	-	-
16	5.188	Step Grp.	*	-	-

(*) Denotes pairs of groups significantly different at $p < .05$.

In sit-up, the mean of gained scores was -.813 /min for the control group, 4.076 /min for the aerobic dancing group and 5.188 /min for the step aerobics group. Tukey-HSD test indicated that there were significant differences between control group and aerobic dancing group, control group and step aerobics group (Table 14).

Tukey-HSD test results revealed that at the end of 8 weeks of training, both step aerobics group and aerobic dancing group showed a significant improvement in terms of abdominal muscular endurance which makes about 23 % increase for the

step aerobics group and 18 % increase for the aerobic dancing group in the number of sit-ups per minute.

Unfortunately no study have been found in the literature related with the effects of step aerobics and aerobic dancing on the muscular endurance. On the other hand the frequency, duration and intensity of the training programs in the present study were within the limits of ACSMs' (1990) and Heywards' (1991) recommendations for the development of muscular endurance. Therefore when the nature of both step aerobics and aerobic dance training are taken into consideration such improvements in muscular endurance was within the expectations of the present study.

Table 15: One-Way ANOVA values for Sit and Reach.

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	63.928	31.964	6.323	.0038*
Within Groups	45	227.450	5.054		
Total	47	291.378			

(*) Significantly different (p< .05).

As can be seen from the table, there were significant differences among the gained scores of three groups in sit and reach at p< .05 level (Table 15).

Table16: Tukey-HSD test results of three groups in Sit and Reach.

N	Mean	Groups	Control Grp	Aerobics Grp	Step Grp.
16	-.375	Control Grp	-	-	-
16	1.277	Aerobics Grp	-	-	-
16	2.437	Step Grp.	*	-	-

(*) Denotes pairs of groups significantly different at p< .05.

In sit and reach test, the mean gained scores was -.375 cm for the control group, 1.277 cm for the aerobic dancing group and 2.437 cm for the step aerobics group. Tukey-HSD test results revealed that there were significant difference between control group and step aerobics group (Table16).

In the present study, Tukey-HSD test indicated that after the 8 weeks of training step aerobics group improved significantly in terms of flexibility when compared with aerobic dance and control groups.

According to Fox, Bowers and Foss (1993) regularly scheduled programs involving stretching exercises, 15-60 min. per day, 2 to 5 days per week will improve flexibility within five weeks.

Heyward (1991) also stated that flexibility exercises should be used in warm-up and cool-down stages of continuous exercises for 10 to 30 min. per day, three days per week at least 4 weeks period in order to get an improvement in flexibility.

In the present study both step aerobics and aerobic dance training involved exercise sessions with 5-7 min. of warm-up and 5 min. of cool-down exercises that include stretching exercises. As a result of 8 weeks of training step aerobics group improved their back of legs and lower back flexibility about 10 % which was a significant increase while aerobic dancing had a 4 % but not a significant improvement in flexibility when all groups are taken into consideration.

Table17: One-Way ANOVA values for VO_2 max..

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	134.153	67.076	13.233	.000*
Within Groups	45	228.086	5.06		
Total	47	362.239			

(*) Significantly different ($p < .05$).

There were significant differences among the gained scores of three groups in VO_2 max. at $p < .05$ level (Table17).

Table18: Tukey-HSD test results of three groups in VO_2 max..

N	Mean	Groups	Control Grp	Aerobics Grp	Step Grp.
16	-.563	Control Grp	-	-	-
16	2.019	Aerobics Grp	*	-	-
16	3.481	Step Grp.	*	-	-

(*) Denotes pairs of groups significantly different at $p < .05$.

In VO_2 max. mean gained scores of control group was -.563 $ml/kg^{-1}.min^{-1}$, mean gained scores of aerobic dancing group was 2.019 $ml/kg^{-1}.min^{-1}$ and mean gained scores of step aerobics group was 3.481 $ml/kg^{-1}.min^{-1}$. Tukey-HSD test results indicated significant differences between control group and aerobic dancing group, control group and step aerobics group (Table 18).

In terms of VO_2 max., Tukey-HSD results revealed that both step aerobics and aerobic dancing groups improved significantly at the end of 8 weeks of training when compared with the control group.

ACSM (1990) recommended that activities that can be maintained continuously for about 20-60 min. and is rhythmical and aerobic in nature, performed 3-5 days per week with an intensity of 60-90 % of HR max. develops and maintains cardiorespiratory fitness and this development may be up to 15 % of increase in VO_2 max.

According to Astrand and Rodahl (1986), training consisting of 3 training sessions per week of some 30 min. duration commonly results in an average of 10-20 % of increase in VO_2 max.

In the study of Velasquez and Wilmore (1991), 12 weeks of step aerobics training program resulted in 16.5 % increase in VO_2 max. while Kravitz et. al. (1993) stated an 8 % increase in VO_2 max. after 8 weeks of step aerobics training.

When aerobic dance studies are considered, it is seen that nearly all of the found significant improvements in VO_2 max. as in the present study.

Milburn and Butts (1983) found a 10.2 % increase in VO_2 max. at the end of 7 weeks of aerobic dance training. Garber et. al. (1992), Blessing et. al. (19879 and Parker et. al. (1989) indicated 10 %, 14.7 % and 11 % increases in VO_2 max. respectively after the 8 weeks of aerobic dance training. Clearly et. al. (1984) stated a 10.7 % and Williford et. al. (1988) stated a 12.28 % increases in VO_2 max. after 10 weeks of aerobic dance training. Finally Mc Cord et. al. (1989) indicated a 7 % improvement in VO_2 max. at the end of 12 weeks of aerobic dance training.

The present study resulted in 11 % of increase in VO_2 max. of the step aerobics group and an 8 % of increase in VO_2 max. of the aerobic dancing group at the end of 8 weeks of training. Therefore results of the present study is consistent with the stated recommendations and the findings of the above studies. Thus both step aerobics dancing and aerobic dance training's are good ways of promoting cardiorespiratory endurance.

Table 19: One-Way ANOVA values for Cholesterol Levels.

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	4085.214	2042.607	8.145	.0010*
Within Groups	42	10533.298	250.793		
Total	44	14618.51			

(*) Significantly different ($p < .05$).

As can be seen from the table, there were significant differences among the gained scores of three groups in cholesterol levels (Table 19).

Table 20: Tukey-HSD test results of three groups in Cholesterol Levels.

N	Mean	Groups	Step Grp.	Aerobics Grp	Control Grp
15	-39.800	Step Grp.	-	-	-
15	-28.167	Aerobics Grp	-	-	-
15	-16.461	Control Grp	*	-	-

(*) Denotes pairs of groups significantly different at $p < .05$.

In cholesterol levels, the mean gained scores was -39.800 mg/dl for the step aerobics group, -28.167 mg/dl and -16.461 mg/dl for the control group. Tukey-HSD test revealed that there were significant difference between step aerobics group and control group (Table 20).

Table 21: One-Way ANOVA values for Triglyceride Levels

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	3716.296	1858.148	2.946	.064
Within Groups	42	26487.953	630.666		
Total	44	30204.248			

There were no significant difference among three groups in triglyceride levels at $p < .05$ level (Table 21).

Table 22: One-Way ANOVA values for HDL-C Levels

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	268.337	134.168	3.690	.033*
Within Groups	42	1526.906	36.355		
Total	44	1795.243			

(*) Significantly different ($p < .05$).

There were significant differences among the gained scores of three groups at $p < .05$ level (Table 22).

Table 23: Tukey-HSD test results of three groups in HDL-C Levels

N	Mean	Groups	Step Grp.	Aerobics Grp	Control Grp
15	6.467	Step Grp.	-	-	-
15	1.750	Aerobics Grp	-	-	-
15	.923	Control Grp	*	-	-

(*) Denotes pairs of groups significantly different at $p < .05$.

In HDL-C levels, the mean gained scores was 6.467 mg/dl for the step aerobics group, 1.750 mg/dl and .923 mg/dl for the control group. Tukey-HSD test revealed that there were significant difference between step aerobics group and control group (Table 23).

Table 24: One-Way ANOVA values for LDL-C Levels

Source	DF	Sum of Squares	Mean Squares	F. Ratio	F. Prob.
Between Groups	2	372.638	186.319	2.485	.096
Within Groups	42	3149.419	74.986		
Total	44	3522.057			

As can be seen from the table, there was no significant difference among three groups at $p < .05$ level (Table 24).

When blood lipids and lipoproteins are taken into consideration, it is seen that 8 weeks of training produced significant decrease in total cholesterol levels (24 %) and a significant increase in the HDL-C levels (17 %)of the step aerobics group when compared with the control group. Aerobics dance group also showed decreases in total cholesterol (18 %) and increases in HDL-C levels (4.5 %) however these changes are not significant when three groups were compared. On the other hand, the 8 weeks of training did not produce any significant changes in any of the group.

Studies related with the effects of exercise on serum lipids and lipoproteins have indicated inconsistent results.

Williford et. al. (1988) investigated the effects of 10 weeks of aerobic dance training on serum lipids and lipoproteins and the results indicated no significant changes in total cholesterol, triglyceride, HDL-C and LDL-C levels of the aerobic dancing group when compared with the control group.

In a meta analysis of studies that investigated the effects of exercise on blood lipids and lipoproteins (Vu Tran, 1983) 66 studies were examined. As a result, this

meta analysis indicated that endurance type of exercise decreases total cholesterol, triglyceride, HDL-C and LDL-C levels of the subjects.

Goldberg et. al. (1985) also indicated that changes in total cholesterol, triglyceride, HDL-C and LDL-C levels are inconsistent. In their review, it is indicated that while in some studies total cholesterol, triglyceride and LDL-C levels decreases, no changes are found in other studies. Also while in some studies HDL-C levels shows significant increases, in other studies no significant changes was found.

In the present study showed inconsistent changes in blood lipids and lipoproteins as a result of step aerobics and aerobics dance training. Perhaps 8 weeks training was not enough to produce expected changes in blood lipids and lipoproteins of both group.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study was designed to compare the effects of 8 weeks of step aerobics and aerobic dancing on selected physiological parameters among college-aged females.

Based on the findings of this study, the following conclusions can be made.

1. Both step aerobics and aerobic dancing group did not experience any change in body weight. Therefore 8 weeks of step aerobics and aerobic dance training were not effective in causing a decrease in body weight.

2. The 8 weeks of training decreased body fat percent of the step aerobics and aerobic dancing group significantly. However these decreases were not significantly different between two experimental groups. Therefore, both step aerobics and aerobic dance training were not superior to each other in decreasing the percent body fat.

3. Although both experimental groups experienced a significant decrease in body fat percent, only step aerobics group had significant changes in fat weight and lean body weight when compared with the control group. There was a significant decrease in fat weight and a significant increase in lean body weight of the step aerobics group. Aerobic dancing group also had decreased fat weight and increased lean body weight, however these changes were not statistically significant. Therefore step aerobics group seemed to be more effective in changing body composition in this study.

4. There was no significant difference in thigh circumference of both experimental groups however in calf circumference step aerobics group showed a

significant decrease when compared with the control group. The two experimental groups were also not difference in calf circumference. Therefore, it can be said that both of the fitness programs did not cause any negative effect in leg circumference.

5. The 8 weeks of step aerobics and aerobic dance training resulted in significant increases in sit-ups. However these increases were not significantly different between these two groups. Hence, both step aerobics and aerobic dancing were effective in improving muscular endurance.

6. In terms of sit and reach, there was significant increase in step aerobics group at the end of 8 weeks of training when compared with the control group. Aerobic dancing group also showed an increase in sit and reach however this improvement was not statistically significant. Therefore step aerobics seemed to be an effective fitness program in improving flexibility.

7. Both step aerobics group and aerobic dancing group showed significant increases in VO_2 max. at the end of 8 weeks of training. However these two groups were not superior to each other in improving VO_2 max. Thus, both step aerobics and aerobic dancing were good ways of promoting cardiorespiratory fitness.

8. The 8 weeks of training produced a significant decrease in total cholesterol levels of the step aerobics group. There also was a decrease in the total cholesterol levels of the aerobic dance group but this decrease was not significant when these three groups were compared. Therefore step aerobics seemed to be an effective way in decreasing total cholesterol levels.

9. Even though, both step aerobics group and aerobic dancing group experienced decreased triglyceride levels after the 8 weeks of training, this was not statistically significant at 0.05 confidence level. Thus it can be said that 8 weeks of step aerobics and aerobic dance training were not effective in decreasing triglyceride levels.

10. There were increases in HDL-C levels of both step aerobics group and aerobic dancing group however, only the increase in step aerobics group was statistically significant.

11. Although both step aerobics and aerobic dancing group showed decreases in LDL-C levels, these were not statistically significant. For this reason, it can be said that 8 weeks of step aerobics and aerobic dance training were not effective in causing a decrease in LDL-C levels.

5.2 Recommendations

In the present study, the effects of step aerobics and aerobic dancing was compared. When the limitations of this study are taken into consideration, the following recommendations are made with regard to further studies.

1. It is recommended that a similar study be carried out with a greater number of subjects.

2. This study was performed with female subjects. It seems to be necessary to repeat similar experiments for both sexes.

3. In the follow-up studies it would be beneficial to control the diet or design a study with a nutritional regimen and examine the effects of it in the selected parameters.

4. It is recommended that in order to achieve a training effect on blood lipids and lipoproteins a similar study be carried out with 10 weeks or longer duration of training period.

5. It is recommended that direct method be used for the determination of VO_2 max.

REFERENCES

American College of Sports Medicine (1990). The Recommended Quantity and Quality for Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness in Healthy Adults. *Medicine and Science in Sports and Exercise.* Vol. 23, No 4 Supplement. pp. 265-274.

American College of Sports Medicine (1993). Resource Manual for Guidelines for Exercise Testing and Prescription. Lea and Febiger. Philadelphia. Second Edition. pp. 66-81, 229-257, 346-347.

American College of Sports Medicine (1991). *Guidelines for Exercise Testing and Prescription.* Lea and Febiger. Philadelphia. Fourth Edition. pp.1-9, 35-50, 271-272.

Astrand, P. O. and Rodahl, K. (1986). *Textbook of Work Physiology: Physiological Bases of Exercise*. Mc Graw-Hill Book Company. New York. pp.330-341, 412-427.

Bell, M. J., and Bassey, J. E. (1994). A Comparison of the Relation Between Oxygen Uptake and Heart Rate During Different Styles of Aerobic Dance and a Traditional Step Test in Women. *European Journal of Applied Physiology.* Vol. 68, pp.20-24.

Berry, J., M. Camala, C. C., Berry, B. C. and Davis, M. (1992). A Comparison Between Two Forms of Aerobic Dance and Treadmill Running. *Medicine and Science in Sports and Exercise*. Vol. 24, No 8, pp. 946-951.

Blessing, D. L., Wilson, D., Puckett, R. J. and Ford, T. H. (1987). The Physiological Effects of Eight Weeks of Aerobic Dance With and Without Hand-Held weights. *The American Journal of Sports Medicine*. Vol. 15, No 5, pp. 508-510.

Blyth, M. and Goslin, B. R. (1985). Cardiorespiratory Responses to Aerobic Dance. *Journal of Sports Medicine*. Vol. 25. pp. 57-63.

Bompa, Tudor. (1994). Theory and Methodology of Training : The Key to Athletic Performance. Kendall/Hunt Publishing Company. Dubuque. Iowa. Third Edition. pp.75-92.

Cline, C. C., Berry, M. J. and Davis M. (1991). Comparison Between Two Forms of Aerobic Dance and Running *Medicine and Science in Sports and Exercise*. Vol. 23, No 4, pp. S141.

Cearly, M. L., Moffatt, R. J. and Knutzen, M. K. (1984). The Effects of Two- and Three-Day-Week Aerobic Dance Program on Maximal Oxygen Uptake. *Research Quarterly for Exercise and Sport*. Vol. 55. No 2. pp. 172-174.

Dowdy, B. D., Cureton, K. J., DuVal, H. P. and Ouzts, G. H. (1985). Effects of Aerobic Dance on Physical Work Capacity, Cardiovascular Function and Body Composition of Middle Aged Women. *Research Quarterly for Exercise and Sport*. Vol. 56. No 3. pp. 227-233.

Eickhoff, J., Thorland, W. and Ansorge, C. (1983). Selected Physiological and Psychological Effects of Aerobic Dancing Among Young Adult Women. *Journal of Sports Medicine*. Vol. 23. pp. 273-280.

Fox, E., Bowers, R. and Foss, M. (1993). *The Physiological Basis for Exercise and Sport*. WCB Brown and Benchmark Publishers. Dubuque. IA. Fifth Edition. pp.158-192, 320-355, 512-532.

Garber, E. C., Mc Kinney, S.J. and Carleton R., A. (1992). Is Aerobic Dance an Effective Alternative to Walk-Jog Exercise Training ? *The Journal of Sports Medicine and Physical Fitness*. Vol. 32. pp.136-141.

Garrick, G. J. and Requa, K. R. (1988). Aerobic Dance: A Review. *Sports Medicine*. Vol. 6, pp. 169-179.

Golding, L. A., Myers, C. R. and Sinning, E. W. (1989). *Y's Way to Physical Fitness : A Complete Guide to Fitness Testing and Instruction*. Human Kinetics Publishers. Third Edition. pp.33-60, 80.

Golding, l. and Elliot, D. L. (1985). The Effects of Physical Activity on Lipid and Lipoprotein Levels. *Medical Clinics of North America*. Vol. 69, No 1, Jan, pp. 41-55.

Haskell, W. J., Leon, S. A., Caspersen, J. C., Froelicher. F. V., Hagberg, M. J., Harlan, W., Holloszy O. J., Regensteiner, G. J., Thompson, D. P., Washburn, A. R. and Wilson, F. P. (1991). Cardiovascular Benefits and Assessment of Physical Activity and Physical Fitness in Adults. *Medicine and Science in Sports and Exercise*. Vol. 24. No 6. pp. S201-220.

Heyward, Vivien. (1991). *Advanced Fitness Assessment and Exercise Prescription.* Human Kinetics Books. Champaign. IL. Second Edition. pp. 1-118, 215-228.

Kravitz, L., Cisar, J. C. and Setterlund, S. J. (1993). The Physiological Effects of Step Training With and Without Hand Weighs. *Journal of Sports Medicine and Physical Fitness*. Vol. 33. pp. 348-358.

McCord, P., Nichols, J. and Patterson, P. (1989). The Effect of Low Impact Dance Training on Aerobic, Submaximal Heart Rate and Body Composition of College Aged Females. *Journal of Sports Medicine and Physical Fitness.* Vol 29. pp. 184-188.

Mc Glynn, G., (1992). *Dynamics of Fitness : A Practical Approach*. Wm.C Brown Publishers. Second Edition. pp.1-9, 67-70.

Milburn, S. and Butts, K. N. (1983). A comparison of the Training Responses to Aerobic Dance and Jogging in College Females. *Medicine and Science in Sports and Exercise*. Vol. 15. No 6. pp. 510-513.

Rogers, Chris. (1990). *Exercise Physiology Laboratory Manual*. Wm. C. Publishers. Dubuque. IA. pp.250

Russell, J., P. (1983). Aerobic Dance Exercise Programs : Maintaining Quality and Effectiveness. *Research Quarterly for Exercise and Sport*. October. pp.114-120.

Parker, S. B., Hurley, F. B., Hanlon, P. D. and Vaccaro, P. (1989). Failure of Target Heart Rate to Accurately Monitor Intensity During Aerobic Dance. *Medicine and Science in Sports and Exercise*. Vol. 21. No 2. pp. 230-234.

Pollock, L. M., Wilmore, H. J. and Fox, M. S. (1978). *Health and Fitness Through Physical Activity*. John Wiley and Sons. New York. First Edition. pp.1-26, 31-65.

Shephard,R.J. and Astrand, P. O. (1992). *Endurance in Sport. Volume II of the Encyclopedia of Sports Medicine*. Blackwell Scientific Publications. Oxford. pp.428-430.

Schraff-Olson, M., Williford, H. N. and Smith, H. F (1991). The Heart Rate VO_2 Relationship of Aerobic Dance : A Comparison of Target Heart Rate Methods. *Journal of Sports Medicine and Physical Fitness*. No 32. pp. 372-377.

Schraff-Olson M., Williford, H. N., Blessing, D.L. and Greathouse, R.. (1992). The Cardiovascular and Metabolic Effects of Bench Stepping Exercise in Females. *Medicine and Science in Sports and Exercise*. Vol. 23. No 11. pp. 1311-1317.

Stanforth, D., Stanforth, P. R. and Velasquez, K. S. (1993). Aerobic Requirement of Bench Stepping. *International Journal of Sports Medicine*. Vol. 14. pp. 129-133.

Velasquez, K. S: and Wilmore, J. H. (1991) (Abs.) Changes in Cardiorespiratory Fitness and Body Composition after a 12-week Bench Step Training Program. *Medicine and Science in Exercise and Sport.* pp.S78.

Vu Tran, Z., Weltman, A., Glass, V. G. and Mood, P. D. (1983). The Effects of Exercise on Blood Lipids and Lipoproteins : A Meta-analysis of Studies. *Medicine and Science in Exercise and Sport* Vol. 15, No 5, *pp. 393-402.*

Williford, N. H., Blessing, D. L., Barksdale, M. J. and Smith, F. H. (1988). The Effects of Aerobic Dance Training on Serum Lipids, Lipoproteins and Cardiopulmonary Function. *The Journal of Sports Medicine and Physical Fitness*. Vol. 28. No 2. pp. 151-157.

Williford, N. H., Schraff-Olson M. and Blessing, D.L. (1989). The Physiological Effects of Aerobic Dance: A Review. *Sports Medicine*. Vol. 8, No 6, pp. 335-345.

APPENDIX A

Informed Consent

There will be series of tests that will evaluate body composition, leg circumference, flexibility, muscular endurance, cardiorespiratory fitness and blood lipids and lipoproteins. Body composition will be determined by taking several skinfold measures to calculate body fat percent. Leg circumference will be determined by taking thigh and calf circumferences. Flexibility will be determined by the sit and reach test. Muscular endurance will be determined by one minute, bent knee sit-up test. Cardiorespiratory fitness will be evaluated by a treadmill walk/run test using Bruce protocol in that the grade and the speed of the treadmill will be increased in every 3 minutes.

You are responsible for monitoring your own condition throughout the tests and should any symptoms occur, you should cease participating and inform the instructor about the symptoms.

I hereby agree that in signing this consent form, I have read this form in its entirety and understand the description of the tests and their components.

Name:_____

Signature:_____ Date:_____

APPENDIX B

Subject Information Sheet

	Pre	Post
Date:	_____	_____

Name: _____ Age: _____ Height (cm): _____

	pre	post
Weight (kg):	_____	_____

Body Composition

Skinfolds	pre	post
Triceps	_____	_____
Suprailiac	_____	_____
Abdomen	_____	_____
Thigh	_____	_____
TOTAL	_____	_____

	pre	post
Body Fat %	_____	_____
Fat Weight (kg)	__	_____
Lean Body Weight (kg)	_____	_____

Circumferences (cm)

	pre	post
Thigh	____	____
Calf	____	____

Muscular Endurance(/min)

	pre	post
Sit-up	____	_____

Flexibility(cm)

	pre	post
Sit and Reach	_____	_____

Blood Parameters(ml/dl)

		Pre	Post
Total Cholesterol	(TC)	_____	_____
Triglyceride	(TG)	_____	_____
HDL-C		_____	_____
LDL-C		_____	_____