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A STUDY OF THE CARDIOVASCULAR TRAINING EFFECTS OF AEROBIC  
DANCE INSTRUCTION AMONG COLLEGE AGE FEMALES

THESIS

Presented to the Graduate Council of the  
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Fulfillment of the Requirements

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By

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Thirty-one college age females enrolled in aerobic dance conditioning classes were subjects. The purposes were to determine if aerobic dance is sufficiently vigorous to elicit a heart rate capable of producing a training effect and to determine whether a training effect heart rate level can be maintained.

The narco-biosystems telemetry was used to monitor heart rates. Each subject performed one aerobic dance at three trials. Twelve-minute run/walk pretests and posttests were given to assign fitness levels.

Results of the study indicate that aerobic dance is an effective cardiovascular training program. Resting heart rates decreased, fitness levels improved, and training intensity heart rates were elicited and maintained at each of the trials.

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## CHAPTER I

### INTRODUCTION

The twentieth century is an age of many technological advances and knowledge explosions; however, technology alone has thus far been unable to bring to a halt our creeping obesity and coronary heart disease. Coronary heart disease is presently killing people in their thirties and forties. Three-fourths of our adult population is overweight, and being overweight contributes to the alarming increase in heart disease (5, p. 732). Other factors which contribute to coronary heart disease are lack of exercise and cigarette smoking (6, p. 6). Despite our technology and knowledge associated with coronary heart disease, the disease is killing people at a greater rate each year.

Many individuals have tried gimmicks to get in "shape," lose weight, and hopefully get on the road to health through exercise. Weight watchers, gym and slim clubs have tried to travel the same road through a variety of dietary regimens. Dr. Kenneth Cooper, president of Cooper's Clinic International, has devoted a great part of his life to research in the areas of preventing heart disease through a program he calls "aerobics." This program provides for a point system to indicate the amount, duration, and frequency of



various types of exercise to determine one's exercise needs.

The idea of aerobics refers to a variety of exercises that stimulate the heart and the lungs for a time period long enough to produce beneficial changes in the body. These beneficial changes are such things as reducing the resting heart rate, increasing stroke volume, decreasing the respiratory rate, lowering systolic blood pressure, lowering blood lipid level, and lowering cholesterol level in the blood (1, pp. 173, 174, 313). All of these improvements will increase human efficiency. The word aerobics means "with oxygen" and refers to the part of the muscle contraction that needs oxygen in order to be performed. Aerobic exercises are not new. They include exercises such as walking, jogging, running, swimming, cycling and rope skipping. In order to be included as aerobic they must be performed at a training intensity with the duration long enough to have a training effect.

Exercises which are not aerobic include bowling, slimnastics, calisthenics, isometrics, gardening, softball, and horseback riding. These are not aerobic, as they are neither vigorous enough nor continuous enough to have a training effect on the heart and circulatory system. All of these should be considered in the situation in which they are presented in order to be classified as aerobic or not. The key terms are training intensity and training duration.

Aerobic capacity is the maximum amount of oxygen that the body can process within a given time period such as a work bout of thirty minutes. Because this capacity reflects the condition of the vital organs, including the lungs, heart, and vascular system, the aerobic capacity is the best index of overall physical fitness (3, p. 33).

Aerobic dance is a new exercise program originated by Jacki Sorensen in 1971. It is an extension of the inherent instinct to play. Aerobic dance is a rhythmic activity and a desirable form of exercise because it meets three of the most important exercise requirements: (1) it trains the cardiovascular system and thus improves the system; (2) it tones skeletal muscles; and (3) it provides mental and emotional release. Aerobic dance has been reported to produce increased agility, coordination, balance, flexibility, and a mental change of pace that disciplines and relaxes the mind (7, pp. 3, 6).

Aerobics, as mentioned earlier, refers to the activity that conditions the body to process and deliver oxygen quickly and efficiently by strengthening the heart, lungs, and vascular system. The word dancing refers to the method Jacki Sorensen uses to improve cardiovascular endurance and to strengthen the musculoskeletal system so a person can move enjoyably and in a vigorous and rhythmical manner.

Jacki Sorensen has choreographed aerobic dances to contain predetermined percentages of (1) vigorous dance

steps to improve aerobic capacity, (2) bends and stretches to improve flexibility, and (3) toning movements.

The dance steps, stretches, and toning movements come from many of the following sources: ballet, modern jazz, modern dance, ballroom dance, folk dance, musical comedy dance, and rock. Movement combinations such as running, rocking, hopping, and jumping in various rhythms have been specifically developed for aerobic dancing.

Aerobic dance workshops are now being conducted throughout the United States by personnel trained by Jacki Sorensen. Although the dancing conditioning classes have been in existence for only two years, considerable response has been evidenced by women attending these classes.

The training procedure for aerobic dancing is for students to dance or keep moving for thirty to forty minutes without sitting down. The students walk or jog between each of the dances. People begin at a walking level when performing the dance and gradually progress to a jogging or running level at their own choosing. This usually depends on their beginning fitness level.

Preliminary results suggest that aerobic dancing is an effective program in conditioning and maintaining the cardiovascular system. In addition it has the added variety and fun necessary to prevent the onset of boredom (7, p. 4).

Oxygen consumption measures during aerobic dancing are now being conducted and results revealed by Foster (4, p. 122)

and Weber (8, p. 30) suggest that this oxygen consumption represents a physiological disturbance comparable to running at a twelve-minute-mile pace.

There is a definite need for a variety of good cardiovascular exercise programs. If research can determine that aerobic dance can be performed at a high level intensity heart rate which would train the cardiovascular system, this would be a big step in validating this new form of conditioning program.

#### Statement of the Problem

Jacki Sorensen, the founder of aerobic dance claims that aerobic dance will train the cardiovascular system. Because of lack of research about aerobic dance, a need exists to investigate if subjects performing aerobic dances can elicit a training intensity heart rate.

#### Purpose of the Study

The study has a two-fold purpose. The primary purpose is to determine if aerobic dance is sufficiently vigorous to elicit a heart rate capable of producing a training effect. A secondary purpose is to determine whether, at five-week intervals of observation, a training effect heart rate level is maintained.

## Hypotheses

The research hypotheses tested for this study are as follows:

I. There will be a significant difference in the mean resting heart rates from trial one to trial three.

II. There will be a significant difference in the mean working heart rates from trial one to trial three.

III. There will be a significant difference in the mean training heart rates from trial one to trial three.

IV. There will be a significant difference in the mean fitness levels from pretest to posttest twelve-minute run/walk scores.

V. There will be a significant difference in the mean working heart rates of three selected aerobic dances.

## Definition of Terms

The following definitions of terms are used in the study:

Aerobic means "with oxygen" and refers to a variety of exercises that stimulate the heart and the lung activity for a time period sufficient enough to produce beneficial long term cardiovascular adjustments.

Aerobic capacity is the maximum amount of oxygen that the body can process within a given time dependent upon the ability to rapidly breathe large amounts of air, forcefully delivering large volumes of blood and effectively delivering

oxygen to the working tissues. This capacity depends on efficient lungs, a powerful heart, and a good vascular system.

Aerobic dance is a rhythmic conditioning program consisting of various pre-choreographed vigorous dances. Each dance lasts from three to five minutes. The pre-choreographed dances include movements such as jogging, hopping, skipping, rocking, and leaping.

Resting heart rate is the heart rate taken after the subject has been reclining for at least ten minutes.

Training effects are changes induced by exercise in the various systems and organs of the body. In connection with aerobic exercises, a training effect would decrease the resting heart rate, lower systolic blood pressure, lower cholesterol level in the blood, lower blood sugar level, lower fat lipid levels in the blood system, increase stroke volume, and decrease the respiratory rate.

Training heart rate is the result of first taking the difference between maximum heart rate (195 bpm) and the resting heart rate, multiplying this difference by 60 percent, and then adding the product to the resting heart rate.

Working heart rate is the heart rate taken immediately upon completion of the dance.

#### Limitations

1. Time of day was not consistent for each subject during the three trials.

2. Eating habits were not regulated, although it was suggested that the subject not eat two hours prior to performing the test.

3. Emotions were not controlled.

4. Consistent motivation could not be controlled.

5. The amount of sleep was not controlled.

6. Apprehension was not controlled.

7. The last five-week session of class was interrupted by one week of vacation and two class periods were missed.

#### Significance of the Study

Aerobic conditioning has been found to be an important part of conditioning for many people. Women are sometimes reluctant to jog, swim, or cycle on a regular basis. If aerobic dance is found to be an aerobic exercise and does have a positive effect on the cardiovascular system, women can have an enjoyable, effective way to become fit.

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## CHAPTER II

### REVIEW OF LITERATURE

Most people will agree to the importance of physical fitness. Many people do question, though, the components of measuring physical fitness. In the literature the majority of authors reviewed seemed to concur that there are three basic components involved in measuring physical fitness. They are as follows:

1. Circulatory and respiratory endurance, which allows one to continue vigorous activities for a reasonably long period of time without becoming breathless or overly fatigued,

2. Muscle endurance, which is the ability to maintain a muscle or a group of muscles in an activity for a length of time, and

3. Muscle strength, which is measured by only one contraction and the effort required for the contraction.

These three components combined promote the following facets of physical fitness: muscle tone, good posture, flexibility, agility, balance, vitality, resistance to fatigue, and the proper functioning of all body systems (7, pp. 10, 11).

Circulatory and respiratory endurance is of importance today as people realize that coronary heart disease is presently killing people at a greater number each year. Studies concerning coronary heart disease have isolated various factors such as lack of exercise, obesity, hypertension, and excessive cigarette smoking as the causes of the disease (12). Graham (16, p. 25) and Cureton (7, p. 3) state that although the development of coronary heart disease is a result of the complex interaction of these features, endurance training appears to have a direct or indirect effect on several of these factors. Endurance training is defined as a mode of exercise involving large muscle masses and is performed continuously for a sufficient duration and intensity to stimulate the cardiovascular system.

#### Intensity

Two classical studies, one by Karvonen, et al. (18) and the other by Hollman and Venrath (17), serve as a practical guide for prescribing exercise for men. Karvonen trained young men for thirty minutes, five times per week on a treadmill and found no significant improvement in maximum working capacity for the group whose sustained heart rate did not reach 130 beats per minute. Subjects whose sustained heart rates were above 143 beats per minute improved significantly. Hollman and Venrath, in a similar

experiment on the bicycle ergometer, found that heart rate values of 130 beats per minute or more were needed to stimulate a training response. These data suggest that young men must exercise at a heart rate level equal to approximately 60 percent of the difference between their maximum and resting heart rates. Astrand (1, p. 213) states that one should train at approximately 50 percent of his maximum oxygen intake, which is in agreement with Karvonen and Hollman and Venrath.

Sharkey and Holleman (26) walked young men on a treadmill three times per week for six weeks at 120, 150, and 180 beats per minute. They found a direct relationship between improvement in cardiovascular efficiency as measured by oxygen intake and the intensity of training.

Shephard (27) designed an experiment to investigate the training stimulus for improving cardiovascular functions. Shephard's design included men training at 96 percent, 75 percent, and 39 percent of maximum intake five, three, and one day per week for twenty-nine, ten, and five minutes per session. He concluded that intensity and duration were the most significant training stimuli, with frequency being less effective.

Gledhill and Eynon (14) further substantiate the value of intensity as a stimulus for eliciting a training effect and they support Shephard's findings concerning level of fitness and its relationship to the threshold for attaining a training response.

### Training in Women

Duration and intensity of exercise required to increase a woman's maximum oxygen consumption have not received much attention in this country. A limited number of investigations of this type are present in the literature. Pollock (23, p. 170) writes that the results from training investigations show that females adapt to training in the same manner as do males. Therefore, it is concluded that the general findings concerning intensity, duration, and frequency should also apply to women. Drinkwater (10) is in accord with Pollock.

Kilbom (19) has provided data of the effects of short-term training of Swedish females across a wide range of ages. For seven weeks they trained on a bicycle ergometer at 70 percent of their maximal aerobic capacity, alternating three minutes of work and two minutes of rest for a period of thirty minutes. As the effect of training was noted in a decreasing heart rate, the intensity of work was increased to keep the rate constant.

A second group worked at 50 percent of maximum either on a bicycle ergometer or walking cross country. A comparison of responses to the same submaximal workloads beforehand and after training revealed significant lower heart rates and blood lactates following training for all girls except the walkers. Increases in maximum oxygen uptakes and blood lactates following training were significant for all age groups. According to Kilbom, there do not

appear to be any sex differences in the ability to profit from physical training.

#### Modes of Training

There are a multitude of training modes available. The question arises as to the relative value of these activities in producing cardiovascular fitness changes. Previous reviews have shown that certain quantities and combinations of intensity, duration, and frequency are necessary to produce and maintain a training effect.

It appears that training effects will occur regardless of mode if the various combinations of intensity, duration, and frequency are held constant. Corbin et al. (6) compared the effects of running, walking, and biking regimen on college men, twenty minutes, five days per week for ten weeks at heart rates of 150 to 160 beats per minute. In general they found running and bicycling to be superior training modes when compared to walking. Pollock et al. (24) found all three modes of training to be equally effective in producing a significant cardiovascular effect at 35 to 90 percent of maximum heart rate or approximately 175 beats per minute.

Skubic and Hodgkins (28) studied heart rate response in women participating in various activities. Tennis and badminton showed moderately high heart rates, but golf, bowling, and archery averaged below 100 beats per minute.

Other studies showing activities that produce significant cardiovascular effects are dancing (8), rope skipping (3, p. 240), and handball (13, p. 139). Cooper (5) has emphasized the point concerning the variety of modes of training response. He devised a point system whereby activities are given point value in respect to their oxygen requirements.

A precise estimate of the energy expended by women during various sports activities is difficult to obtain. The necessity of adding bulky equipment to the performer to measure oxygen uptake directly make such measurements impractical, except during simulated competitions. For these reasons a number of investigators have chosen to predict oxygen uptake from telemetered heart rates, using equations based on relationships determined in the laboratory between maximum oxygen consumption and heart rate during treadmill workouts or other forms of exercises. These predictions are subject to considerable error and should be used as gross estimates (9, p. 190).

When oxygen consumption tests are not possible the relative strenuousness of certain sports has been evaluated by telemetering heart rate (15, 20, 21). It is generally accepted that activities which increase the heart rate above 140 beats per minute provide stimulus for the improvement of cardiovascular functions (26, p. 700).

Heart rate depends on age, body position, food intake, time of day, emotions, and the type of physical activity the person has been engaged in prior to testing (22, pp. 271, 272).

#### Maximum Heart Rate

Christensen and Hoberg (4, p. 292) report that pulse rates as high as 250 to 300 beats per minute may be encountered during short bursts of very intense activity. Astrand and Rhyning (2, p. 220) report that in sustained maximum exercise the pulse rate of young men and of young women is a little under 200 beats per minute. The maximum pulse rate may be somewhat less in athletes than in sedentary subjects.

#### Aerobic Dance

Research on aerobic dance is limited. Jacki Sorensen (29) reports that over 150 women ranging from 13 to 51 years of age have engaged in a test program to verify the physical benefits of aerobic dancing. The women were initially given a twelve-minute run/walk test. A portion of the group was maintained as a control group and continued their normal activity while the remainder of the group participated in twelve-week sessions of aerobic dance. At the end of these sessions all women were retested.

On the initial testing, 61 percent of the test group were in the "very poor" or "poor" category. No one was in the "excellent" category. After participating in the

aerobic dancing sessions only 27 percent were in the "very poor" or "poor" categories, while 25 percent were in the "good" category, and 3 percent had advanced to the "excellent" category.

The control group showed little change in the fitness categories with 8 percent in the "good" category initially and 10 percent at the end of the period. No one was in the "excellent" category after either test.

The other studies in the literature at the present time add to the available information concerning the physiological requirements of aerobic dancing. Foster (11) tested four female subjects performing one of the aerobic dance routines while oxygen consumption was monitored. Peak load which represented the greatest rate of oxygen consumption found during any full minute of the routine was 39 ml/kg/min. Mean load, which represents the total oxygen consumption during the routine, was 33.6 ml/kg/min. This was in substantial agreement with Weber's data.

Weber (30) tested six subjects during one aerobic dance at three intensity workouts. His investigation found that low intensity workouts required 3.8 calories per minute. A medium dancing intensity workout required 6.8 calories per minute. High intensity aerobic dancing incurred substantial cardiovascular stress. Heart rates average 175 beats per minute. High intensity workouts required 8.8 calories per minute. Weber has presented evidence that aerobic dancing



requires an average oxygen consumption of 29 ml/kg/min. for work periods of up to thirty minutes.

An examination of the literature on endurance conditioning, females, and aerobic dancing reveals that females will have an improvement in cardiovascular functioning much the same as males if their training program is of the proper intensity, duration, and frequency.

The available information on aerobic dancing reveals that under single observations the energy cost is of training intensity; however, no training study on the effects of aerobic dancing has yet to be conducted.

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## CHAPTER III

### PROCEDURES

The procedures followed in the course of the investigation are divided into five categories. These categories include selection of subjects, testing instruments, administration of the test, research design, and analysis of data.

#### Selection of Subjects

The subjects were females selected from two North Texas State University conditioning classes. The conditioning was accomplished by doing aerobic dance throughout a twelve-week period of time. The females who volunteered were between the ages of eighteen and twenty-two years. Thirty-one subjects volunteered, out of a total two-class population of forty-eight students.

#### Testing Instruments

The Narco biosystems telemetry-type DMP-4A, manufactured by Narco Bio-Systems, Inc. of Houston, Texas, was used to record resting heart rate prior to the dance and was also used to monitor working heart rate immediately upon completion of the dance. The subject was attached to the telemetry by two surface electrodes. The ground electrode was attached to the skin over the sternum, while another

electrode was placed on the left sixth rib. The telemetry battery was taped to the subject directly above the navel. Figure 1 illustrates the placement of the two telemetry electrodes and the telemetry battery. The receiving antenna and the printout sheet are on both sides of the subject.



Fig. 1--The telemetry system

A twelve-minute run/walk test was given prior to the beginning of the conditioning course to determine to which category of fitness the subject belonged. The twelve-minute run/walk test was also given after the final trial, and again the subjects were reassigned to a fitness level. The subject ran for twelve minutes around a 440-yard track and the number of laps was recorded. The fitness levels were

assigned according to Dr. Kenneth Cooper's chart for women under thirty (1, p. 30).

<u>Fitness Level</u>	<u>Distance Covered</u> (laps)
1. Very poor	Under 3-5/8
2. Poor	3-3/4 to 4-3/8
3. Fair	4-1/2 to 5-1/8
4. Good	5-1/4 to 6-3/8
5. Excellent	6-1/2+

Pretests and posttests were given out-of-doors on the track at North Texas State University.

The music for the dance was "Ruby Red Dress." "Ruby Red Dress" is one of the dances from the 1974 Aerobic Dance workshop and is considered representative of aerobic dances. The cassette tape presented at the workshop in Denton, Texas, was used to play the music.

In an effort to test the validity of selecting "Ruby Red Dress" as the sample dance for this study, additional dances were used to determine the comparative work intensity. This served as a means of determining the validity of using a single dance to represent all the available dances. Two other aerobic dances, "In the Mood" and "One Toke Over the Line," both from the aerobic dance workshop, were performed by ten of the thirty-one subjects on separate days.

### Administration of the Test

Each subject had met with the aerobic dance conditioning class twice before the actual testing with the telemetry system. The first class period was utilized to give the twelve-minute run/walk test in order to classify subjects in a fitness category. The test was given at the stadium track at North Texas State University. The fitness categories were assigned according to Kenneth Cooper's fitness chart in his book, The New Aerobics (1). The second class period was used to introduce the techniques of aerobic dance and to acclimatize subjects to physical and verbal cues of the dance "Ruby Red Dress."

Personal data were collected. The personal data collected included height, weight, and age. These data are reported in Appendix B.

All experimental treatment trials of heart rate assessment were given in the Physiology of Exercise Laboratory at North Texas State University. Each subject had ample room to perform the dance and movements were unrestricted. The people in the room included the subject, an assistant, and the investigator.

The subject was seated for the time required to place two telemetry electrodes, one sternal and one mid-axillary. After the placement, the subject assumed a reclining position for ten minutes. Resting heart rate was monitored for one minute, and recorded as beats per minute.



The subject then stood and began dancing when the cassette tape recorder was started. The assistant, who was knowledgeable about the dance, gave any verbal and physical cues to the subject as they both performed the dance.

The length of the dance was three minutes and thirty seconds. After the dance, the subject remained standing and the heart rate was monitored immediately upon completion of the music. This was referred to as working heart rate. The heart rate was monitored for ten seconds, multiplied by six, and recorded as beats per minute.

Maximum heart rate is assumed, for females under thirty, to be 195 beats per minute, according to charts on maximum heart rates for adults (3, p. 11). Training heart rate was recorded as the difference between maximum heart rate and resting heart rate. The remainder was multiplied by 60 percent, which is the rate at which a person should train, and this answer was added to the resting heart rate.

Five weeks of conditioning classes of aerobic dance were continued before trial number two was given. Five weeks was time enough for the subjects to become acquainted with the techniques of aerobic dance and to become familiar with the dance steps. A log of what each class period consisted is found in Appendix A. Each class did consist of rope skipping and sit-ups for warm-ups lasting ten minutes. Thirty to forty minutes of the class was continuous moving, either in reviewing dances already learned, learning new dances, or walking, or jogging in between the dances. No one was allowed to sit

down during the dancing time. At least one dance was learned each class period. During the aerobic dance classes the test dance, "Ruby Red Dress," was not reviewed until the last class period prior to the test in order for the subject to refresh her memory about the dance. Trials number two and three were administered exactly like trial number one. Five weeks also elapsed between trial number two and three in order for more learning to take place.

Subjects were tested at their convenience at times chosen between 10:00 A.M. and 5:00 P.M. Each subject was requested not to consume any food two hours prior to the test. The two-hour period is the suggested length of time for food to leave the stomach, and thus not affect physical activity (2, p. 100).

A twelve-minute run/walk posttest was given at the stadium track a week after the completion of the third trial. The subjects were then reassigned to a fitness category.

Testing procedures for two other aerobic dances performed by ten subjects were exactly like the three trials of "Ruby Red Dress." The two other dances performed were "One Toke Over the Line" and "In the Mood." "One Toke Over the Line" was two minutes in length and "In the Mood" was three minutes and fifteen seconds long.

#### Research Design

There were two research designs used for the conduct of this study.

One research design used was a repeated measures with three trials. The dependent variables used with this design were resting heart rate, working heart rate, and training heart rate; therefore, separate analysis of variance computations were performed for each of the dependent variables.

The second research design was a pretest and posttest design for the twelve-minute run/walk test. The dependent variable was the number of laps finished in twelve minutes.

#### Analysis of Data

All data were analyzed at the computer center at North Texas State University. The computer program listing ST017 was used for the analysis of variance. The computer program listing ST003 was used for the  $t$  test for correlated means.

A one-way analysis of variance was used with the data results for the three trials. Working heart rate, resting heart rate, and training heart rate were the variables for each of the analyses.

A  $t$  test for correlated means was used to compare how the subjects improved or did not improve on fitness levels recorded as distance covered from pretest to posttest times.

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## CHAPTER IV

### ANALYSIS OF DATA

Thirty-one college age females enrolled in two North Texas State University aerobic dance conditioning classes were tested at three separate times at five-week intervals. During the trials, resting heart rates were monitored prior to their performing an aerobic dance. Working heart rates were monitored immediately following the dance to determine if a training intensity level heart rate was elicited.

Ten of the subjects were also tested on two other aerobic dances to validate the use of the one representative aerobic dance. These two trials were given exactly like the three trials on two separate days.

A pretest and posttest twelve-minute run/walk was given to determine if any improvements in fitness levels took place as a result of the aerobic dance conditioning treatment.

#### Descriptive Data

The subjects were between the ages of eighteen and twenty-two years, with the mean age being nineteen years. Mean height for the females was 64.50 inches. Mean weights taken before the aerobic dance class began were 127.48

pounds, and mean weights taken at the conclusion of the conditioning course were 127.22 pounds. See Appendix B.

#### Resting Heart Rate

Resting heart rates were monitored in a reclining position at each of the three trials prior to the dance. The subject remained in a reclining position for ten minutes before the resting heart rate was monitored. The mean group resting heart rates were 77 beats per minute  $\pm$  12.53, 72 beats per minute  $\pm$  9.62, and 70 beats per minute  $\pm$  10.53. The range of resting heart rates were 44 beats per minute to 96 beats per minute.

The descriptive statistics for resting heart rate for the three trials are summarized in Table I.

TABLE I  
MEANS AND STANDARD DEVIATIONS OF RESTING HEART RATES OF  
COLLEGE AGE FEMALES

Trial	Mean	SD
1	76.58	12.53
2	72.19	9.62
3	69.55	10.53

A one-way analysis of variance with three repeated measures was utilized to determine if the difference from one trial to the next was significant. A summary table for

the one-way analysis of variance for resting heart rate is presented in Table II.

TABLE II

SUMMARY TABLE FOR ANALYSIS OF VARIANCE AT THREE TRIALS FOR RESTING HEART RATE OF COLLEGE AGE FEMALES

Source	DF	MS	F
Between	30	391.10	6.18*
Within	62	63.32	. . .
Total	92	. . .	. . .

\*An  $F$  ratio of 5.37 is required for significance at the .01 level.

The results reported in Table II indicate that the differences among the trials were statistically significant at the .01 level. This would suggest that aerobic dance is a good conditioning program and is consistent with the thought that a good cardiovascular conditioning program will decrease resting heart rate over a training period.

A Fisher's  $t$  test was utilized to compare means. The results of the three trials are summarized in Table III. There was a significant difference from trial one to trial two. There was a highly significant difference from trial one to trial three. There was no significant difference from trial two to trial three. The difference is in favor of lowering resting heart rate from the first trial to the third trial.

TABLE III

SUMMARY TABLE FOR FISHER  $t$  TEST OF CORRELATED RESTING  
HEART RATE MEANS AT THREE TRIALS FOR COLLEGE AGE  
FEMALES

Trials	1	2	3
1	0.0	2.17*	3.48**
2	2.17*	0.0	1.30
3	3.48**	1.30	0.0

\*A  $t$  ratio of 1.69 is required for significance at the .05 level.

\*\*A  $t$  ratio of 2.75 is required for significance at the .01 level.

The significant difference in resting heart rate from trial one to trial three would indicate that aerobic dance conditioning is a good program for cardiovascular improvement. One of the objectives of a good cardiovascular program is that resting heart rate is decreased.

#### Working Heart Rate

The mean heart rates immediately after the aerobic dance for the three trials were 173 beats per minute  $\pm$  14.97, 173 beats per minute  $\pm$  13.64, and 175 beats per minute  $\pm$  11.87. The range of working heart rates were from 138 beats per minute to 200 beats per minute. The descriptive statistics are presented in Table IV.

A one-way analysis of variance with three repeated measures was utilized to determine if the difference from



TABLE IV

MEANS AND STANDARD DEVIATIONS OF WORKING HEART RATES OF COLLEGE AGE FEMALES AFTER AN AEROBIC DANCE

Trial	Mean	SD
1	172.71	14.97
2	173.39	13.64
3	175.42	11.87

one trial to the next was significant. The summary table of one-way analysis of variance for working heart rate is presented in Table V.

TABLE V

SUMMARY TABLE OF WORKING HEART RATES OF COLLEGE AGE FEMALES

Source	DF	MS	F
Between	30	61.65	.85
Within	62	72.29	
Total	92	133.94	

An F ratio of 1.69 was required for significance at the .05 level.

The results indicate that there was no significant difference in working heart rate from one trial to the next at the .05 level.

The non-significant difference in working heart rate is a good indicator that aerobic dance has built-in progression levels. As a person becomes more fit, she can continue

to increase her aerobic dance workload and continue to work at a training intensity heart rate. Learning techniques of aerobic dance enables the subject to push herself to a higher level to maintain the working heart rate at a training intensity.

#### Training Heart Rate

Group means and standard deviations are recorded in Table VI for training heart rates for the three trials. Mean training heart rates for the three trials were 148 beats per minute  $\pm$  5.01, 146 beats per minute  $\pm$  3.91, and 145 beats per minute  $\pm$  4.34. The range of training heart rates were from 135 beats per minute to 155 beats per minute. The descriptive statistics are presented in Table VI.

TABLE VI  
MEANS AND STANDARD DEVIATIONS OF TRAINING HEART RATES AT  
THREE TRIALS FOR COLLEGE AGE FEMALES

Trials	Mean	SD
1	147.74	5.01
2	145.90	3.91
3	144.77	4.34

A one-way analysis of variance with three repeated measures was utilized to determine if there was a significant difference from one trial to the next. The summary table for one-way analysis of variance with three repeated measures is presented in Table VII.

TABLE VII

SUMMARY TABLE FOR ANALYSIS OF VARIANCE AT THREE TRIALS FOR TRAINING HEART RATE OF COLLEGE AGE FEMALES

Source	DF	MS	F
Between	30	69.56	6.39*
Within	62	10.88	
Total	92	80.44	

\*An  $F$  ratio of 5.37 is required for significance at the .01 level.

The results reported in Table VII indicate that the differences among the trials were statistically significant at the .01 level. Fisher's  $t$  test for correlated means was utilized to determine where the difference took place. The results of the three trials are summarized in Table VIII.

TABLE VIII

SUMMARY TABLE FOR FISHER  $t$  TEST OF CORRELATED TRAINING HEART RATE MEANS AT THREE TRIALS FOR COLLEGE AGE FEMALES

Trials	1	2	3
1	0.0	2.19*	3.54**
2	2.19*	0.0	1.30
3	3.54**	1.30	0.0

\*A  $t$  ratio of 1.69 is required for significance at the .05 level.

\*\*A  $t$  ratio of 2.75 is required for significance at the .01 level.

There was a significant difference from trial one to trial two and a highly significant difference from trial one to trial three. There was no significant difference from trial two to trial three. The results suggest that aerobic dance will lower the training intensity level that must be maintained in order for training to occur. Training intensity heart rate is dependent upon resting heart rate. As a person becomes more fit, the training intensity, as measured by heart rate, will also decrease.

#### Twelve-Minute Test

Means and standard deviations for the twelve-minute run/walk test are recorded in Table IX. Mean score recorded in laps for the pretest was 4.47 laps  $\pm$  .45 and for the posttest was 4.92 laps  $\pm$  .50. The range of scores was from 3.5 laps to 6.0 laps.

TABLE IX

MEANS AND STANDARD DEVIATIONS FOR TWELVE-MINUTE RUN/WALK PRETEST AND POSTTEST SCORES FOR COLLEGE AGE FEMALES

	Mean	SD
Pretest	4.47	.45
Posttest	4.92	.50

A t test for correlated means was utilized to determine the significant difference at the .05 level from pretest to posttest. The findings are summarized in Table X.

TABLE X

SUMMARY TABLE FOR THE  $t$  TEST FOR CORRELATED MEANS OF PRETEST AND POSTTEST SCORES OF THE TWELVE-MINUTE RUN/WALK OF COLLEGE AGE FEMALES

Test	Mean	SD	$t$
Pre	4.47	.45	6.94*
Post	4.92	.50	

\*A  $t$  ratio of 1.69 is required for significance at the .05 level.

Examination of the results indicate that aerobic dance did cause a fitness level improvement during the twelve-week aerobic dance class. Percentage scores for fitness level improvement are found in Table XI. The percentage increases indicated in Table XI from pretest to posttest suggest that aerobic dance is an excellent program for fitness improvement.

TABLE XI

PERCENTAGE SCORES OF FITNESS LEVELS ON TWELVE-MINUTE RUN/WALK PRETEST AND POSTTEST OF COLLEGE AGE FEMALES

	Pretest	Posttest
Very Poor	6%	0%
Poor	39%	13%
Fair	52%	45%
Good	3%	42%
Excellent	0%	0%

### Other Aerobic Dances

Group means and standard deviations of the two other aerobic dances performed by ten of the thirty-one subjects are presented in Table XII. Working heart rate for "One Toke Over the Line" was 178 beats per minute  $\pm$  4.21. Group mean working heart rate for "In the Mood" was 181 beats per minute  $\pm$  7.38.

TABLE XII

MEANS AND STANDARD DEVIATIONS OF WORKING HEART RATES OF COLLEGE AGE FEMALES ON TWO AEROBIC DANCES

Dance	Mean	SD
1	178.00	4.21
2	181.20	7.38

The results indicate that both aerobic dances are of training intensity. This suggests the "Ruby Red Dress" is representative of aerobic dances by the fact that these two dances validate the use of one dance, with all the results being near the same intensity. Range of scores for "One Toke Over the Line" were from 170 beats per minute to 180 beats per minute. Range of scores for "In the Mood" were from 170 beats per minute to 200 beats per minute.

### Summary of Findings

The results of the analysis indicate the following findings.

1. Resting heart rates decreased from trial number one to trial number two to trial number three.

2. Working heart rates were maintained at each of the three trials.

3. Training heart rates decreased.

4. Fitness levels improved from the twelve-minute run/walk pretest to the twelve-minute run/walk posttest.

5. Training intensity heart rates were elicited from subjects performing two other aerobic dances.

#### Discussion of the Findings

The result of resting heart rates decreasing from trial number one to trial number three is an indicator that aerobic dance is an effective cardiovascular conditioning program. One of the objectives of a good conditioning program is to decrease resting heart rate over a period of time. The study indicates that aerobic dance conditioning has the capability of fulfilling this objective of cardiovascular conditioning. This finding is compatible with Foster (1), who found maximum oxygen consumption values during aerobic dance to be 30 ml/kg/min. and suggests that aerobic dancing, performed three times weekly for an hour is an effective means of training the cardiovascular system.

Working heart rates were of training intensity and were maintained at each of the three trials. The techniques and learning of aerobic dance enables subjects to increase

their workloads progressively and thus continue to work harder. Aerobic dance has built-in progression loads so as to push the subject when she is ready to move up to a higher workload. These findings are compatible with Weber (3), who monitored maximum oxygen consumption at high intensity levels of aerobic dance and monitored heart rate. He had a group mean working heart rate of 174 beats per minute.

Fitness levels did improve because of the twelve-week aerobic dance conditioning class. Aerobic dance is an effective way to improve fitness level. This is in agreement with Sorensen (2), who reported an improvement in fitness level of 150 women who engaged in aerobic dance conditioning.

Training heart rates significantly changed from trial one to trial three as the result of the lowering of resting heart rates. Training heart rate is dependent upon the value of the resting heart rate. The lowering of the subject's resting heart rate also lowers the training rate.

Training intensity heart rates being elicited from two other aerobic dances validates the use of one aerobic dance, "Ruby Red Dress," in the investigation. "Ruby Red Dress" is a good representative of aerobic dances. This is in agreement with Foster (1) and Weber (3), who found heart rates of 175 beats per minute. Foster's study did not monitor heart rates, but oxygen intake was that of training intensity.



To summarize the findings of the study, it would seem that aerobic dance classes for college females will reduce resting heart rate, serve as an adequate training mode, and produce significant improvements in cardiovascular fitness.

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## CHAPTER V

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Thirty-one college age females enrolled in two aerobic dance conditioning classes at North Texas State University were the subjects for the study. The study had a two-fold purpose. The main purpose was to determine if subjects performing an aerobic dance could elicit a training intensity heart rate; second, the purpose was to determine if a training intensity heart rate could be maintained at five-week intervals of observation.

The aerobic dance "Ruby Red Dress" was used as the representative aerobic dance for the thirty-one subjects. A twelve-minute run/walk pretest and posttest were given prior to the class beginning and at the termination of the class to determine fitness levels and improvement in fitness. Ten of the subjects were also tested on two other aerobic dances, "One Toke Over the Line" and "In the Mood" to validate the use of "Ruby Red Dress" to elicit a training intensity heart rate.

The narco-biosystems telemetry was used to monitor resting heart rate taken in a reclining position and to monitor working heart rate immediately upon completion of the dance.

Working heart rates for the three trials were 173 beats per minute, 173 beats per minute, and 175 beats per minute. Resting heart rates for the three trials were 77 beats per minute, 72 beats per minute, and 70 beats per minute. Working heart rates for the two other aerobic dances performed by the ten subjects were 178 beats per minute and 181 beats per minute. Fitness level scores as recorded in laps were 4.47 laps for the pretest and 4.97 laps for the posttest.

Results indicate that a training intensity heart rate can be elicited from subjects performing aerobic dances. This training intensity heart rate can be maintained at three trials five weeks apart. Aerobic dance is an effective cardiovascular conditioner in that it decreases resting heart rate over a period of six and twelve weeks of conditioning. Fitness levels also improved from the pretest to posttest results. Aerobic dance has built-in progressive workloads that are essential to a good and effective conditioning program because of the need for an overload training principle.

Data were analyzed by a one-way analysis of variance with three repeated measures for heart rate assessment.

A t test for correlated means was utilized for the test results on the pretest and posttest twelve-minute run/walk.

### Conclusions

The findings would seem to warrant the following conclusions concerning the effects of an aerobic dance conditioning course on college age females if the course is properly conducted:

1. Aerobic dance conditioning should be classified as an effective mode for obtaining cardiovascular fitness.

2. Aerobic dance conditioning is done in such a way that training intensity heart rates may be maintained over the period of twelve weeks.

3. Participation in an aerobic dance conditioning class will cause improvement on the twelve-minute run/walk fitness test.

4. Aerobic dances when choreographed professionally tend to produce training intensity heart rates.

### Recommendations

The following recommendations are made as a result of this investigation:

1. It is recommended that this study be repeated with females of various ages and with males of various ages.

2. It is recommended that a study be done on the effects of the length of an aerobic dance on heart rate.

3. It is recommended that a study be done on the effects of aerobic dance on flexibility.

4. It is recommended that a study be done to research another of Jacki Sorensen's claims that aerobic dance tones the muscles.

5. It is recommended that a study be done on the effects of the duration of an aerobic dance class.

6. It is recommended that an investigation be performed as to the frequency per week needed by aerobic dance to obtain cardiovascular improvements.

7. It is recommended that a study be done to compare a regular conditioning class meeting three times per week and an aerobic dance conditioning class meeting three times per week.

8. It is recommended that a study be done concerning perceived exertion heart rates of subjects involved in a jogging program and an aerobic dance program.

9. It is recommended that a study be done concerning the effects of an aerobic dance class on girth measurements and body weight.

10. It is recommended that a study be done concerning the effects of aerobic dance conditioning on other cardiovascular parameters such as blood lipids, oxygen consumption, respiratory rate, cholesterol level, and glucose level.

APPENDIX A

The following conditioning program for aerobic dance classes was used in the investigation.

January 21

Introduction to class  
Requirements  
Procedures for the class

January 23

Jump roping-5 minutes  
12-minute run/walk test  
(taken in two groups)

January 27

Rope skipping-10 minutes  
Sit-ups-5 minutes  
Taught three new aerobic dances:  
a. Bye Bye Birdie  
b. Consider Yourself  
c. Ruby Red Dress  
Testing week

January 29

Rope skipping-10 minutes  
Taught forward and backward skips  
Reviewed dances  
Taught:  
a. Bad Bad Leroy Brown  
b. 12th Street Rag  
c. She's A Lady  
Bentknee sit-ups--5 minutes

February 4

Rope skipping--10 minutes  
Taught criss crosses  
Sit-ups and splits--5 minutes  
Weighed and measured and recorded  
Reviewed--15 minutes  
Taught  
a. Grass  
b. I've Got a Name

February 6

Rope skipping, sit-ups, and stretches--15 minutes  
Reviewed--30 minutes  
Taught  
a. Spanish Flea  
Movie: "Run Dick, Run Jane"  
Discussed the Aerobics Program

February 11

Rope skipping, sit-ups, and stretches--15 minutes  
Taught double jumps  
Reviewed

February 13

Rope skipping--10 minutes  
30 second sit-ups test  
Reviewed dances

February 18

Rope skipping test--number of forward and backward skips without missing

February 20

Rope skipping, sit-ups, and stretches--15 minutes  
Reviewed

February 18 (cont.)

Taught  
 a. Sugar Sugar  
 Reviewed  
 Talked about nutrition

February 25

Rope skipping, sit-ups, and  
 yoga stretching--15 minutes  
 Reviewed  
 Taught  
 a. 76 Trombones  
 b. One Toke Over the Line  
 c. Joy  
 Assigned times to come to the  
 lab

March 4

Rope skipping  
 Danced straight--40 minutes  
 Taught  
 a. Shaggy Bop  
 Sit-ups  
 Testing Week

March 11

Rope skipping and yoga  
 stretching  
 Danced--40 minutes  
 Taught  
 a. Pom Pom  
 Sit-ups

March 18

Rope skipping and sit-ups  
 Danced--40 minutes  
 Taught  
 a. England Swings

March 25

Easter vacation

February 20 (cont.)

Taught  
 a. I'd Love to Teach  
 the World to Sing  
 b. Country Cousins

February 27

Rope skipping, sit-ups--15  
 minutes  
 Reviewed test dance "Ruby  
 Red Dress"  
 Reviewed  
 Taught  
 a. In the Mood

March 6

Rope skipping  
 Danced--40 minutes  
 Taught  
 a. Betty Co-ed  
 Sit-ups

March 13

Rope skipping and sit-ups  
 Danced--40 minutes  
 Taught  
 a. Hey Look Me Over  
 b. Rock Around the  
 Clock

March 20

Rope skipping and sit-ups  
 Danced--30 minutes  
 Jogged cross country--  
 20 minutes

March 27

Easter vacation



April 1

Rope skipping and stretching  
exercises  
Sit-ups  
Reviewed

April 8

Rope skipping and sit-ups  
Danced--40 minutes  
Taught  
    a. You are the Sunshine  
        of My Life  
Jogged--10 minutes

April 15

Rope skipping and sit-ups  
Questionnaire  
Reviewed  
Final testing week

April 3

Rope skipping and sit-ups  
Reviewed  
Taught  
    a. Popcorn  
Jogged out-of-doors--10  
minutes

April 10

Rope skipping and sit-ups  
Reviewed and danced--40  
minutes  
Taught  
    a. You and Me  
Reviewed "Ruby Red Dress"  
Jogged--10 minutes

April 17

Rope skipping and sit-ups  
12-minute run/walk test  
at university track

APPENDIX B

AGES, HEIGHTS, AND WEIGHTS OF EXPERIMENTAL SUBJECTS

<u>Subject</u>	<u>Age (Months)</u>	<u>Height (Inches)</u>	<u>Weight (Pounds)</u>
Adams	221	69.25	138
Brantly	258	67.25	135
Brown	245	65.50	178
Brown	238	63.50	121
Bush	222	64.00	133
Clanton	223	65.50	115
Crump	240	60.00	100
Dempsey	235	63.00	100
Elizonda	222	60.50	117
Ellison	220	67.25	129
Finley	236	64.25	107
Golihar	251	64.75	128
Henslee	221	69.75	138
Gonzales	217	65.25	154
Howard	222	64.00	148
Humphrey	264	60.25	96
Jones	233	64.25	112
Kampe	233	65.25	127
Lunsford	238	65.50	142
Mahrer	266	67.25	120
McCallister	242	65.00	130
Montez	256	60.00	137
Moss	275	63.50	123
Muesse	250	64.25	134
Norman	234	68.00	160
Pace	243	69.50	151

<u>Subject</u>	<u>Age (Months)</u>	<u>Height (Inches)</u>	<u>Weight (Pounds)</u>
Norwood	226	62.00	95
Palmore	233	64.25	107
Peterschmidt	240	64.75	136
Seiffert	246	64.50	121
Stoermer	236	64.25	120
N = 31	$\bar{x} = 238$ SD = $\pm 2.63$	$\bar{x} = 64.00$ SD = $\pm 19.29$	$\bar{x} = 127$ SD = $\pm 14.85$

APPENDIX C

12-MINUTE RUN/WALK RAW SCORES AND FITNESS LEVEL

<u>Subject</u>	<u>Pretest</u>	<u>Level</u>	<u>Posttest</u>	<u>Level</u>	<u>Difference</u>
Adams	3.75	II	4.50	III	+ .75
Brantly	4.25	II	4.75	III	+ .50
Brown	4.75	III	4.75	III	.00
Bryant	4.75	III	5.50	IV	+ .75
Bush	3.50	I	4.75	III	+1.25
Clanton	5.00	III	6.00	IV	+1.00
Crump	5.00	III	5.25	IV	+ .25
Dempsey	5.00	III	5.25	IV	+ .25
Elizondo	4.50	III	5.25	IV	+ .75
Ellison	5.00	III	5.50	IV	+ .50
Finley	4.75	III	4.50	III	- .25
Golihar	5.00	III	5.25	III	+ .25
Gonzales	3.50	I	4.25	II	+ .75
Henslee	4.50	III	5.25	IV	+ .75
Howard	4.75	III	4.75	III	.00
Humphrey	4.25	II	5.00	III	+ .75
Jones	5.00	III	5.50	IV	+ .50
Kampe	4.50	III	4.75	III	+ .25
Lunsford	4.50	III	4.50	III	.00
Mahrer	4.75	III	5.25	IV	+ .50
McCallister	4.25	II	4.50	III	+ .25
Montez	4.00	II	4.50	III	+ .50
Moss	4.50	III	5.25	IV	+ .75
Muesse	4.00	II	4.25	II	+ .25
Norman	4.00	II	4.50	III	+ .50
Norwood	4.50	III	5.00	III	+ .50

<u>Subject</u>	<u>Pretest</u>	<u>Level</u>	<u>Posttest</u>	<u>Level</u>	<u>Difference</u>
Pace	4.25	II	4.50	III	+ .25
Palmore	4.25	II	4.75	III	+ .50
Peterschmidt	4.25	II	4.25	II	.00
Seiffert	4.25	II	5.25	IV	+1.00
Stoermer	5.25	IV	6.00	IV	+ .75

N = 31

 $\bar{x} = 4.46$ SD =  $\pm .45$  $\bar{x} = 4.88$ SD =  $\pm .92$  $\bar{x} = .45$

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