A COMPARISON OF PERCEIVED EXERTION RATINGS OF AEROBIC DANCE
AND TREADMILL PERFORMANCES AMONG COLLEGE AGE
MALES AND FEMALES

THESIS

Presented to the Graduate Council of the
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Fulfillment of the Requirements

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MASTER OF SCIENCE

By
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Denton, Texas
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The purposes of the study were to compare ratings of perceived exertion of aerobic dance and treadmill performances under equal work loads and to compare ratings of perceived exertion by males and females in aerobic dance and treadmill work.

Subjects were twenty-six college men and women in co-educational conditioning classes. Heart rates were monitored after work bouts and perceived exertion was determined using Borg's RPE scale. Data were analyzed by a two-way analysis of variance with repeated measures. Conclusions of the investigation were: (1) aerobic dance is perceived as less strenuous than the treadmill under equal work loads, and (2) males and females perceive aerobic dance as less strenuous than the treadmill under equal energy bouts.
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CHAPTER I

INTRODUCTION

Few would question the need and value of physical fitness in our mechanized society; however, there exists little consensus as to the type and amount of exercise required to produce adequate fitness levels. Thomas Cureton (6) suggests that physical fitness can be divided into two categories: (1) fitness for sports participation and (2) fitness for life. Each category possesses specific fitness needs. Fitness for sports participation is vital for athletes during competition and emphasizes a level of endurance, strength, or flexibility relative to the sport involved, while fitness for life involves the ability to perform daily tasks with vigor and a healthy body.

The aerobics program, developed by Kenneth Cooper, is directed toward lifetime fitness (5). Unlike other fitness programs, aerobics involves total body participation. A primary assumption in this program is found in its use and development of the cardiovascular system as well as results in increased muscle tone and weight loss.

Aerobic activities include running, jogging, swimming, cycling, treadmill, and walking; however, tennis, handball, racquetball, and badminton are aerobic sports but require
additional time to obtain a training effect due to low intensity of the activities. Aerobic activities are characterized as rhythmical and sustained and serve as a means to achieve cardiovascular fitness (5).

A variation of Cooper's aerobic program, aerobic dance, was created by Jackie Sorensen (13). This mode of aerobic activity provides for continuous changes in activity pattern and tempo. Aerobic dance, like any other program of aerobics, combines training for the musculo-skeletal system, muscle toning, and cardiovascular training.

Aerobic dance has been promoted by Sorensen through the President's Commission on Physical Fitness and the Texas Governor's Commission on Physical Fitness. Colleges, public schools, and YWCA's are currently conducting classes for men and women. Instructors of aerobic dance are certified by Jackie Sorensen during in-service training sessions at selected universities and YWCA's throughout the nation.

Dances are choreographed to popular music, appealing to all ages and both sexes. Dance steps are limited to those steps easily learned by a beginner. Skill in the dance steps is less important than the intensity level at which the dance is performed. Dances can be performed at a low level—a walk; a medium level—a jog; or a high level—a run (14).
Each individual dances at his or her own fitness level and increases or decreases intensity (vigor) of the dance during each session according to physical limitations.

Participants in aerobic dance are encouraged to "do their own thing" in regard to style. Skill and technique are not emphasized. The most important concepts of aerobic dance are fitness and fun.

Findings from research studies have shown that aerobic dance is highly aerobic (8, 11, 16). Men and women, therefore, should achieve similar results. It is interesting to note that men have participated in small numbers in the Texas programs. Beisser (3) states that men are on shaky cultural grounds and tend to participate in those activities that society labels as "masculine." They tend to overlook any activity that may have the slightest connotation of "femininity." Dance is included as an activity for males during elementary school. As males enter junior high school, "sports" are encouraged and dance is eliminated from activity programs for males only (15). Females continue to participate in various kinds of dance, while the males are encouraged to participate in "masculine activities." Sal E. Abitanta(1) suggests that the absence of men in dance programs is probably due to a lack of exposure to the powerful masculine, virile kinds of dance. Bruce King (10) states, however, that dance will be accepted as an appropriate activity for boys in the way music and the
visual arts are when parents and educators see a need for the inclusion of males in dance education. Regarding gender and dance, Terry (15) says that a dance is neither masculine nor feminine until either a male or female starts to dance. Given the opportunity, males might discover aerobic dance as an acceptable and additional method of aerobic training.

In addition to the cultural connotations of masculine and feminine activities, one of the strongest features of aerobic dance is its combination of potential fitness and fun. It is possible that fun—or enjoyment—is a component which may be absent from traditional programs of fitness. Perception of work may be distorted by the "fun" feeling of participating in aerobic dance. Dances are choreographed to popular music and include relatively simple steps which enhance a feeling of enjoyment and pleasure. Traditional activities such as jogging, treadmill, and cycling, while necessary, are labeled as boring and monotonous by some participants. Frankenheuser et al., (9) state that muscular work may act as a mental stressor if it is perceived as unpleasant or if no competitive element is present. Since there is now a means of quantifying the level of one's perception of work intensity, it would seem desirable to conduct research to determine the level of perceived exertion of subjects performing aerobic dance when compared to equal intensities of a standard laboratory exercise test.
It is hoped that this study will provide information concerning subjective feelings of work intensity during two aerobic activities which will contribute an understanding of how an individual's perception of the nature of a task influences assessment of work performance. The study further seeks to compare the perception of exertion expressed by males and females to one activity which is often labeled by society as "feminine" and one activity which is classified as a typical, traditional exercise for both sexes.

Statement of the Problem

This study was designed to compare perceived exertion ratings of college males and females during equal workload intensities in aerobic dance and treadmill performances.

Purposes of the Study

The purposes of the study were

1. To compare ratings of perceived exertion of aerobic dance and ratings of perceived exertion of an equal workload on a motor driven treadmill;

2. To compare ratings of perceived exertion by males and females in aerobic dance and treadmill work;

3. To compare an interaction effect of type of exercises and gender differences.
Definition of Terms

The following terms and definitions were used in the study:

1. **Aerobic activity.**--exercises that demand oxygen without producing an intolerable oxygen debt so that they can be continued for long periods (5);

2. **Aerobic dancing.**--a program of physical fitness which involves simple, vigorous dancing choreographed for the non-dancer (14);

3. **Borg's Rate of Perceived Exertion scale (Borg's RPE scale).**--a psychological scale numbering from six to twenty with corresponding verbal phrases as subjective feelings of work intensity (4);

4. **Cardiotachometer.**--an instrument which records the heart rate continuously for hours or days (7);

5. **Electrocardiogram.**--the graphic recording from the body surface of variations in electrical potential produced by the heart (7);

6. **Electrode.**--an electric conductor through which current enters or leaves a cell, apparatus, or body (7);

7. **Treadmill.**--a motor driven conveyor belt that has a large surface upon which to walk or run (12);

8. **Working heart rate.**--the number of ventricular beats per minute during exercise as counted from records on the electrocardiogram (2).
Scope of the Study

The present study was designed to compare the perceived exertion ratings for aerobic dance and treadmill performances made by college men and women enrolled in physical education activity classes at North Texas State University, Denton, Texas, during the spring semester, 1976. Twenty-six students who met the established criteria were selected as subjects for this study. One limitation of the study was the selection of an aerobic dance which was neither masculine nor feminine in choreography.

Summary

Subjective feelings of work intensity during any aerobic activity determines whether a person will continue that activity. Aerobic activities vary with regard to type, duration, and intensity. The present investigation is an attempt to compare subjective feelings of exertion during two equal energy cost activities, and to determine if differences exist between males and females when expressing these feelings about perceived exertion.
CHAPTER BIBLIOGRAPHY


A review of the literature revealed that extensive research has been accomplished in the areas of perceived exertion and aerobic activities. There was, however, a limited number of experimental studies directly related to aerobic dance. The literature review in this section was selected because of its importance to the general concept of fitness. Studies related to fitness, aerobic dance, perceived exertion and cultural patterns in selection of activities are included.

Exercise Programs

There are several methods of exercise that are incorporated into fitness programs, although when performed singularly in relation to total body fitness, these methods do not achieve overall body conditioning. The two types of activities specifically designed for muscle strength and endurance are isotonic and isometric exercises. Isotonic exercises are those exercises in which a muscular contraction and movement occurs, while in isometric exercises, no movement occurs with a muscular contraction. Studies comparing the two types of activities indicate isotonic exercises are more efficient than isometric exercises in developing muscular strength and endurance (6).
Metabolic exercises also are included in fitness programs. These metabolic activities involve an increased oxygen demand and they are labeled, according to oxygen consumption, as anaerobic or aerobic exercises. Anaerobic activities are those activities which can be maintained for a short period only before the body must cease the activity to recover from the oxygen debt. Aerobic activities also demand oxygen, but at a lower consumption rate than anaerobic activities, and can be maintained over a longer period of time (8).

In a complete program of fitness, all elements of motor fitness as well as cardiovascular fitness are desirable. The lungs, heart, and circulatory system require training to maintain efficiency. The aerobics program by Cooper (7) is one means of achieving complete and total body fitness. Exercises included in such a program demand oxygen without producing an intolerable oxygen debt, thus they can be maintained for long periods of time. Jogging, swimming, cycling, and walking are examples of aerobic activities. In Cooper's program, these activities are performed at a certain energy level to receive "aerobic points." Specific points are earned during each workout session according to the intensity and duration of the workout. Women are required to earn at least thirty points a week for any training effect to occur
in the cardiorespiratory system. A typical weekly program designed to earn the appropriate points might include the following routines (7):

<table>
<thead>
<tr>
<th>Day</th>
<th>Aerobic Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>Rest</td>
<td>0</td>
</tr>
<tr>
<td>Monday</td>
<td>Jog - 2 miles</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>20 minutes</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>Cycling - 4 1/2 miles</td>
<td>4 1/2</td>
</tr>
<tr>
<td></td>
<td>9 minutes</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>Jog - 2 miles</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>20 minutes</td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>Cycling - 4 1/2 miles</td>
<td>4 1/2</td>
</tr>
<tr>
<td></td>
<td>9 minutes</td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td>Jog - 2 miles</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>20 minutes</td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>Rest</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day</th>
<th>Aerobic Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>Rest</td>
<td>0</td>
</tr>
<tr>
<td>Monday</td>
<td>Jog - 1 1/2 miles</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12 minutes</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>Rope Skip - 10 minutes</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>12 minutes</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>Jog - 1 1/2 miles</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>12 minutes</td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>Rope Skip - 10 minutes</td>
<td>3</td>
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<tr>
<td></td>
<td>12 minutes</td>
<td></td>
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<tr>
<td>Friday</td>
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<tr>
<td></td>
<td>12 minutes</td>
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<tr>
<td></td>
<td>TOTAL</td>
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It is recommended that an aerobics program contain a variety of activities to avoid boredom and monotony.
Aerobic Dance

Aerobic dance, a relatively new methodology or activity for aerobic training, was developed by Jackie Sorensen. It is a conditioning program combining flexibility for the musculoskeletal system, muscle toning, and cardiovascular endurance training (31). The dances are choreographed to include percentages of vigorous dance steps to improve aerobic capacity, bends and stretches for flexibility, and muscle toning movements (27, 28).

The dance steps are based on movements from modern jazz, ballet, rock, folk, ballroom, and musical comedy dance. The dance sessions are choreographed to include a warm-up, conditioning dances, and a cooldown. Workouts are facilitated by alternating more aerobic dances with less aerobic dances. Continuous movement is required between each dance by either walking, jogging, or running in a circle, or by reviewing dance steps as a group.

Dances are choreographed to match the beat and mood of the music. Broadway show music, movie themes, pop music, and country-western music have been used for the aerobic dances. The dances also are choreographed for the "non-dancing" man, woman, or child, yet challenging for the skilled dancer.

"Doing your own thing" in regard to style and physical capabilities is encouraged. There is no group competition; however, one is encouraged to compete with himself. In
general, women tend to dance with more attention to technique; men tend to dance with more emphasis upon vigor; children tend to dance with more freedom than adults (28).

Dances are changed periodically in this conditioning program. During an instructional unit, a different series of dances are presented every twelve weeks with new music, new choreography, and new and different steps. For continuing participants, motivation, fun, and challenge begin all over again. The two most important concepts of aerobic dance are fitness and fun (27).

In addition to its purpose as a unique methodology for physical activity, several investigators have emphasized the function of aerobic dance in physiological terms. Foster (13) conducted a study to determine physiological requirements of aerobic dancing. Four females participating in an Aerobic Dance Workshop in June, 1973, at the University of Texas, volunteered to perform a dance routine while oxygen consumption was monitored. The oxygen consumption of the group was 39.2 ml/kg/min which is comparable to running at 9.5 min/mi. This intensity can be maintained for at least thirty minutes which is sufficient time to obtain a cardiovascular training effect. The results of the study suggested that aerobic dance provides for cardiorespiratory training and can serve as an additional alternative to aerobic training.
Maas (16) reported that college age females performing a selected aerobic dance reached heart rates of 172.1 beats per minute with a standard deviation of 14.97 prior to an instructional unit. With aerobic dance training, heart rates reached 173.4 beats per minute with a standard deviation of 11.9, indicating a significant improvement in aerobic capacity.

In a study involving the investigation of energy cost of aerobic dancing, Weber (31) measured oxygen uptake of ten women who participated in a forty-five minute aerobic dance workout. Each subject performed the experiment with a portable respirometer on her back. At the conclusion of the dance session, oxygen consumption was measured and recorded. It was found that aerobic dance served as a highly strenuous activity comparable to such activities as handball, basketball, and jogging. Weber also stated that when aerobic dance is performed regularly at a level which produces a cardiovascular stress, an aerobic training effect will result.

A recent study by Durrant (10) compared the effects of jogging, rope jumping, and aerobic dancing on body composition and maximum oxygen uptake while maintaining comparable heart rates. The experiment included four groups of subjects: (1) twenty-seven women in the jogging group; (2) twenty-five women in the rope jumping group; (3) thirty women in the aerobic dance group; and (4) nineteen women in the control group. Results of the study indicated that there was no
significant difference in maximum oxygen uptake between the treatment groups, but there was a significant difference between the treatment groups and the control group. There was a significant difference between groups in lean body mass but no significant difference in body composition between the groups. It was concluded that aerobic dance produces training effects similar to those effects acquired in rope jumping and jogging.

Psychocultural Patterns of Activity

During years in the elementary school, girls and boys are introduced to dance in the form of rhythms and dance games. In the secondary school, boys are both consciously and unconsciously forced out of dance and into sporting activities (30). The ramifications of this action appear to be sociological in nature and explained by the cultural concept that dance is feminine and sport is masculine. Beisser (3) stated that "male and female" characteristics are not all biologically determined. Cultural forces tend to shape attitudes toward femininity and masculinity rather than physical differences, and in the American culture, "athletics" is considered the most masculine of activities.
Schroeder (23) contends that our culture enforces masculinity to such a degree that men may be afraid to participate in dance programs due to "what others may think." Men who do participate in dance obviously must have no doubts or insecurity regarding masculinity.

Jinks (15) discussed the problem of the "culturally imposed standard" which suggests that dance is for girls and football is for boys. It appears that dance has no value for males, yet some athletic coaches recommend dance training as an aid to the sports participant (30). Dance has been included in the curriculum to improve balance, agility, and coordination. Given the chance, males may find that dance is a highly specialized creative activity.

Perceived Exertion

An important aspect of any physical conditioning program is the internalized feelings which an individual has about the program, its objectives, and its demands. Fellows (12) defined perception as a process which involves reception and analysis. Analysis takes place following the reception of information. This discrimination process can involve two additional steps which include judgment and response. Bartley (2), however, believes that perception is an immediate discriminatory response to a given situation.
Perception has been described as a "combination of input from various senses plus memory traces from past experiences." This input is influenced by visual, auditory, tactile, and kinesthetic stimuli. Bartley (2) and Melzak (17) are in agreement that the way an individual perceives a given situation is influenced by personality, attitudes, and individual experiences.

It can be noted that every individual perceives a situation differently. When dealing with an activity involving physical exertion or expenditure of energy, a certain amount of pain may be experienced during the activity. Gelfand (14) noted that pain tolerance is more affected by psychological factors than physiological variables. Any type of aerobic activity involves a certain amount of pain depending upon the intensity and type of activity. Morgan (18) stated that pain is a "subjective, quite personal, and extremely complex sensation." Subjective feelings determine intensity as well as duration of physical work, and often, they indicate one's continuation or cessation of an activity.

Pandolf and others (21) investigated the ratings of perceived exertion upon older individuals during physical conditioning. It was found that through training, the psychological feeling of intensity decreases, in regard to muscle strain and stress on the cardiovascular system, but, when one set of sensations dominated (muscular pain, oxygen debt),
other sensations were perceptually de-emphasized. It appears that during a conditioning program, perception of the entire activity may be distorted by physiological variables.

Perceived exertion, or subjective feelings concerning work intensity, has been the topic of several research endeavors. The initial discovery related to the concept of perceived exertion involved a group of lumber workers. It was found that an individual's own conception of work tolerance frequently did not agree with the work capacity measured (4). Lumber workers expressed a feeling of declining endurance of 50 percent or more, when, according to an ergometer test, fitness had only decreased 10 to 20 percent. This discrepancy in the feeling of work output and the actual energy expenditure stimulated research in psychophysical work.

Borg's first studies (4) in perceived exertion revealed that RPE values will follow the working heart rate very closely. Healthy men performing on a bicycle ergometer or a motor driven treadmill will select a RPE rating which will equal the working heart rate when multiplied by ten. Correlations between .80 and .90 were reported for varying work loads using Borg's RPE scale.

Several studies have revealed information regarding factors which influence ratings of perceived exertion. According to Skinner, Borg, and Buskirk (24), perceived exertion is not governed by activity history, nor by body
composition. Twenty-six young men were classified as lean and sedentary (LS), lean and active (LA), heavy and sedentary (HS), and heavy and active (HA). Subjects were tested on a bicycle ergometer and asked to rate perceived exertion using Borg's RPE scale. Lean-active subjects were able to achieve a higher working capacity than the heavy-active subjects. When the heart rates of the four groups were compared with the perceived exertion ratings, no differences existed, although the heart rates for the active group and sedentary group differed. It may be concluded that, regardless of body composition or activity history, no differences will exist in RPE.

Skinner and others (25) compared stated levels of perceived exertion between eight "lean" and "overweight" young and middle-aged men who performed bicycle ergometer and treadmill tasks. Each subject began exercising at 150 kilograms per minute until a self-imposed maximum was reached. The treadmill test began by walking at 3.5 miles per hour at zero percent elevation and increased every two minutes by 2.5 percent until a self-imposed maximum was reached. Subjects were asked to rate perceived exertion by touching the number on Borg's RPE scale corresponding to the subjective feeling of exertion. Results indicated no differences in RPE between lean and obese subjects on the bicycle ergometer, but lean subjects gave a higher rating for perceived exertion on the treadmill. All subjects rated work on the bicycle to be
significantly harder than that on the treadmill at the same VO$_2$ level. In relation to working heart rate, no difference in RPE existed in either group. The study confirmed previous results (1, 24) which stated that activity and body size do not affect RPE.

Bar-Or and others (1) conducted a study involving physically active and sedentary men regarding conditioning and body fatness. Graded treadmill and bicycle ergometer tests were administered to subjects until a heart rate of 150 beats per minute was reached or until the subjects rated exertion to be "very hard." Subjective ratings of perceived exertion were obtained using Borg's RPE scale. From the data, no significant differences were observed for RPE in relation to the working heart rate and body type. It was found that treadmill has some advantages over bicycle ergometer when direct comparisons of subjects differing in body size and weight are to be made.

Docktor and Sharkey (9) concluded that there is a decrease in RPE as exercise training increases. In this study, five non-athletic men trained for five weeks on a treadmill at 3.5 miles per hour until the heart rate reached 180 beats per minute. The mean pre-test RPE before the training period was 11.4. Mean post-test RPE was 10.6. Although there was a change in RPE, it was not significant. The time required to reach the 150 beats per minute increased with training.
Skinner and others (26) reported that in many different areas of physical work, subjective intensity grows in a positively accelerated fashion with the physical work load. Eight lean and eight obese subjects participated in a study to determine if they could perceive small differences in work loads presented in random and progressive order on the bicycle ergometer. The initial work load consisted of two minutes at 150 kilograms per minute, at which time the work load was increased to either 300, 450, 600, 750, or 900 kilograms per minute and maintained for four minutes. After an eight minute rest period, subjects followed the same procedure at randomly chosen work loads. The progressively increasing work loads followed a pattern of an increase of 150 kilograms per minute every two minutes until the subject had reached a self-imposed maximum. Subjects were asked to numerically rate perceived exertion after each work load using Borg's RPE scale. There was no significant difference in RPE during the random and progressive test, which indicated that subjects were able to perceive accurately the intensity of the work load. It also was concluded that progressive tests are highly reliable and valid and are less time-consuming to administer than the random test.

Ekblom and Goldbarg (11) conducted a study comparing subjective ratings of perceived exertion using Borg's RPE scale in different types of physical work, such as running,
cycling, and swimming. Included in the study was an analysis of an eight week period of physical training on the rate of perceived exertion. In all three work areas (treadmill, ergometer, and swimming), subjects performed two or three different submaximal work loads for six minutes with ten minute rest periods between each trial. Maximal work loads were chosen to exhaust the subjects in three to six minutes and were preceded by a two-to-three minute warm-up, with a forty-to-fifty percent of the subject's maximal oxygen uptake. Immediately after each work period, subjects were asked to rate perceived exertion using Borg's RPE scale.

Training for the eight week physical conditioning period involved cross-country running five to seven days per week. Exercise testing was performed on the bicycle ergometer. Subjects were given a pre-test and a post-test on maximal oxygen uptake and perceived exertion rating. Results from the study indicated that variations in RPE exist between different types of testing procedures. Subjective ratings of perceived exertion on the bicycle were higher in arm work than leg work. Relative to work load, RPE during bicycling and treadmill running was the same. At a given submaximal heart rate, RPE was higher in bicycle exercise. At maximum heart rates, identical values of RPE were obtained. At a given submaximal VO$_2$ level, RPE was the same in swimming and running. Subjects performing the eight week training period gave no
significant difference in RPE values. At submaximal work loads, the RPE was 1.5 to 2.0 points lower after training. It was concluded that RPE during any heavy exercise is directly related to the size of the muscle mass involved. It was also concluded that no difference in RPE will occur with training in relation to the working heart rate.

The psychological state of an individual also may influence perceived exertion. Morgan (18) found, using Borg's RPE scale, that subjects who are anxious, depressed, and neurotic tend to make more errors in RPE. Work capacity of the neurotic has been found to be quite low. In contrast, perceived exertion for extroverts was inversely correlated to work loads. The extroverted subject who worked at a high work load rated perceived exertion at a low intensity level. The extroverted subject, when given the opportunity, selected a higher level of work than the introvert and perceived this to be light. Variables such as extroversion, anxiety, neuroticism, and depression may interact with the perception of exertion during muscular work.

Noble and others (20) directed an investigation to identify physiological parameters which may account for variance in RPE responses. Six highly fit male students between the ages of eighteen and twenty-two years were selected as subjects. The experiment consisted of pedaling a bicycle ergometer at sixty revolutions per minute for thirty
minutes for two experimental conditions which included five trials each. A neutral environment and a heated environment served as the two environmental situations. During each trial, data were recorded at five, fifteen, and thirty minutes. Rate of perceived exertion, heart rate, ventilation, respiratory rate, oxygen consumption, carbon dioxide production, respiratory quotient, rectal temperature, and skin temperature were recorded. Results indicated that at five minutes ventilation accounts for the most variance in RPE. At fifteen minutes, ventilation also contributed the greatest single influence on RPE, although ventilation, respiratory quotient, heart rate, and skin temperature accounted for seventy-nine percent of the variance. At thirty minutes, respiration rate replaced ventilation as the highest contributor to RPE variance; ventilation was second. It was observed that, in a heated environment, rectal and skin temperature appear sooner and account for more variance than in the neutral environment. It was noted that at fifteen minutes, physiological parameters reached a steady state, yet RPE continued to rise. Results of the study indicated that ventilatory variables are perceived more readily than heart rate, oxygen consumption, carbon dioxide production, and rectal temperature. The study also suggested that any RPE derived from sensations which result from physiological processes, such as ventilation, respiratory rate, and skin temperature can be directly perceived.
Although in most studies RPE mirrors the working heart rate, there are several instances in which the RPE responses do not correspond to the heart rate. Noble and others (19) compared perceived exertion responses during walking and running. Twenty male university students walked and ran at four randomly presented velocities of 2.5, 3.5, 4.5, and 5.5 miles per hour. Each trial lasted three minutes, and heart rate and RPE were recorded the final twenty seconds at 2:40-2:55, 2:55-3:00 minutes. In this study, perceived exertion ratings did not mirror the heart rate. The RPE ratings for the treadmill were lower than the RPE ratings for the walking, although the working heart rates were the same. It was concluded that factors other than heart rate (local muscular discomfort) influence the perceptual process involving perceived exertion.

Similar results were obtained regarding a difference in RPE scores related to working heart rate in a study by Soule and Goldman (29). Six subjects walked one hour out of every six hours on a treadmill during two separate thirty-one hour test sessions, carrying either a fifteen or thirty kilogram pack. Each test session consisted of six one hour periods (or 4.8 kilometers each period) and five hour rest periods with no sleep between each session. Subjects were able to accelerate or decelerate the treadmill continuously. The results indicated that heart rates varied between 99-111 beats
per minute and 103-119 beats per minute for the fifteen kilogram and thirty kilogram load conditions, respectively. The perceived exertion ratings overestimated the heart rates for both the fifteen kilogram and thirty kilogram load conditions. It was observed that, near the completion of each thirty-one hour session, RPE increased, but only the difference between session one and six for the fifteen kilogram were significant. It was concluded that the pack may have caused increased discomfort and distorted the perception of work requirement.

Summary

A review of the literature revealed a limited number of experimental studies related to aerobic dance. No studies have been conducted in which individuals assessed the degree of work performance in aerobic dance with a traditional activity. A resume of literature for this chapter focused upon fitness programs, aerobic dance as a methodology and as a training program, and perceived exertion related to the nature and demands of an energy cost work load.
CHAPTER BIBLIOGRAPHY


CHAPTER III

PROCEDURES

The problem of this study was to compare ratings of perceived exertion of an aerobic dance and ratings of perceived exertion of an equal work load on a treadmill. The study further sought to compare ratings of perceived exertion expressed by males and females in aerobic dance and treadmill work.

Preliminary Procedures

A comprehensive review of the literature was conducted. Information related to aerobic dance, perceived exertion, and methods of work tests utilizing the treadmill were included. From the review, the procedure for administering Borg's Rate of Perceived Exertion scale was determined as well as the decision to use the treadmill for the work test.

A pilot study was conducted in order to determine specific testing procedures, average time needed for each subject during experimentation, and adequacy of laboratory space. It was essential to the study to determine the effectiveness of the selected aerobic dance and the adaptation of subjects to the treadmill. Also included in the preliminary procedures was the determination of a need for laboratory assistants during the experimental period.
Four female undergraduate students who were familiar with the aerobic dance "Easy Come Easy Go" were subjects for the pilot study. They were chosen to eliminate the time involved in the aerobic dance training period. The subjects were tested individually during each testing session with no other subject present on two consecutive days in the Human Performance Laboratory in the Women's Gymnasium at North Texas State University, Denton, Texas. Only the investigator was present during the testing periods for the first three subjects. A laboratory assistant was included during both testing sessions for the fourth subject.

Each subject reported to the laboratory dressed in a halter top, shorts, and tennis shoes. Electrodes were attached to the sternum and mid-axillary position. Next, each subject read directions for rating perceived exertion (Appendix A), and questions were answered by the investigator. The subject was then instructed to assume a position in a space free of any equipment in the laboratory. Upon a signal from the investigator, the subject began the aerobic dance. The investigator did not verbalize cues for the first two subjects in the pilot study. The last two subjects, however, received verbal cues during the entire dance. At the conclusion of the dance, the investigator stopped the cassette recorder, began the electrocardiogram, and placed Borg's RPE scale (Appendix B) in front of the subject, who then pointed to a number that
corresponded to the feeling of the work load. Perceived exertion scores and the working heart rate were recorded on prepared score sheets by the investigator. The subject cooled down by walking in the laboratory for two minutes before leaving.

The following day, the subjects reported to the laboratory for the treadmill testing session. Subject preparation followed the same procedure as the previous day. The subject read instructions for rating perceived exertion and questions were answered by the investigator. The subject assumed a position on the treadmill and began walking when the investigator nodded. The subject worked on the treadmill at a predetermined speed and elevation for a time period similar in length to the aerobic dance. When the subject's heart rate reached the same number of beats per minute as during the aerobic dance, the treadmill was stopped, the physiograph was turned on to record the working heart rate, and the investigator placed Borg's RPE scale in front of the subject who pointed to a number corresponding to perceived exertion of the work load. Working heart rate and RPE were recorded on score sheets.

The working heart rate during the treadmill test was determined by counting the number of ventricular beats recorded on the physiograph. A metric ruler was used to count the beats. The heart rate was measured every ten
seconds after the first minute of work was completed. This proved to be very time-consuming and not as reliable as was previously thought due to the time lapse in counting the beats and initiating the procedure to record RPE scores and working heart rate.

The pilot study demonstrated the need for three changes in the proposed procedures. Each modification was incorporated to insure accurate and consistent research.

In the original proposal, subjects were to perform the aerobic dance without verbal cues from the investigator. It was noted from the performances of the first two subjects that the entire aerobic dance could not be performed without hesitation before some dance steps. It was obvious that the subjects needed a verbal cue to facilitate a smooth, consistent dance routine. The third and fourth subjects received a verbal cue from the investigator, and the performance appeared to be easier and more coordinated than the performance of the non-cued subjects.

A second change dictated by the findings from the pilot study was the necessity of a trained laboratory assistant to monitor and record working heart rates during both testing sessions. The investigator was unable to function efficiently in performing the necessary tasks required to obtain working
heart rate and RPE. The laboratory assistant was seated in a chair by the physiograph until the investigator nodded to indicate that it was time to record the working heart rates.

A third alteration in the original proposed procedures was the addition of an instrument to facilitate accurate knowledge of working heart rates. A cardiotachometer was used during the treadmill test to provide an instant cue to the working heart rate. The cardiotachometer was placed directly in front of the laboratory assistant during the test. When the subject had reached the same working heart rate as that obtained during the aerobic dance, the laboratory assistant nodded to the investigator, at which time the investigator turned the treadmill off, turned the physiograph on to record the working heart rate, and placed Borg's RPE scale in front of the subject. This system of recording the RPE and working heart rate for the subject proved to be efficient and reliable.

Due to functional problems, the cardiotachometer was not used for the first three subjects. Only the last subject's heart rate was monitored through the cardiotachometer as well as the physiograph. The first two subjects received no verbal cue during the aerobic dance; the last two received a verbal cue. These changes were administered during the pilot study to improve the quality of the research.
Subjects

The subjects for the study were fifteen college male volunteers and fifteen college female volunteers enrolled in two coeducational conditioning classes at North Texas State University, Denton, Texas, during the spring semester, 1976. Students from the activity classes who met the established criteria were randomly selected for this study. Criteria for selection were as follows:

1. No previous experience in aerobic dance;
2. No medical limitations for aerobic activities;
3. No subject weighed more than thirty pounds over the desired body weight for safe participation in an aerobics program;
4. No participants used in the pilot study served as subjects for the study.

Experimental Design

Subjects attended physical education conditioning classes that met three times a week on Monday, Wednesday, and Friday for forty-five minutes. The subjects participated in aerobic dance the third and fourth weeks of the semester. Included in the two week training session was a warm-up dance, three aerobic dances, and a cooldown. The warm-up dance--"The Most Beautiful Girl"--was choreographed to begin at a slow moving pace and designed to stretch and move large muscles of the body. As the warm-up was performed, it
increased in intensity level. At the conclusion of the warm-up, subjects were performing at a jog-run level. The three dances taught were: (1) "Easy Come Easy Go," (2) "Rock Around the Clock," and (3) "Joy to the World." These dances were selected because the dance steps involved neither masculine nor feminine movements. "Easy Come Easy Go" served as the aerobic dance measure for perceived exertion. The cooldown dance--"The Way We Were"--served as a "recovery period" during which a slow-moving dance routine was performed while the working heart returned to normal.

The dances were taught by the investigator. A Sony cassette player was used during the teaching and testing periods. All routines were pre-recorded on cassette tapes. After each dance was taught, it was practiced at least nine or ten times during the two week session, except for the warm-up and cooldown, to assure familiarity with the movement and habituation of the pattern. A schedule of the two week orientation is given in Appendix F. The investigator performed each dance with the class as well as giving verbalized cues. Male and female subjects were randomly scattered in the classroom while performing in the aerobic dance sessions (Appendix G). Placement of subjects in a predetermined pattern prevented clustering of males and females, which might have led to an internal perception of masculine or feminine groups rather than movement patterns with no gender reference.
The total amount of time spent in daily orientation to aerobic dance and treadmill work was fifty minutes. The first twenty minutes of each period was utilized for aerobic dance instruction in which all subjects participated. At the conclusion of this phase, subjects reported to the Human Performance Laboratory to perform a two minute work bout on the treadmill in the following manner (7):

1. First and second days: 4 mph at 10 percent elevation (walk);
2. Third and fourth days: 6 mph at 0 percent elevation (slow jog level);
3. Fifth and sixth days: 7 mph at 10 percent elevation (jog level).

This pattern of treadmill practice gave subjects exposure to all elevations and speeds that were used in the final testing procedures. The treadmill speeds of four, six, and seven miles per hour and the treadmill elevations of ten, zero, and ten percent were selected to acclimatize subjects to speeds and elevations on the treadmill.

From the sixty students who met the established criteria, fourteen males and females from the 9:00 class and sixteen males and females from the 11:00 class were randomly selected. The daily total treadmill orientation time was twenty-eight minutes for the 9:00 class (fourteen subjects) and thirty minutes for the 11:00 class (fifteen subjects). Due to absences the first two days of the orientation period, one female in the 11:00 class was dropped from the study. Two
males were absent during the week of testing and were also dropped from the study. In order to maintain statistical balance in subjects, one female was randomly eliminated at the conclusion of the testing. Total subjects numbered thirteen males and thirteen females.

The total experimental period consisted of three weeks. The first two weeks were utilized for orientation to testing procedures and the final week was spent in actual laboratory testing. The total testing time per subject was approximately thirty minutes. The first test day included aerobic dance performance and rating of perceived exertion, which took approximately fifteen minutes. The second test day consisted of treadmill performance and rating of perceived exertion, which also took approximately fifteen minutes. Appendix H includes the aerobic dance and treadmill testing schedule.

Test Instruments

Borg's Rate of Perceived Exertion Scale (RPE) was used to determine exertion during aerobic dance and treadmill performances. It is a numerical scale ranging from six to twenty with physical feelings corresponding to every odd number. The scale has a validity coefficient of .80 to .90 when ratings are correlated with working heart rate (1). A subject rates perceived exertion by indicating which of the
feelings is most closely indicative of the intensity of the work performed. The scale was printed on a fifteen by twenty-four inch white poster board. Subjects observed the scale within five seconds following each testing activity and rated perceived exertion.

It has been reported that treadmill testing has several advantages over bicycle ergometer testing for aerobic experiments (3, 4, 6, 8). Treadmill walking is a non-supported activity similar to aerobic dance; bicycle ergometer work is a supported activity. The treadmill was utilized in order to maintain consistency in two non-supported aerobic activities.

A modified version of the treadmill practice schedule was used to achieve identical heart rate during the treadmill testing for RPE. There was no standardized treadmill test for the length needed in this study. Subjects exercised at four miles per hour at ten percent elevation for one minute, six miles per hour at zero percent elevation for one minute, and seven miles per hour at ten percent elevation for one minute. The total testing time on the treadmill was designed to parallel that of the length of the aerobic dance, which was three minutes. If at any time, the subject reached the identical working heart rate as during the aerobic dance, the treadmill was stopped and exertion was rated. If the subject had not reached the working heart rate at the
conclusion of the three minutes on the treadmill, work was continued at the same speed and elevation until the required heart rate was obtained. During the treadmill test, the working heart rate was observed by a trained laboratory assistant using a cardiotachometer.

Working heart rates were recorded during the final ten seconds of the aerobic dance and treadmill tests using a Narco-bio Systems electrophysiograph. This provided for an actual count of heart rates.

Test Administration

The tests were conducted in the Human Performance Laboratory in the Women's Gymnasium at North Texas State University, Denton, Texas. A trained laboratory assistant operated the physiograph while the investigator administered the RPE test to alleviate the possibility of experimenter variability. All equipment was checked and calibrated to assure accurate and functional use prior to each experimental session. Subjects were instructed to wear tennis shoes and shorts for the testing sessions. Females were asked to wear a halter top, and males were asked to remove shirts in order to accurately place electrodes on the chest. The Narco-bio system was used to monitor heart rates during both testing sessions.
Aerobic Dance Test

Each subject arrived for the initial testing dressed for the activity. Skin resistance was minimized by applying alcohol and electrode paste. An electrode was placed over the sternum and in the mid-axillary position by the investigator. The radio transmitter was taped to the abdominal area. Next, the subject was instructed to read the directions for rating perceived exertion. Each subject was given one minute for the reading. Any questions were answered by the investigator. Next, the subject was instructed to assume a position in a location in the laboratory that was free from any objects that might have restricted movement. The investigator verbally cued the dance, "Easy Come Easy Go" as the subject performed the dance. Since no subject reached a working heart rate of 200, all subjects completed the aerobic dance. Immediately upon conclusion of the dance and within five seconds, the subject rated perceived exertion during the activity according to Borg's RPE scale. The investigator held the scale in front of the subject, who pointed to the number which corresponded to the subjective intensity of the dance. Working heart rate and the numerical ratings of perceived exertion were recorded on prepared score sheets. The investigator removed all testing equipment from the subject. The subject cooled down by walking in the laboratory before leaving.
**Treadmill Test**

Each subject returned to the laboratory the day following the aerobic dance test to perform the treadmill test. The same procedure regarding subject preparation was followed. During this testing session, the Biotach Model #4710 cardio-tachometer was used to visually display working heart rates. The subject was given one minute to read directions for rating perceived exertion. The subject then began the treadmill performance which was timed using a stopwatch. A modified version of the practice session was administered to each subject until the subject had reached the same working heart rate as recorded during the aerobic dance testing. Thus, the duration, intensity, and mode of locomotion was similar to that of each subject's performance in the aerobic dance. When this working heart rate was reached, the investigator stopped the treadmill and the stopwatch. The investigator held Borg's RPE scale in front of the subject within five seconds of the conclusion of the test, and the subject rated perceived exertion. Heart rate, perceived exertion scores, and length of the treadmill performance were recorded (Appendix I). Electrodes were removed from the subject and the subject walked in the laboratory for two minutes to cool down.
Analysis of Data

The data were treated by use of a two-way analysis of variance with repeated measures. The independent variables were the type of exercise and gender differences. The dependent variables were rating of perceived exertion scores. The F ratio was used to determine if significant differences existed between the mean scores of exertion for aerobic dance and the mean scores for the treadmill performances as well as determining differences between male and female responses to the performance test. In this study, the .05 level of significance was used for acceptance or rejection of the hypotheses being tested (5).

The testing procedures utilized were for the purpose of creating similar physiological environments among male and female subjects with the major difference being the medium used for the work load. The major question of the study could then be answered by analyzing the difference in the ratings of exertion. Data were analyzed by the IBM 360 Model 50 Computer System at the North Texas State University Computer Center.

Summary

This chapter described the design and procedures used in the investigation. It included a discussion of the pilot study, the subjects tested, the experimental design, Borg's RPE scale, the treadmill test, testing procedures, and the statistical analysis of results.
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CHAPTER IV

PRESENTATION OF DATA

Findings of the Study

The purpose of the present investigation was to compare perceived exertion ratings during equal work load intensities in aerobic dance and treadmill performances. The investigation also was designed to compare male and female ratings of perceived exertion during the two types of aerobic activities.

The design of the study was a two by two factorial. The independent variables were gender (male and female) and treatment (aerobic dance and treadmill). The dependent variable was the perceived exertion rating. Data collected included RPE scores and working heart rates of subjects during the two work loads (Appendix I). Data were analyzed by a two-way analysis of variance with repeated measures. The .05 level of significance was used to determine significance for the study.

Information regarding height, weight, age and year in school was collected prior to the first testing session. Appendix E includes these data.
Meaningful comparisons of the perceived exertion scores required that each subject's working heart rate on the treadmill be the same or close to that obtained during the aerobic dance. Table I includes the means and standard deviations of working heart rates for male and female subjects during aerobic dance and treadmill.

TABLE I
MEANS AND STANDARD DEVIATIONS OF WORKING HEART RATES OF MALES AND FEMALES DURING AEROBIC DANCE AND TREADMILL PERFORMANCES

<table>
<thead>
<tr>
<th>Gender</th>
<th>Aerobic Dance</th>
<th>Treadmill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>I. Male Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 13)</td>
<td>161.53</td>
<td>14.30</td>
</tr>
<tr>
<td>II. Female Subjects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 13)</td>
<td>171.92</td>
<td>10.92</td>
</tr>
</tbody>
</table>

The mean male working heart rates were ten beats per minute lower than the mean female working heart rates during aerobic dance and treadmill tests. Mean working heart rates for subjects during both testing sessions were reported at a difference of less than one beat per minute. There was, however, a greater variance in the male heart rates in aerobic dance and treadmill performances.
An analysis of variance was computed using the subjects' working heart rates to determine if a significant difference existed between aerobic dance and treadmill working heart rates. Table II includes the results of the analysis of variance.

**TABLE II**

ANALYSIS OF VARIANCE OF AEROBIC DANCE AND TREADMILL WORKING HEART RATES

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B (Groups)</td>
<td>1</td>
<td>1320.07</td>
<td>1320.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error B</td>
<td>24</td>
<td>8304.92</td>
<td>346.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (Treatments)</td>
<td>1</td>
<td>3.76</td>
<td>3.76</td>
<td>0.65</td>
<td>0.42</td>
</tr>
<tr>
<td>AB (Interaction)</td>
<td>1</td>
<td>1.23</td>
<td>1.23</td>
<td>0.21</td>
<td>0.64</td>
</tr>
<tr>
<td>Error W</td>
<td>24</td>
<td>138.00</td>
<td>5.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>9768.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*F .05 = 4.24  df = 25.*
The F ratios of 3.81 and 0.65 were not significant at the .05 level of confidence for the comparisons of working heart rates between groups and the two aerobic activities (2). This would suggest that differences in working heart rates attributable to gender or the treatments are due to chance fluctuations. Equal work loads were produced during the treadmill test and the aerobic dance.

Table III contains the means and standard deviations of the RPE scores recorded during aerobic dance and treadmill performances. The data were used to determine if significant differences existed between the rate of perceived exertion when subjects were engaged in aerobic dance and the treadmill exercise.

**TABLE III**

MEANS AND STANDARD DEVIATIONS OF RATE OF PERCEIVED EXERTION SCORES DURING AEROBIC DANCE AND TREADMILL PERFORMANCES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic Dance</td>
<td>11.96</td>
<td>1.63</td>
</tr>
<tr>
<td>Treadmill</td>
<td>13.53</td>
<td>1.55</td>
</tr>
</tbody>
</table>
These scores represent the group feelings of perceived exertion during aerobic dance and the treadmill task under equal work loads. It can be noted from inspection of the mean scores that the treadmill activity was rated two points higher than the aerobic activity indicating a feeling of greater work or exertion.

Table IV reports the means and standard deviations of perceived exertion responses to aerobic dance and the treadmill made by males and females.

**TABLE IV**

**MEANS AND STANDARD DEVIATIONS OF MALE AND FEMALE RATE OF PERCEIVED EXERTION RESPONSES TO AEROBIC DANCE AND TREADMILL PERFORMANCES**

<table>
<thead>
<tr>
<th></th>
<th>Aerobic Dance</th>
<th>Treadmill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>I. Male subjects ( N = 13 )</td>
<td>11.69</td>
<td>1.31</td>
</tr>
<tr>
<td>II. Female subjects ( N = 13 )</td>
<td>12.23</td>
<td>1.92</td>
</tr>
</tbody>
</table>

Mean male RPE scores during aerobic dance were slightly lower than the mean female RPE scores during aerobic dance. Both groups rated the treadmill activity the same. Visual inspection of these data would suggest possible differences existing in RPE scores between treatments.
Table V includes the analysis of variance for the perceived exertion scores by males and females during aerobic dance and treadmill performances. Although the male ratings of perceived exertion for the aerobic dance and treadmill performances were slightly lower than the female ratings, the F ratio of 1.42 for the between subject comparisons (male-female) of the aerobic dance and treadmill activity was not significant at the .05 level of confidence. This would suggest that any differences observed between the males and females could be attributed to chance fluctuations and not to real or probable differences.

**TABLE V**

ANALYSIS OF VARIANCE OF AEROBIC DANCE AND TREADMILL PERCEIVED EXERTION RATINGS BY MALES AND FEMALES

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B (Groups)</td>
<td>1</td>
<td>5.55</td>
<td>5.55</td>
<td>1.42</td>
<td>0.24</td>
</tr>
<tr>
<td>Error B</td>
<td>24</td>
<td>93.69</td>
<td>3.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A (Treatments)</td>
<td>1</td>
<td>32.32</td>
<td>32.32</td>
<td>27.70*</td>
<td>0.00002</td>
</tr>
<tr>
<td>AB (Interaction)</td>
<td>1</td>
<td>0.17</td>
<td>0.17</td>
<td>0.14</td>
<td>0.70</td>
</tr>
<tr>
<td>Error W</td>
<td>24</td>
<td>28.00</td>
<td>1.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>159.75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*F .05 = 4.24  df = 25.*
The within subject comparison of treatments (aerobic dance and treadmill) revealed an F ratio of 27.70 which was significant at the .05 level of confidence. This indicates that a difference existed in the RPE scores reported during the aerobic dance and treadmill tests. Subjects perceived the treadmill task as more demanding in terms of exertion than the aerobic dance. The interaction comparison of treatment and subject yielded an F ratio of 0.14 which was not statistically significant.

Discussion of the Findings

In the present investigation, twenty-six male and female subjects rated perceived exertion using Borg's RPE scale following an aerobic dance and a treadmill work bout. Each work bout was similar in energy cost, thereby creating similar physiological demands. Since working heart rates were statistically the same, it was important to compare the psychological measure of differences in perceived exertion which existed.

According to previous studies in perceived exertion (1, 6, 7), the score given for the rate of perceived exertion times ten will approximate the working heart rate. In the present investigation, not all subjects accurately rated perceived exertion according to working heart rates. Only one female rated perceived exertion at the expected value of ten times the working heart rate during the aerobic dance.
This female, however, was the only subject in the study to rate aerobic dance as more strenuous than the treadmill task. Three male subjects rated their exertion or work output as identical during the treadmill task; one female rated the two activities the same. Two male subjects and one female subject rated the treadmill test accurately in terms of rate of perceived exertion scores multiplied by ten to obtain the working heart rate. Noble et al (4) and Soule and Goldman (9) have reported discrepancies when comparing heart rate and RPE. The variability which occurred in the present study regarding RPE and working heart rates may be due to the selection of the subjects in the study. Variations may also be due to the three minute length of the aerobic dance and treadmill activities compared to a longer period of time.

There was a significant difference in perceived exertion ratings between the aerobic dance and treadmill test. According to Borg's RPE scale, the mean score of 11.96 for aerobic dance indicated that this activity was perceived as "fairly light;" the mean RPE score of 13.53 for the treadmill activity represents a feeling of "somewhat hard." From these results, it may be concluded that aerobic dance is perceived as easier or lighter than a traditional aerobic activity (treadmill) of similar energy cost requirements. These findings substantiate previous results in perceived exertion found by Pandolf and others (5), which states that sensations
may become perceptually de-emphasized during an aerobic activity. It is possible that during the aerobic dance, perception of the work load was distorted by the music, the novelty of the dance steps, and the "fun" of performing a dance, while during the treadmill activity, the uncomfortable feelings of the aerobic activity were over-emphasized. The activity contained no novelty or uniqueness. It was a continuous, rhythmic performance until the time to cease the activity was reached. Since treadmill or similar "traditional" aerobic activities may be boring to some, one may be more aware of the pain involved in participation. This study supports the findings of Gelfand (3), which state that pain tolerance is affected more by psychological factors than physiological factors.

There was no significant difference between male and female ratings of perceived exertion during the aerobic dance and treadmill tests. Also, there was no significant interaction effect between gender (male and female) and the type of activity (aerobic dance and treadmill). It appears that, when presented with an activity that society may label as "feminine," it was perceived as less strenuous than a traditional activity. It was not known how males would perceive this activity. It was possible that males might find aerobic dance to be more "difficult" due to the complexity of the dance steps, keeping the steps in rhythm, and
the necessity of total body movement during the dances. Males, however, rated the activity "fairly light" eliminating this possibility. The reason for this assessment may be due to the ease with which males performed the dances. It was observed from the working heart rates that the male heart rates were lower than the female heart rates. Mean male heart rates were approximately ten beats below the mean female heart rates during both activities. The males may not have been enjoying the activity as much as the females, and therefore did not participate to their full intensity or fitness level. It also is possible that the males were more cardiovascularly fit and the three minute work bout was not enough time to obtain working heart rates in the 170 or 180 beats per minute range. Regardless of the reason, any differences in heart rates and perceived exertion may be considered a result of chance fluctuation.

Females perceived the aerobic dance to be easier than the treadmill work bout. Sorensen (8) has concluded that "women tend to enjoy aerobic dance and find that it is rewarding as well as a 'chance to let yourself go'".

When presented with equal work loads, both sexes perceived aerobic dance as less strenuous than the treadmill activity. It appears that aerobic dance may serve as a viable and interesting aerobic activity which provides cardiorespiratory training results.
Summary

Data in the present investigation were analyzed by the analysis of variance method. A significant difference was found between perceived exertion ratings immediately following an aerobic dance and treadmill exercise bout on two successive days. There was no significant difference in the perceived exertion ratings by males and females during the aerobic dance and treadmill performances.
CHAPTER BIBLIOGRAPHY


CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Purpose and Procedures

The purposes of the study were to (1) compare ratings of perceived exertion of an aerobic dance and ratings of perceived exertion during equal work loads on a treadmill, (2) to compare the ratings of perceived exertion expressed by males and females in aerobic dance and treadmill work, and (3) to compare an interaction effect of type of exercises and gender differences.

The subjects were twenty-six males and females enrolled in two coeducational conditioning classes at North Texas State University, Denton, Texas. Students who met the established criteria for the present investigation were randomly selected as subjects for the study.

Total training and testing time extended over three weeks. The first two weeks consisted of orientation to aerobic dance and treadmill procedures. Included in the aerobic dance orientation were a warm-up dance, a cooldown, and three conditioning aerobic dances. The treadmill training consisted of predetermined speeds and elevations to acclimatize subjects to the treadmill. Each class period contained a twenty minute aerobic dance session and a twenty-six to
thirty minute treadmill session. Each subject received two minutes of treadmill work each day. At the conclusion of the two week orientation, subjects were randomly assigned a schedule for the two testing sessions. All subjects were tested the third week of the study.

The testing instrument used to measure rate of perceived exertion was Borg's RPE scale, which is a numerical scale ranging from six to twenty with physical feelings corresponding to every odd number. The aerobic dance, "Easy Come Easy Go," served as the aerobic dance test for RPE. The treadmill test included exercising at four miles per hour at ten percent elevation for one minute, six miles per hour at zero percent elevation for one minute, and seven miles per hour at ten percent elevation for one minute.

The first testing session was the aerobic dance measure of perceived exertion. Subjects performed the aerobic dance while the investigator verbally cued the dance. Heart rates were monitored throughout the dance. At the conclusion of the dance, subjects rated perceived exertion using Borg's RPE scale. Working heart rates and RPE were recorded.

The following day, the subjects reported to the laboratory to perform the treadmill test. Each subject performed an exercise bout on the treadmill which was similar in energy cost to the aerobic dance. Working heart rates were monitored on the physiograph and a cardiotachometer to insure accurate
knowledge of the heart rate. When the subject reached the same heart rate as that reached during the aerobic dance, the treadmill was stopped and the subject rated perceived exertion for the activity. Working heart rate, RPE, and duration of the treadmill exercise bout were recorded.

Data were analyzed by the analysis of variance method with repeated measures to determine significant differences between activity responses and group or gender responses. Alpha was .05.

Results

The following are the results of the present investigation:

1. No significant differences existed in working heart rates between the two aerobic activities;

2. Mean male heart rates were approximately ten beats below the mean female heart rate during both activities, although this difference was not statistically significant;

3. A significant difference was found between perceived exertion ratings during aerobic dance and the treadmill task;

4. Both males and females perceived aerobic dance as less strenuous than the treadmill activity;

5. No significant differences were found between the male and female responses of perceived exertion during aerobic dance and treadmill. No significant differences were found in the interaction effect of gender and exercise.
Conclusions

The results of the investigations would seem to justify the following conclusions:

1. Aerobic dance is perceived to be less strenuous than the treadmill during equal work loads;
2. Males and females perceive aerobic dance as less strenuous than the treadmill during equal energy cost situations.

Recommendations

The following recommendations are offered:

1. It is recommended that this study be repeated comparing RPE after a longer aerobic dance session and a similar aerobic activity lasting a comparable length of time while monitoring working heart rates;
2. It is recommended that this study be repeated with males and females of various ages;
3. It is recommended that a study be conducted comparing RPE during aerobic dance and any other aerobic activity while playing background music;
4. It is recommended that a study be conducted comparing RPE of male and female athletes with male and female non-athletes during aerobic dance and treadmill or any other similar aerobic activity while monitoring heart rates.
5. It is recommended that this study be repeated comparing any change of RPE during a semester of aerobic dance and treadmill activity. This study might determine if longer treatment periods in aerobic activity might influence RPE.

Summary

This chapter presented a summary of the purposes and procedures of this investigation, as well as the results and conclusions of the study. Recommendations for future investigation involving aerobic activities and perceived exertion were included.
APPENDIX A

INSTRUCTIONS FOR RATING PERCEIVED EXERTION

You should now be holding a scale which contains numbers from six to twenty. We use this scale so that you may translate into numbers your feelings of exertion while exercising. The range of numbers should represent a range of feelings from "no exertion at all" (number 6) to "maximal exertion" (number 20). In order to help you select a number which corresponds to your subjective feelings every other number has an attached verbal expression (for example 7 is associated with feelings of very, very light exertion while 19 is associated with feelings of very, very hard exertion). Your goal is to rate your feelings which are caused by the work and not the work itself. These feelings should be general, that is about the body as a whole. We will not ask you to specify the feeling but to select a number which most accurately corresponds to your perception of your total body feeling. Keep in mind that there are no right or wrong answers. Use any number you think is appropriate.
APPENDIX B

Borg's Scale for Ratings of Perceived Exertion

6
7 Very, very light
8
9 Very light
10
11 Fairly light
12
13 Somewhat hard
14
15 Hard
16
17 Very hard
18
19 Very, very hard
20
## APPENDIX C

### SCORE SHEET

<table>
<thead>
<tr>
<th>NAME</th>
<th>ADHR (Aerobic Dance Heart Rate)</th>
<th>ADRPE (Aerobic Dance RPE)</th>
<th>TMHR (Treadmill Heart Rate)</th>
<th>TMRPE (Treadmill RPE)</th>
<th>SEX</th>
<th>TIME (Length of time during treadmill test)</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
CERTIFICATION OF INFORMED CONSENT
AND SUBJECT INFORMATION

I have been informed of the research program at North Texas State University involving a study in perceived exertion and two aerobic activities.

I understand the nature and purpose of the study and also am aware that I may withdraw my consent for my status. With my understanding of this and having received this information and satisfactory answers to any questions asked, I voluntarily consent to participate in the study described.

In addition, I can truthfully answer the following questions:

1. I have never participated in an aerobic dance class.  
   ___Yes   ___No

2. To my knowledge, I have no medical limitations for participation in aerobic activities.  ___Yes   ___No

3. With regard to height and weight measurements, I am within the range of no more than thirty pounds over the desired body weight for my height.  ___Yes   ___No

Signed ____________________________ Date ____________________________
Witness ____________________________
APPENDIX E

AGES, HEIGHTS, WEIGHTS AND YEAR IN SCHOOL OF MALE AND FEMALE SUBJECTS

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Age (Months)</th>
<th>Height (Inches)</th>
<th>Weight (Pounds)</th>
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<td>II. Females</td>
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<td></td>
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</tr>
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<td>V.F.</td>
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<td>L.G.</td>
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</tr>
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</tr>
<tr>
<td>R.L.</td>
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<td>O.M.</td>
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<td>108</td>
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<td>A.W.</td>
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<td>67.50</td>
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</tbody>
</table>
APPENDIX F

AEROBIC DANCE ORIENTATION SCHEDULE

Week #1
Monday
Teach warm-up - "The Most Beautiful Girl" - review two times
Teach aerobic dance #1 - "Easy Come Easy Go" - review and perform two times
Teach cooldown - "The Way we Were" - review and perform one time
Wednesday
Warm-up - "The Most Beautiful Girl" - perform one time
Review: "Easy Come Easy Go" - perform two times
Teach aerobic dance #2 - "Rock Around the Clock" - perform one time
Cooldown - "The Way we Were" - perform one time
Friday
Warm-up - "The Most Beautiful Girl" - perform one time
Review: "Rock Around the Clock" - perform three times
"Easy Come Easy Go" - perform one time
Cooldown - "The Way we Were" - perform one time

Week #2
Monday
Warm-up - "The Most Beautiful Girl" - perform one time
Teach aerobic dance #3 - "Joy to the World" - perform three times
Review - "Easy Come Easy Go" - perform two times
"Rock Around the Clock" - perform three times
Cooldown - "The Way we Were" - perform one time
Wednesday
Warm-up - "The Most Beautiful Girl" - perform one time
Review: "Rock Around the Clock" - perform two times
"Joy to the World" - perform three times
"Easy Come Easy Go" - perform one time
Cooldown - "The Way we Were" - perform one time
Friday
Warm-up - "The Most Beautiful Girl" - perform one time
Review: "Joy to the World" - perform three times
"Rock Around the Clock" - perform one time
"Easy Come Easy Go" - perform two times
Cooldown - "The Way we Were" - perform one time
APPENDIX G

Subjects will be placed in a scatter formation during the aerobic dance session. Males will be instructed to stand on any "X" and females will stand on any "O". Each line will rotate forward after each dance during the six aerobic dance sessions.

\[
\begin{array}{ccccccccc}
\downarrow & 0 & X & 0 & X & 0 & X & 0 & X & \downarrow \\
X & 0 & X & 0 & X & 0 & X & 0 & \ \\
\uparrow & 0 & X & 0 & X & 0 & X & 0 & X & \uparrow \\
\end{array}
\]
APPENDIX H

AEROBIC DANCE AND TREADMILL TESTING SCHEDULE

<table>
<thead>
<tr>
<th>Monday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:00 N.B. - Aerobic Dance</td>
<td>8:30 R.L. - Treadmill</td>
</tr>
<tr>
<td>2:30 D.C. - Aerobic Dance</td>
<td>8:45 D.A. - Aerobic Dance</td>
</tr>
<tr>
<td>3:00 S.H. - Aerobic Dance</td>
<td>9:00 B.F. - Treadmill</td>
</tr>
<tr>
<td>3:15 A.C. - Aerobic Dance</td>
<td>9:15 L.T. - Treadmill</td>
</tr>
<tr>
<td>3:30 K.N. - Aerobic Dance</td>
<td>12:00 R.B. - Treadmill</td>
</tr>
<tr>
<td>3:45 R.H. - Aerobic Dance</td>
<td>12:15 L.G. - Aerobic Dance</td>
</tr>
<tr>
<td>4:00 J.M. - Aerobic Dance</td>
<td>5:30 C.R. - Aerobic Dance</td>
</tr>
<tr>
<td>5:00 V.T. - Aerobic Dance</td>
<td>5:45 A.W. - Treadmill</td>
</tr>
<tr>
<td>5:15 M.L. - Aerobic Dance</td>
<td>6:00 H.B. - Treadmill</td>
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<tr>
<td></td>
<td>6:15 R.B. - Treadmill</td>
</tr>
<tr>
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<td>6:30 V.F. - Aerobic Dance</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Monday</td>
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<tr>
<td>8:30 S.H. - Treadmill</td>
<td>2:00 K.G. - Aerobic Dance</td>
</tr>
<tr>
<td>8:45 N.B. - Treadmill</td>
<td>2:15 R.B. - Aerobic Dance</td>
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<tr>
<td>9:15 M.L. - Treadmill</td>
<td>2:45 J.B. - Treadmill</td>
</tr>
<tr>
<td>12:00 K.N. - Treadmill</td>
<td>3:00 N.W. - Treadmill</td>
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<tr>
<td>12:15 N.W. - Aerobic Dance</td>
<td>3:15 D.R. - Aerobic Dance</td>
</tr>
<tr>
<td></td>
<td>3:45 L.T. - Aerobic Dance</td>
</tr>
<tr>
<td></td>
<td>4:00 S.C. - Aerobic Dance</td>
</tr>
<tr>
<td></td>
<td>4:15 R.B. - Aerobic Dance</td>
</tr>
<tr>
<td></td>
<td>4:30 A.W. - Aerobic Dance</td>
</tr>
<tr>
<td></td>
<td>4:45 N.B. - Treadmill</td>
</tr>
<tr>
<td></td>
<td>5:00 H.B. - Aerobic Dance</td>
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<table>
<thead>
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<th>Wednesday</th>
<th>Friday</th>
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</thead>
<tbody>
<tr>
<td>2:00 K.G. - Aerobic Dance</td>
<td>2:00 D.A. - Treadmill</td>
</tr>
<tr>
<td>2:15 R.B. - Aerobic Dance</td>
<td>2:15 S.C. - Treadmill</td>
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<tr>
<td>2:30 R.L. - Aerobic Dance</td>
<td>2:30 L.G. - Treadmill</td>
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<tr>
<td>2:45 J.B. - Treadmill</td>
<td>2:45 O.M. - Treadmill</td>
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<tr>
<td>3:00 N.W. - Treadmill</td>
<td>3:15 C.R. - Treadmill</td>
</tr>
<tr>
<td>3:15 B.F. - Aerobic Dance</td>
<td>3:30 V.F. - Treadmill</td>
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<tr>
<td>3:30 D.R. - Treadmill</td>
<td>4:00 J.C. - Treadmill</td>
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<tr>
<td>3:45 L.T. - Aerobic Dance</td>
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<td>4:00 S.C. - Aerobic Dance</td>
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<td>4:15 R.B. - Aerobic Dance</td>
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<tr>
<td>4:45 N.B. - Treadmill</td>
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</tr>
<tr>
<td>5:00 H.B. - Aerobic Dance</td>
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APPENDIX I

PERCEIVED EXERTION RATING SCORES AND HEART RATES ELICITED BY MALES AND FEMALES DURING AEROBIC DANCE AND TREADMILL PERFORMANCES

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<th>Aerobic Dance Heart Rate (bpm)</th>
<th>Treadmill Heart Rate (bpm)</th>
<th>Treadmill Performance (seconds)</th>
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<td>5. DC</td>
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