ABSTRACT


Twenty-one female Ss participated in either a 2-day (n=5) or a 3-day (n=16) Jazzercise program for 7 wks to determine if Jazzercise training would elicit changes in maxVO₂ and body composition. The Ss ranged in age from 18-33 yrs. All Ss were given pre (T₁) and post (T₂) maxVO₂ tests using the Modified Astrand Protocol, and were hydrostatically weighed. A target HR of 75% of age-predicted MHR was assigned and the THRs were recorded. The 2 and 3 day groups worked at an average intensity of 78.8% and 77.3%, respectively. A mixed design 2-way ANOVA was used to analyze the following variables: body weight, % body fat, R, maxVO₂ (l·min⁻¹ and ml·kg·min⁻¹), treadmill run time, maxVE, and MHR. Sig (p<.05) increases were found for both groups for maxVO₂, both relative and absolute. Sig (p<.05) decreases were found for both groups for % body fat. There were no sig (p<.05) changes for either group for all other variables with the exception of a sig (p<.05) increase in ventilatory efficiency for the 3-day group. There were no sig (p>0.05) interactions between groups for all variables with the exception of ventilatory efficiency. It was concluded that participation in Jazzercise either 2 or 3 times per wk is effective for producing positive body composition and cardiovascular responses.
JAZZERCISE AS A TRAINING MODE IN WOMEN

A Thesis Presented to The Graduate Faculty University of Wisconsin—La Crosse

In Partial Fulfillment of the Requirements for the Master of Science Degree

by

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December, 1985
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ACKNOWLEDGEMENTS

I would like to sincerely thank my excellent thesis committee, Dr. Nancy Butts, thesis chairperson, and the rest of my committee, Dr. Sandra Price and Dr. Julie Sichler. A special thanks to Dr. Butts for her expert guidance but most of all for her continued encouragement. A special acknowledgement to Dr. Price for allowing the Jazzercise program to be incorporated into the UW-L Intramural program. To Kathy Castleman, Betsy Henry, and Kenrick Smith .......
I could not have done it without your invaluable assistance in the lab but mostly for being supportive friends. I would also like to acknowledge Judi Sheppard Missett, founder of Jazzercise, who combined in a program two of my most favorite things in life, fitness and dance. Thanks to my family for their support through another one of my adventures.

Dancing is an art, we may be sure, cannot die out, but will always be undergoing a rebirth. Not merely as an art, but also as a social custom, it perpetually emerges afresh from the soul of the people.

Havelock Ellis
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CHAPTER I

INTRODUCTION

The American public has become increasingly aware of the benefits of regular exercise. In recent years, the emphasis on exercise has shifted toward aerobic fitness which is currently recognized as a major health goal of the United States (Goodrick & Iammarino, 1982).

Despite our advances in technology and knowledge about cardiovascular disease, it accounts for more death and disability than any other disease in our country. According to Heyward (1984):

It is estimated that cardiovascular disease is responsible for more than 51% of all deaths and that one out of every four people whose death is attributable to cardiovascular disease is less than 65 years of age. More than 40 million Americans have some form of cardiovascular disease. (p. 2)

Specifically, aerobic exercise has been recognized as one key to cardiovascular fitness. When Cooper (1968) wrote the first in a series of books on aerobic exercise, he introduced the concept of exercise called "aerobics". In the past few years, this term has become a household word. Aerobic exercise includes such activities as swimming, biking, jogging, brisk walking, and jumping rope which are all aimed at improving cardiorespiratory
endurance. Cooper (1982) defined aerobic exercise as:

Those exercises that demand large quantities of oxygen for prolonged periods of time and ultimately force the body to improve those systems responsible for the transportation of oxygen. (p. 112)

Participation in a fitness program for improvement in cardiovascular fitness is dependent upon the intensity, duration, and frequency of the exercise mode (Pollock, Wilmore, & Fox, 1978). Increased awareness of the benefits of regular aerobic exercise has stimulated the growth of programs to meet this increased demand. This demand for different modes of aerobic exercise has led to the development of dance fitness programs. One of the most commonly known of these is Aerobic Dancing created and copyrighted by Jackie Sorenson in 1969. The dance fitness approach appealed to a portion of the female population that was not interested in jogging, swimming, biking, or similar types of exercise modes. Some women even feel a cultural bias against jogging, despite its acceptance as a means for improving cardiovascular fitness (Rockefeller & Burke, 1979).

Since the creation of Jackie Sorenson's Aerobic Dancing, many similar dance fitness programs have evolved nationwide. Physical educators, recreation supervisors, and physical fitness instructors have incorporated aerobic dance into their programs (Vaccaro & Clinton, 1981).
Aerobic dance programs are currently offered in colleges, universities, community recreation programs, and in the health club "business" (Russell, 1983). According to Legwold (1982) approximately 350,000 members of the Health and Tennis Corporation of America are participating in aerobic dancing. In addition, a large percentage of YMCAs and YWCAs have some form of aerobic dance.

When analyzing specific dance fitness programs, the enrollment in Jackie Sorenson's Aerobic Dancing increased five fold from 1972 to 1982 with 150,000 participants (Legwold, 1982). The current enrollment of Jazzercise, the largest dance fitness program created and copyrighted by Judi Sheppard Missett, is over 400,000 with over 3,000 instructors worldwide (Jazzercise Instructor's Manual, 1985).

Along with the growth of the industry came a growing concern as to whether or not aerobic dancing had value as a modality for cardiovascular fitness improvement. There is still somewhat of a void in the scientific data available, considering the large number of participants. Some studies have been done to examine the effects of aerobic dance on the cardiovascular system as well as other components of fitness obtained through participation in these programs (Dowdy, Cureton, DuVal, & Ouzts, 1985; Gatch, Baudier, & Ferriss, 1982; Hooper & Noland, 1984; Maas, 1975; Milburn & Butts, 1983; Rockefeller & Burke, 1979; Vaccaro
& Clinton, 1981; Watterson, 1984; White et al., 1984). Most of these studies have concluded that aerobic dance can provide enough duration and intensity to elicit a training effect. Other aerobic dance studies have shown that the degree of energy expended during an aerobic dance routine can provide sufficient stimulus to produce cardiovascular training effects but this is dependent upon the intensity at which the dance routines are performed (Foster, 1975; Igbanugo & Gutin, 1978; Metcalf, Watson, Matthews, & Guynn, 1981; Weber, 1974).

It should be noted that one study concluded that the degree of cardiovascular improvement in aerobic dancing may not be as much when compared to other modes of training (Vaccaro & Clinton, 1981). Data from this ten week study were compared to training studies done by Eisenman and Golding (1975) and Fringer and Stull (1974). Eisenman and Golding (1975) did a 14 week running and bench stepping program while Fringer and Stull (1974) did a 10 week bicycle training program. Vaccaro and Clinton (1981) found a ten percent improvement in the maximal rate at which an individual can utilize oxygen \( \text{max} \dot{V}O_2 \) as a result of aerobic dancing, compared to a 18 percent improvement found by Eisenman and Golding (1975) and a 39 percent change reported by Fringer and Stull (1974). The differences in improvement of \( \text{max} \dot{V}O_2 \) may be attributed
to low initial fitness levels of the participants and the comparison of data from training studies of different lengths. The differences in results between the aerobic dance study and the biking and running studies may not be related to the effectiveness of the mode of training. A different conclusion was drawn by Milburn and Butts (1983) who concluded from their study comparing aerobic dance and jogging, that both were equally effective exercise modalities for significant improvement in cardiovascular fitness if performed at a similar intensity, frequency, and duration.

If there is still a paucity in the literature about aerobic dance programs, then there is a real void concerning another dance related fitness program, specifically Jazzercise. Jazzercise began its development in 1968 by Judi Sheppard Missett, a professional dancer. With 400,000 students in 52 states and 17 foreign countries, the Jazzercise program has the largest enrollment of any single dance fitness program (Jazzercise Instructor's Manual, 1985). Perhaps Jazzercise has been ignored in the literature because it was considered to be just another "form" of aerobic dance.

The Jazzercise program has a distinct class structure and is based on jazz dance technique. Many dance fitness programs being taught today have incorporated ideas and
class structure from Judi Sheppard Missett’s Jazzercise
and Jackie Sorenson’s Aerobic Dancing. To explain the
interest in dance fitness programs, Balke (cited in Polley,
1983) made the following observations:

Many activities can provide opportunities to achieve
a decent level of fitness, which could be defined as
optimal circulatory-respiratory-metabolic reserves to
meet the demands of daily life, plus the necessary
recreational compensations without fatigue or damage
to health. But one of the oldest and most popular
forms of exercise in all societies is dancing. With
its many varieties and forms, dancing is always
movement par excellence. Responding to the simple
rhythms of drums or any combination of musical
instruments can involve all components of aerobic
training. The demands of the heart and lungs, and
the high energy turnover are seldom fully realized
in the enjoyment of dancing. Like jogging and other
endurance exercises dancing uses fat as the main
energy source, thus making it helpful in weight
control. (p. 13)

It is also important to note that a large segment of
the participants in dance fitness programs would probably
not participate in any other activity if dance fitness
programs were not available. In Schuster (1979), Jackie
Sorenson commented that jogging is neither enjoyable nor
easy for many of her students, mostly women. Dancing is
not a substitute for jogging. The participants in dance
fitness programs would do nothing else if they did not
"dance".

Purpose of the Study

The purpose of this study was to analyze the
Jazzercise fitness program to determine its training effect
on the cardiovascular system and body composition.

Need for the Study

As a popular recreational fitness activity, Jazzercise needs to be studied in terms of its effect on the cardio-respiratory system and body composition. The Jazzercise organization has conducted several studies, but nothing has been published in the research literature to date. It would be beneficial to determine how Jazzercise compares to other forms of activity as a method to improve cardiovascular fitness and reduce percent body fat. As previously stated, numerous studies have been conducted on the effects of various aerobic dance programs.

A preliminary, unpublished study (Huhn & Rehm, 1983) was done to determine the cardiovascular fitness value of Jazzercise. This study concluded that the heart rate increases which occurred during Jazzercise appeared to border on stimulating cardiovascular endurance. This study also concluded that different music, class location, and instructors might influence results. Another study reported in the Jazzercise Newsletter (Phillips, 1984) reported significant improvement in cardiovascular endurance and a reduction of percent body fat. This study used maximal time on the treadmill as the measurement of cardiovascular endurance rather than actually measuring metabolic responses with gas collection.
Although both Jazzercise and aerobic dance programs use dance related movements and music there are structural differences between the two and they need to be addressed as separate activities. The conclusions drawn from the studies done on aerobic dance programs should not be automatically assigned to the Jazzercise program.

**Hypothesis**

The null hypotheses were assumed for this study. A seven week training session of Jazzercise comprised of a two day a week and a three day a week group will have no significant effect on cardiovascular fitness and body composition. There will also be no significant differences between the two training groups. The rejection criteria used for this study was the 0.05 level of significance.

**Delimitations**

Delimitations of this study were:

1) The subjects were untrained female volunteers with an initial max\(\dot{V}O_2\) of 45.0 ml·kg·min\(^{-1}\) or less who were enrolled in Jazzercise classes offered by the University of Wisconsin - LaCrosse Intramural program, Winter Semester, 1985.

2) The study was conducted over a seven week training period.

3) The subjects had to attend a minimum of 90% of the training sessions and could not be participating in
any other regular aerobic exercise.

4) Smokers were eliminated from the study.

5) Subjects had only two components of fitness measured: cardiovascular fitness (maxVO₂) and percent body fat (hydrostatic weighing).

6) There was no control group.

7) Only six second heart rates were taken due to Jazzercise policy of no more than a six second pause between cardiovascular routines.

8) The normal class length of 14-15 routines and 55-60 minutes had to be shortened to 13 routines and 50 minutes due to scheduling conflicts. None of the cardiovascular routines were eliminated.

Limitations

Possible limitations of this study were:

1) The subjects were all volunteers and not randomly assigned to the two and three day a week training groups.

2) Diet and rest were not controlled and the subjects were assumed to be healthy.

3) Motivation levels of the subjects could not be totally controlled.

4) There is a certain amount of learning effect in performing Jazzercise routines that might affect performance.
5) The atmosphere at the University of Wisconsin - LaCrosse has the tendency to promote participation in exercise.

Definitions of Terms

Aerobic Exercise - types of exercise that demand oxygen over a period of time and stimulate a training effect in the cardiorespiratory system.

Aerobic Dance - a fitness activity that combines the principles of dance, calisthenics, and aerobic exercise consisting of vigorous rhythmic choreographed steps and routines to specific pieces of music.

Body Fat - one component of body composition which includes both essential and storage fat. Essential fat is fat present in bone and nerve tissue and various organs required for physiological function. Storage fat is the fat that accumulates mainly as adipose tissue under the skin and acts as an energy reserve. This was measured by hydrostatic weighing, a method of determining body density and subsequent estimation of percent body fat.

Cardiovascular Fitness - the ability of the circulatory and respiratory systems to transport adequate amounts of oxygen to the muscles, allowing performance of activities that use large muscle groups to be sustained over long periods of time.

Experimental Groups - the two groups of subjects that received pre and post tests as well as the treatment of a
seven week Jazzercise training session. The two groups consisted of two day a week and three day a week participants.

Jazzercise - a total body conditioning program based on jazz dance choreography designed to improve cardiovascular fitness was well as balance, posture, coordination, flexibility, muscle toning and strengthening with an added emphasis on mental fitness. Routines are performed to specific pieces of music (Jazzercise Instructor's Manual, 1985).

Maximal Heart Rate - the highest heart rate obtained during a treadmill test that pushes the subject to max $\dot{V}O_2$ (Brooks & Fahey, 1984). In this study, it was measured by the R to R intervals on a 15 second ECG strip taken every minute after warm-up and at maximum workload.

Max $\dot{V}E$ - the greatest amount of air that can be exchanged in a one minute period during maximal exercise.

Max $\dot{V}O_2$ - the maximal rate at which oxygen can be consumed per minute during strenuous exercise; the power of the aerobic or oxygen system. This can be expressed in milliliters of oxygen per kilogram of body weight ($ml \cdot kg \cdot min^{-1}$) or in liters per minute ($l \cdot min^{-1}$). It is a measure of cardiovascular fitness. For this study, it was measured by a max $\dot{V}O_2$ test using the Modified Astrand Protocol (Pollock et al., 1978).
Training Effect - the systemic changes that occur in response to the intensity of the workload particularly in the skeletal muscles and the cardiorespiratory systems. It is affected by the intensity, duration, and frequency of the training sessions and by the mode of exercise used during the training period. In the present study it was measured by the determination of max\(\dot{V}O_2\).

Respiratory Exchange Ratio \(\text{(R)}\) - a ratio of the volume of carbon dioxide output per minute, to the volume of oxygen uptake per minute. The R value will change in relation to different metabolic states. In this study, it was used as an indicator of maximal effort by reaching a value of 1.00 or greater.

Treadmill Run Time - the subject's total test time on the treadmill from the beginning of the warm-up through the maximal workload but not including the cool-down period, expressed in seconds.

Untrained - for this study, it is defined as a female having a max\(\dot{V}O_2\) value of 45 ml·kg·min\(^{-1}\) or less. A higher value would place the subjects in an above average fitness level.
CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The review of related literature has been divided into three parts. The first part discusses cardiovascular fitness, the second part reviews hydrostatic weighing and percent body fat, while the third part reviews literature related to Jazzercise and dance fitness programs. Also included in the third part is a detailed description of the Jazzercise program.

Cardiovascular Fitness

Definition of Cardiovascular Fitness

The definition of physical fitness is still one of controversy and varied opinion. No single definition of fitness has ever been universally accepted. Katch and McArdle (1983) stated that:

While it is difficult to formulate a precise definition of fitness, it is appropriate to view total fitness as a state of physical well-being that incorporates a balance between several well-developed fitness components. More specifically, total fitness requires adequate muscular strength and endurance, reasonable joint flexibility, an efficient cardiovascular system with a good level of aerobic fitness, and favorable body composition with acceptable control of body weight. (p. 187)
Berger (1982) defined physical fitness as "the ability to perform tasks that involve the components of strength, power, and endurance" (p. 258).

Some definitions listed by Heyward (1984) include various components of fitness such as: cardiorespiratory endurance, muscular strength and endurance, body weight and composition, flexibility and neuromuscular relaxation.

Another opinion is that each individual must fully develop their cardiovascular potential to remain healthy and free of cardiovascular disease (Lamb, 1978).

When defining fitness most physiologists agree that of all the possible components the most representative of general fitness is cardiorespiratory endurance or cardiovascular fitness (Brooks & Fahey, 1984; Foster, 1975; Morehouse & Miller, 1976; Stewart, Williams, & Gutin, 1977).

Many exercise physiologists have come to consider the oxygen transport capacity or maximal oxygen consumption to represent a factor of major importance within any definition of physical fitness. It has been recognized that activities which tax the oxygen transport system such as running, walking, swimming, and cycling generally provide an adequate stimulus to elicit a training effect. (Foster, 1975, p. 120)

Brooks and Fahey (1984) concluded that maxVO₂ is a term that could be used synonymously with fitness. The maximal rate at which an individual can utilize oxygen is a measurement of the capacity of the cardiovascular system. These authors stated:
This realization that physical work capacity, max\(\dot{V}O_2\) and cardiovascular fitness are interrelated has resulted in a convergence of physical education (athletic performance) and medical (clinical) definitions of fitness. From the physical education-athletics perspective, cardiovascular function determines max\(\dot{V}O_2\), which in turn determines physical work capacity, or fitness. From the medicoclinical perspective, fitness involves freedom from disease. Because cardiovascular disease represents the greatest threat to health of individuals in contemporary Western society, medical fitness is largely cardiovascular fitness. One of the major ways to determine cardiovascular fitness is to measure max\(\dot{V}O_2\). Therefore, \(\dot{V}O_2\) is not only an important parameter of metabolism, it is also a good measure of fitness for life in contemporary society. (p. 9-10)

Cooper (1982) emphasizes the importance of the many discoveries related to participation in these types of activities that he defines as aerobic exercise, on fitness levels. He is convinced of the beneficial effects that accompany participation in aerobic exercise for the development of cardiovascular fitness. At present, the affect of endurance type activities on the prevention of heart disease is an active area of investigation.

Research into exercise and cardiovascular fitness indicates that it may have the potential for improving the general well-being and quality of life for individuals.

Measurement of Cardiovascular Fitness

Generally, max\(\dot{V}O_2\) is accepted as the best physiological indicator of cardiovascular fitness (Anderson, Shepard, Denolin, Varnauskas, & Masironi, 1971; Fox & Mathews, 1981; Stewart et al., 1977; Taylor, Buskirk, &
Henschel, 1955; Weltman & Stamford, 1982). As previously stated, maxVO\textsubscript{2} is defined as the maximal rate at which oxygen can be consumed during strenuous exercise. Weltman and Stamford (1982) stated that maxVO\textsubscript{2} measurement is highly stable and with the careful use of the testing procedures it should be very accurate.

The two most common exercise modes for testing maxVO\textsubscript{2} include: treadmill test and bicycle ergometer test. Treadmill tests produce the highest values for maxVO\textsubscript{2} in the average individual and are least affected by variations in skill and efficiency (Lamb, 1978). The reason for the higher values obtained from the use of the treadmill test may be related to differences in size of active muscle mass, which is largest during a treadmill run (Fox & Mathews, 1981).

The use of the bicycle ergometer has a disadvantage due to the potential onset of local muscle fatigue before maxVO\textsubscript{2} values can be obtained. In addition, cycling mainly uses the large muscles of the thigh and can be affected by skill.

In general, criteria to indicate an individual has attained their maxVO\textsubscript{2} can be determined by a leveling off or decrease in VO\textsubscript{2} with increasing workloads, maximal heart rate, a respiratory exchange ratio (R) greater than unity, blood lactate levels above 100 mg percent, and volitional exhaustion (Astrand & Rodahl, 1977; Brooks & Fahey, 1984; Fox & Mathews, 1981; McArdle, Katch, & Katch, 1981).
Many protocols have been developed for performing maximal treadmill tests to determine $\dot{V}O_2$. Opinions vary as to the best method or protocol to follow. Pollock and associates (1978) reviewed three of the most popularly used tests; the Balke, the Bruce, and the Modified Astrand protocols. Although the length of the tests differed, the end result of $\dot{V}O_2$ values were approximately the same. Pollock and associates (1978) indicated that the Bruce and Balke protocols are appropriate diagnostic tests while the Modified Astrand test starts at a higher energy cost level thus making it better suited for more conditioned individuals.

Since the subjects in the present study were considered healthy, the Modified Astrand protocol was used as a functional test to determine cardiorespiratory fitness ($\dot{V}O_2$). This protocol is preceded by a five minute warm-up at 3.5 mph and a 2.5% grade appropriate for beginners. The speed and grade is then adjusted to exhaust the subject within 7 to 10 minutes after the warm-up period, a time span considered adequate for maximal physiological adjustments to occur (Pollock et al., 1978). If necessary, the speed can be adjusted for varying abilities.

Training Requirements for Cardiovascular Fitness

Improvement of cardiovascular fitness results from many factors. In order for an exercise mode to elicit a
training effect, it must meet certain criteria including sufficient duration, frequency, intensity level and an appropriate mode. The development of cardiovascular fitness is best achieved by a mode of exercise that involves the large muscle groups in rhythmic activity. Most research in this area has been done on male subjects but the studies that have been conducted on females support the idea that most of the conclusions from studies involving males are applicable to females.

The American College of Sports Medicine (ACSM) (1978) has established guidelines and recommendations for the quantity and quality of training for developing and maintaining cardiorespiratory fitness and body composition in the healthy adult. These include:

1) Frequency of training: 3 to 5 days per week.
2) Intensity of training: 60% to 90% of maximum heart rate reserve or, 50% to 85% of maximum oxygen uptake (maxV\textsubscript{O2}).
3) Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity thus, lower intensity activity should be conducted over a longer period of time.
4) Mode of activity: any activity that uses large muscle groups, that can be maintained continuously and is rhythmical and aerobic in nature. (p. vii-x)

Frequency. Frequency of exercise depends partly upon the initial health and fitness levels of the individual. There are conflicting opinions regarding how often exercise sessions should occur and how they should be dispersed.
It is generally agreed that little or no benefit can be derived from one workout per week.

In a study done by Gettman, Pollock, Durstine, Ward, Ayres, and Linnerud (1976) maxVO₂ improvements were 8, 13, and 17% for 1, 3, and 5 day per week training, respectively. Gains in aerobic capacity decreased from 19.5% to 16% when training was reduced from five to three sessions per week (Morehouse & Miller, 1976). Significant changes in maxVO₂ have been found in college age females in programs conducted two and three times per week (Atomi, Ito, Iwasaki, & Miyashita, 1978). DeVries (1980) stated that research has shown improvement accelerates with workouts done four to five times per week. Improvements begin to decrease at six and seven times per week related to muscle glycogen. The American College of Sports Medicine (1978) position statement on the recommended quantity and quality of exercise for developing and maintaining fitness in health adults stated:

The amount of improvement in maxVO₂ tends to plateau when frequency of training is increased above three days per week. For the non athlete, there is not enough information available at this time to speculate on the value of added improvement found in programs that are conducted more than five days per week. Participation of less than two days per week does not show an adequate change in maxVO₂. (p. vii-x)

It should be noted, that with increased frequency of training comes the increase of risk for orthopedic injuries.
Research has shown that beginning exercisers who train longer than 30 minutes per session and more than three days per week have an increased incidence of foot, leg, and knee injuries (ACSM, 1978). Chronic jogging and marathon training also tend to manifest overuse injuries.

Related to the frequency of training is the regularity of continued participation. If training is stopped or diminished, improvements gained in a program will rapidly diminish (Pollock et al., 1978). Cureton and Phillips (1964) did a study using equal eight-week periods of training, detraining and then retraining. They found significant improvement, loss of cardiovascular fitness and then improvement, respectively.

Russell (1983) found no significant improvement in cardiovascular fitness with two day per week sessions of aerobic dance in participants who supposedly followed the recommended duration and intensity for improvement in cardiovascular fitness. Cearly, Moffatt and Knutzen (1984) did a 10 week aerobic dance study comparing the cardiovascular training effects of two day a week versus three day a week participation. Results showed statistically significant differences between the two and three day a week groups for $\text{max} \dot{V}O_2$, $\text{max} V_E$, and treadmill run time to exhaustion. Studies done on aerobic dance programs with
three and four times per week frequency of training showed significant improvement in either max\(\dot{V}O_2\) or Cooper's 12-minute field performance test (Milburn & Butts, 1983; Watterson, 1984). Vacarro and Clinton (1981) showed a 10% increase in max\(\dot{V}O_2\) values after a ten week, three day a week aerobic dance program. Similar results were found by Rockefeller and Burke (1979) who reported a 13% increase in max\(\dot{V}O_2\) following a ten week, three day a week program.

The question of training frequency is important in terms of dance fitness programs since due to facility limitations, many are only offered two days per week which does not follow the ACSM (1978) guidelines for the necessary frequency of training sessions per week to elicit a training effect.

**Duration.** Duration is an important factor in improving cardiovascular fitness. Although improvements have been shown with moderate to high intensity workouts lasting only five to ten minutes daily (Pollock et al., 1978), it is generally thought that programs of less than 30 to 60 minutes will show a lower training effect than programs of longer duration per session. A study done on male subjects 20 to 35 years of age for 20 weeks showed significant max\(\dot{V}O_2\) improvement levels of 8.5, 16.1, and 16.8% for the 15, 30, and 45 minute duration groups, respectively (Pollock et al., 1978).
Another study done by Pollock and associates (1978) concluded that two groups jogging at different intensities had similar results when total energy expenditures were analyzed. If total energy expenditure was equalized between the two groups, it can be concluded that the joggers can slow down pace, run longer to make up for the decreased caloric expenditure, and end up with the same approximate training effect.

It should be noted that duration and intensity are closely interrelated. The ACSM (1978) recommends a training duration of 15 to 60 minutes of continuous aerobic exercise with lower intensity activities being performed over a longer duration. The duration is dependent on the intensity of the activity. Because total fitness is more readily attained in longer duration exercise sessions and because of the potential orthopedic hazards and compliance factors with high-intensity programs, the lower to moderate intensities and longer duration activities are recommended (Fox & Mathews, 1981; ACSM, 1978).

Aerobic dance studies (Cearly et al., 1984; Hooper & Noland, 1984; Milburn & Butts, 1983; Rockefeller & Burke, 1979; Watterson, 1984) that involve training of 20 to 40 minutes showed significant improvement in maxVO₂ or cardiovascular fitness if sufficient frequency and intensity were employed.
Eisenman and Golding (1975), who studied young women in a 14 week program of bench stepping and running three days per week, 30 minutes per day, found a 18% increase in maxVO2. Fringer and Stull (1974) showed a 39% increase in maxVO2 in a ten week study done on females using interval bike training three times per week for 30 minutes each session.

**Intensity.** Improvement in cardiovascular fitness is directly related to intensity (Pollock et al., 1978). Low intensity programs may show less than 5% or no improvement while a higher intensity program can elicit a 15 to 20% increase in aerobic capacity during brief training sessions. Intensity is the variable responsible for the most significant training effect. A threshold intensity level is defined as a level of intensity above which significant improvement occurs and below which improvement is non-significant. This level varies among individuals and is related to the initial fitness levels of the individuals (Fox & Mathews, 1981).

The level of intensity for training is determined by applying the overload principle. The heart rate method is the easiest to use when ascertaining overload. Fox and Mathews (1981) explained that the degree of heart rate response to an exercise load is an indicator of the overload being placed on the cardiovascular system (i.e. the higher
the heart rate, the greater the intensity of the work).

The minimal threshold level for improvement in $\text{max}\bar{VO}_2$ is generally accepted as 60% of the maximal heart rate reserve (MHR). Maximal heart rate reserve represents the percent difference between resting heart rate and maximal heart rate added to the resting heart rate. This technique was initially described by Karvonen, Kentala, and Mustala (1957).

Although researchers agree that there is a minimum training threshold necessary to elicit a training effect, conflicting views can be found in the literature in regards to the role of intensity in eliciting the training effect. Several studies have indicated that the effects of training are directly related to the exercise intensity (Faria, 1970; Sharkey & Holleman, 1967). Yet, there is evidence to suggest that for certain subjects the training threshold may be somewhat lower than initially conjectured by Karvonen (Crevis & Roberts, 1976; Edwards, 1974). Kearny, Stull, Ewing, and Strein (1976) investigated the influence of training intensity on the cardiorespiratory responses of sedentary women and concluded that training at either 50 or 65% of MHR was sufficient enough to elicit a training effect. In another study (Edwards, 1974) it was concluded that an intensity of 125 beats per minute provided enough stimulus for training effects in sedentary women and in
this case, must be considered a greater than minimal or threshold stimulus for the initially very sedentary young women. It should be noted, that this stimulus (HR 125) was well below the suggested heart rate of 150 beats per minute suggested by Cooper (1968) as necessary for cardiorespiratory training in untrained adult males. It was concluded that champion athletes train at higher heart rates but that this is neither possible, nor recommended (Edwards, 1974). This level is apparently not necessary for all people, particularly those who for medical or other reasons need to improve cardiorespiratory fitness.

While there may be a minimal threshold intensity below which a training effect will not be elicited, there may also be a ceiling or limit of intensity above which no further gains will occur (McArdle et al., 1981). These two limits may depend on the initial fitness level and state of training of the individual. Sharkey (1970) found that the fitness level changes yielded a strong negative correlation with initial fitness levels before training (i.e., subjects who were initially low showed greater improvement than those with higher initial fitness levels). In the same study, no significant differences were found between pre and post tests after a six week training period using the intensities of 130, 150, and 170 beats per minute.

For unfit subjects, the training threshold may be
closer to 60% of maximal heart rate or 45% of max\(\dot{V}O_2\). For subjects of higher fitness levels a higher threshold is found. The ceiling for training intensity is still largely unknown, although 85% max\(\dot{V}O_2\) or 90% maximal heart rate is thought to be the upper limit (McArdle et al., 1981).

Whether or not dance fitness programs meet the heart rate intensity thresholds to elicit a cardiovascular training effect is often questioned. Several aerobic dance studies have concluded that aerobic dance can provide enough intensity to provide a training effect (Cearly et al., 1984; Hooper & Noland, 1984; Milburn & Butts, 1983; Rockefeller & Burke, 1979; Russell, 1983; Watterson, 1984). These studies had participants training at their target heart rate zone of an intensity of 60 to 90% MHR or 50 to 85% of max\(\dot{V}O_2\) as is the recommended level of intensity of training by the ACSM (1978).

Weber (1974) indicated that the intensity of aerobic dancing was equal to that of playing basketball if the dance program was approached vigorously. In another aerobic dance study it was found that the energy expenditure for a low intensity cardiovascular routine was metabolically similar to walking, a medium intensity routine to playing tennis, and a high intensity routine was compared to playing hockey (Igbanugo & Gutin, 1978). These researchers concluded that the medium and high intensity routines could provide
adequate stress on the cardiovascular system to influence increased efficiency of that system. Foster (1975) concluded that aerobic dance performed three times per week for an hour would be effective in improving cardiovascular fitness. This study also observed a relative intensity of 70 to 80% \( \text{maxVO}_2 \) which would seemingly meet the criteria for exercise intensity.

Research on the heart rate effects of aerobic dance (Metcalf et al., 1981) found intensity levels resulting in periods of anaerobic work. This study monitored heart rate and rhythm responses. It was concluded that the effort demanded by aerobic dance meets or can exceed threshold for cardiovascular training and might not be recommended for individuals with heart conditions since it has the potential to be intense enough to trigger dysrhythmias.

The ACSM (1978) recommended that the intensity of training should be at 60 to 90% of maximum heart rate reserve or 50 to 85% of \( \text{maxVO}_2 \).

**Body Density and Percent Body Fat**

**Definition of Hydrostatic Weighing and Body Composition**

The composition of the body can be divided into two areas: lean body mass or fat-free weight, and body fat. Fat free weight consists of non-fat tissue such as the skeleton, water, muscle, connective and organ tissue. The fat component includes both essential fat which is comprised of lipids
found in organs and tissues and storage or non-essential fat which is found primarily within adipose tissue (Brooks & Fahey, 1984).

The evaluation of body composition is based on principles discovered by Greek mathematician Archimedes over 2000 years ago. The hydrostatic or underwater weighing technique is based on the Archimedian principle of determining body density. With this method, percent body fat is calculated from body density or the ratio of body weight to body volume. This principle stated: "A solid heavier than a fluid, if placed in it, descends to the bottom of the fluid, and the solid, will when weighed in the fluid, be lighter than its true weight by the weight of the fluid displaced" (Pollock et al., 1978, p. 88). The density of bone and muscle tissue is higher than water (1.2 to 3.0), while fat is less dense than water (0.90) (Pollock et al., 1978). Relating this to underwater weighing, an individual with more bone or muscle mass will weigh heavier in water and have a higher body density, thus lower percent body fat.

Chemical analysis of human cadavers has shown characteristics of body composition that have made possible indirect methods of measurement of percent body fat and hydrostatic weighing is one of those methods. Research has shown that the density of fat and muscle, and the ratios of skeletal weight and body water to lean body weight are
Density of a body can be spoken in terms of mass per unit volume:

\[ D = \frac{M}{V} \]

where \( D \) = density (gm/cc), \( M \) = mass (gm), and \( V \) = volume (cc).

The mass of the subject is determined by the amount of water displaced. Once both body weight in air and submerged are determined, along with the residual volume, body density can be computed by the following formula developed by Brozek, Grande, Anderson, and Keys (1963):

\[ D_b = \frac{W_a}{K - RV} \]

where:
- \( D_b \) = body density (gm/cc)
- \( W_a \) = weight in air in grams
- \( K \) = weight in air minus weight in water divided by the density of water at the weighing temperature
- \( RV \) = residual volume in cc

Two other volumes need to be taken into consideration from the gross body volume to yield body density. These include the volume of air left in the lungs or residual volume (RV) and the gas in the gastro-intestinal (GI) tract. Failure to consider these volumes, as well as water temperature will decrease the subject's water weight and result in an overestimation of volume (Brooks & Fahey, 1984). Residual volume can be measured by an oxygen dilution method described by Wilmore (1969). Based on the findings of
Bedwell, Marshall, DeBois, and Harris (1956), a correction factor of 100 ml or 0.1 liters (BTPS) is used to account for the gas present in the GI tract. The amount of air in the GI tract will vary but should not be greater than 100 ml if the subject is weighed after a 12 hour fast (Goldman & Buskirk, 1961).

The calculation of volume must be corrected for a difference in water density if the water temperature is other than 39.2 F (Brooks & Fahey, 1984). The hydrostatic method of measuring density, hence percent body fat, is still considered the "gold standard" of tests for an accurate assessment of body density and consequent percent body fat.

Conversion of Body Density to Percent Body Fat

Once body density is ascertained, the proportion of body fat can be calculated using an equation that converts density to percent body fat.

Researchers have been unable to agree on the exact density of lean body mass and adipose tissue which has led to the development of several formulas to predict percent body fat from the known body density. The formulas most often used in current research include one by Siri (1961) and another by Brozek et al. (1963). Their slight variances are based on different estimations of the density of fat and lean mass. The equation by Siri (1961) is as follows:
\[
\text{% Fat} = \frac{(4.95 - 4.50)}{\text{body density}} \times 100
\]

The equation by Brozek and associates (1963) is stated:

\[
\text{% Fat} = \frac{(4.570 - 4.142)}{\text{body density}} \times 100
\]

According to Siri (1961) there is a standard deviation of +/- four percent error in prediction of percent body fat by hydrostatic weighing. Although the hydrostatic weighing technique is still considered the most accurate, it is subject to error based on underlying assumptions of the method. These include individual variability in density of the lean mass compartment, variations in bone mineral and body water, and differences in density and proportions between the target population and the "reference man" used in the research and development of the original formulas (Brooks & Fahey, 1984).

**Body Composition and Training**

Some studies have concluded that body composition changes can be elicited through exercise at an appropriate intensity, frequency, and duration (ACSM, 1978; Noland & Kearney, 1978; Smith & Stransky, 1975). Endurance training has been shown to elicit improvement in body composition by reducing percent body fat (Moody, Kollias, & Buskirk, 1969; Pollock, Cureton, & Greninger, 1969; Skinner, Holloszy, & Cureton, 1964).

Eickhoff, Thorland, and Ansorge (1983) found a
significant percentage of fat reduction after a ten week, three day a week aerobic dance program, but only in the category of subjects who were considered low fit and initially had a higher percent of body fat than the more fit subjects. Another study (Vaccaro & Clinton, 1981) found no significant changes in percent body fat from participation in aerobic dance. The pre-training value was 26.5% while the post value was 27.2%, a slight increase for the 19 to 27 year old female subjects. These values are somewhat higher than those reported in other non-aerobic dance studies of 21.4% and 23.7% (Katch, Michael, & Jones, 1969), 21.4% and 21.1% (Smith & Stransky, 1976), and 22.4% and 20.6% (Wallace, 1975). These studies also showed no significant changes in percent fat after training programs of 16 weeks, 7 weeks, and 16 weeks, respectively.

Studies that started with higher percent body fats to begin with may indicate that those particular subjects were less active. Costill, Bowers, and Krammer (1970) stated that there may be a direct relationship between percent body fat and level of training. It has also been shown that subjects who fall into an optimal percent fat range before training and who do not change dietary habits usually fail to have significant decreases in percent body fat (Katch et al., 1969).
Jazzercise

Definition of Jazzercise

A commonly asked question is what is the difference between aerobic dance and Jazzercise. Problems arise in answering that question because there are so many different types of dance fitness programs on the market today that define themselves as aerobic dance. Calisthenics done to music is not aerobic dance as is often assumed simply by the presence of music.

Many programs which are called aerobic dance consist of a heavy concentration of jogging, running, skipping, and hopping movements used to elicit a heart rate response. Some have specific choreography and repetitions to specific pieces of music while other programs have the instructor changing movement patterns and repetitions at any point in the music differently each routine or class. Most commonly, aerobic dance combines calisthenics, jogging, skipping, hopping, and simple dance movements into each routine or class (Eickhoff et al., 1983; Foster, 1975).

The main differences between aerobic dance and Jazzercise is the style of movement used and the class structure. The Sorenson program and Jazzercise are both standard programs. All Jazzercise and Aerobic Dancing classes across the world teach the same routines with the same copyrighted choreography. The individual instructor
is not allowed to deviate from the set choreography of each routine (Jazzercise Instructor's Manual, 1985).

A Jazzercise class consists of 14 to 15 routines set to specific pieces of music and each routine is designed with a specific physiological purpose. These include routines for warm-up, cardiovascular work, cool-down, flexibility, muscle toning and strengthening of the upper torso, abdominal and hip and thigh areas (see Appendix F). The routines are generally based on the jazz dance technique giving the Jazzercise class a distinct style and structure.

The cardiovascular segment is designed to provide enough intensity and duration to provide a cardiovascular training effect. Each routine is designated as a light, light-medium, medium, medium-heavy, or heavy intensity of workout, although the individual is instructed to work at a pace suited to his/her fitness level (see Appendix F).

When comparing Jazzercise to other aerobic dance programs it should be noted that many of the aerobic dance programs concentrate exclusively on the cardiovascular system while Jazzercise attempts to incorporate other aspects of fitness into each class as well as having an aerobic segment. Jazzercise also concentrates on mental fitness and stress release. The program encourages the students to sing and vocalize 'during the whole class as a mechanism of releasing tension as well as monitoring breathing.'
Participants are encouraged to pace themselves and work at a level suited to their individual needs. The routines are constructed so that the participant may walk, jog, or run through the class depending on their fitness level and individual motivation. Participants are given freedom of style as well as intensity (Jazzercise Instructor's Manual).

An adaptation of Borg's (1970) perceived exertion chart is used in each class to help the student monitor his/her own exertion level.

Research on Jazzercise

Although there continues to be an increasing amount of studies being published in the literature on aerobic dance programs, none to date have been published on Jazzercise. Jazzercise, Inc. has done several in-house studies on the program. The results of these limited studies were documented in a student newsletter (Phillips, 1984) and a preliminary report (Huhn & Rehm, 1983).

The 12 week research study done by Phillips (1984) included 26 sedentary females who showed improvement in cardiovascular fitness measured by a treadmill run to exhaustion. The data were analyzed using a paired t-test with significant (p<.05) changes noted for treadmill run time, blood pressure, maximal heart rate, sit and reach test, situps, percent body fat, and lean body mass. The average treadmill run time increased from 8.7 to 9.7 minutes,
blood pressure values decreased from 109/71 to 103/67 mmHg, and the average maximal heart rate increased from 182 to 187 beats per minute. The sit and reach test was used to determine flexibility of the hamstrings and low back and increased from 30 to 32.7 inches. The number of situps performed increased from 22 to 28 in a minute period. A drop in percent body fat was noted from 31.6% to 29.4% as determined by underwater weighing and circumference measurements. Lean body weight increased from 97.2 to 98.7 lbs. The average number of classes attended by the subjects per week was 2.8 with the requirement being to attend at least three times per week. Those participants who consistently attended three to four classes per week lost an average of five pounds and three percent body fat. It was concluded that while attending two times per week produced positive results, those attending at least three classes per week experienced greater improvements. This is consistent with the recommendations of the American College of Sports Medicine (1978). No dietary changes were initiated and outside aerobic activity was restricted.

A preliminary study on the cardiovascular fitness value of Jazzercise was done by Huhn and Rehm (1983) and concluded that the heart rate increases elicited during a Jazzercise class bordered on stimulating cardiovascular endurance changes. This study compared different instructors
and locations, different fitness levels, and different music. Individual perceptions of work and how it related to their heart rate responses were also analyzed. All subject's heart rates were monitored by telemetry with recordings made 44 times within each workout session. Perceived exertion was also analyzed in terms of heart rate response. The fitness levels were divided into class leaders, fit, and unfit. The fit category included those participating in a regular Jazzercise exercise program while the unfit or sedentary were defined as those individuals just starting Jazzercise. The fit subjects perceived exertion responses correlated with their heart rate responses while the unfit subjects perceived exertion underestimated heart rate responses, thus the work they were doing. Class leaders remained in the target heart rate zone for the full aerobic segment with heart rates on the higher side of the zone. Results showed that the heart rates of the unfit subjects were at a slightly higher level of the target zone than the more fit individuals. The fit were found to be under the necessary heart rate level for cardiovascular fitness improvement. The average heart rate during a selected cardiovascular segment was 170 beats per minute for leaders, 145 beats per minute for the fit, and 152 beats per minute for the unfit subjects. Heart rate responses were also found to be related to the vigorousness of the music
which led to higher heart rate responses. This study concluded that the increase in heart rate bordered on stimulating cardiovascular endurance changes during the cardiovascular segment of the class. Different music and instructors may affect this variable.

**Max\(\dot{V}O_2\) and Dance Fitness Programs**

When discussing values of improvement in terms of max\(\dot{V}O_2\) by participants in dance fitness programs, several aerobic dance studies showed significant improvements. An improvement of 10.7% was found by Cearly and associates (1984). In this study, the mean max\(\dot{V}O_2\) values of 36.9 pre and 38.7 ml·kg·min\(^{-1}\) post-test were found for the two day a week aerobic dancers while the mean pre and post-test ml·kg·min\(^{-1}\) for the three day a week group were 40.1 and 44.5, respectively. These are comparable to improvements found by other researchers using different modes of training (Burke, 1977; Edwards, 1974; Eisenman & Golding, 1975; Flint, Drinkwater, & Howarth, 1974; Magel, Faglia, McArdle, Gutfin, Pesar, & Katch, 1975; Shire, Avallone, Boileau, Lohman, & Wirth, 1977).

Milburn and Butts (1983) showed a 10.2% gain from participation in aerobic dance with the mean max\(\dot{V}O_2\) ml·kg·min\(^{-1}\) values of 35.4 pre and 39.0 post-test for a seven week, four day a week study. The jogging group in this study (Milburn & Butts, 1983) also demonstrated similar improvement from 36.4 pre to 39.4 post-test ml·kg·min\(^{-1}\). Both
Gatch et al. (1982) and Vaccaro and Clinton (1981) showed a 10% increase in \( \text{maxVO}_2 \). Vaccaro and Clinton (1981) showed a post-test \( \text{maxVO}_2 \) of 38.2 ml·kg·min\(^{-1}\) which was a 7.1 ml·kg·min\(^{-1}\) increase. The mean pre-test value of these subjects was 31.1 ml·kg·min\(^{-1}\) which is about what might be expected in normal college age females (Drinkwater, 1973). This improvement in \( \text{maxVO}_2 \) is almost identical to the \( \text{maxVO}_2 \) values reported for a ten week aerobic dance study done by Rockefeller and Burke (1979), a change from 34.3 to 38.7 ml·kg·min\(^{-1}\) (13%). Eisenman and Golding (1975) found a somewhat higher increase of 18% in 18 to 21 year old females after a 14 week, three times per week running and bench stepping program. An initial \( \text{maxVO}_2 \) of 38.1 and a post-test of 44.8 ml·kg·min\(^{-1}\) were ascertained for the experimental group.

Fringer and Stull (1974), in a ten week study with interval bicycle training, reported a 39% increase which is a much higher value than found in most aerobic dance studies reported for improvement in \( \text{maxVO}_2 \). A pre-training value of 34.1 ml·kg·min\(^{-1}\) which is comparable to the 31.1 value found by Vaccaro and Clinton (1981) for an initial value was found, but the post training value was 47.3 ml·kg·min\(^{-1}\) which might raise the question of effectiveness of different modes of training. Different time spans of studies must be considered although the Vaccaro and Clinton
(1981) and Fringer and Stull (1974) were both ten weeks. This emphasizes the need to account for variability in structure and effectiveness of different dance fitness programs.

It can be difficult to compare maxVO\textsubscript{2} gains from one study to another due to the variability in initial fitness levels as demonstrated in the above studies. Initially high maxVO\textsubscript{2} values often result in smaller increases with training. Fox and Mathews (1981) conclude that the percent improvement in maxVO\textsubscript{2} from training is inversely related to initial fitness level.

An average improvement from participation in aerobic dance seems to be 10% but the length of the training sessions and each individual aerobic segment must be taken into consideration before drawing any conclusions across the board.

**Summary**

Aerobic capacity is considered a very important component of cardiovascular fitness. The most accurate and generally used measure of cardiovascular fitness is maxVO\textsubscript{2}. A treadmill test provides the greatest values of maxVO\textsubscript{2}.

The mode of exercise used to elicit a training effect in the cardiovascular system must be aerobic. Intensity, duration, and frequency of exercise are important factors in developing an aerobic exercise program.
The density of the body and its percent fat can be calculated by dividing the body weight by the body volume which is calculated by underwater weighing. Since muscle has a higher density and fat a lower density than water, individuals with a greater percent of body fat tend to float and weigh less underwater, while leaner individuals tend to sink and weigh more underwater. Therefore, at a given weight a person with more fat tissue has a larger volume and thus a smaller density.

Endurance training has been shown to change body composition when the mode of exercise is of an appropriate intensity, duration, and frequency as outlined by the American College of Sports Medicine (1978). Initial percent body fat levels and initial fitness levels may impact on body composition changes.

One fitness program that has been developed in recent years is the Jazzercise program. Jazzercise is a total fitness program structured to develop cardiovascular endurance and other aspects of general fitness. No published studies are available in the research literature on the Jazzercise program. Some studies have been done on a similar program called aerobic dance that conclude that aerobic dance can elicit a training effect on the cardiovascular system.
CHAPTER III

METHODS

Subject Selection

The active participants of this study were untrained females ranging in age from 18 to 33 years, who attended Jazzercise classes offered Mondays, Wednesdays, and Fridays at 12:00 p.m. through the Intramural program of the University of Wisconsin - LaCrosse. They attended during the second semester of the 1984-1985 school year. There were two experimental groups, one participating two times per week while the second group participated three times per week.

A questionnaire was developed to determine the exercise habits of potential volunteers (see Appendix A). Individuals already participating in regular aerobic activities or other dance fitness programs two or more times per week were eliminated. Smokers were also eliminated from this study. Subjects with an initial max VO₂ greater than 45 ml·kg·min⁻¹, which according to Katch and McArdle (1983) would place them in a high level fitness category, were also eliminated.

The importance of regular attendance and refraining
from other regular aerobic exercise was emphasized to the participants before and during the investigation. Subjects were informed that they would be eliminated from the study if their attendance dropped below 90% of the scheduled sessions.

There was an initial group of 44 volunteers. As a result of the exercise habit questionnaire and/or the participant's availability, the group was reduced to 29 actual participants. Of the 29 individuals who were pre-tested, there were six volunteers for the two day a week group and 23 volunteers for the three day a week group. After the pre-test, one subject from the two day a week group and two subjects from the three day a week group were eliminated because they had an initial max\(\text{VO}_2\) value above the set upper limit for this study. After the pre-test, 26 individuals began the training program.

**Testing Procedures**

Max\(\text{VO}_2\) tests were done as a determinant of cardiovascular fitness prior to and the week following the seven week training period. Hydrostatic weighing was also done to determine pre and post percent body fat for both groups. Testing before and after the training period took place in the Human Performance Laboratory in Mitchell Hall at the University of Wisconsin - LaCrosse. It was stressed to the subjects the importance of putting forth their best effort.
An appropriate consent form was signed by each subject for participation in the Jazzercise program (see Appendix B) and for all laboratory testing procedures (see Appendix C). All procedures and potential risks were explained and any potential questions were satisfactorily answered. Testing instructions for both the max\(\dot{V}O_2\) test and the underwater weighing test were distributed to each participant at the time of registration for the Jazzercise classes (see Appendices D & E). The subjects were familiarized with the Human Performance Laboratory preceding the initial testing and were briefed on all test procedures and protocols to be used.

**Max\(\dot{V}O_2\) Testing**

A practice run was administered on the treadmill prior to each pre-test. This included the proper method of getting on and off the treadmill as well as walking and running at speeds used in the protocol. At that time, the subjects were fitted with the nose clip and headgear to familiarize them with the testing apparatus. The use of the perceived exertion chart was also explained.

The subjects performed pre and post maximal treadmill runs to determine if any significant training effects had occurred during the training period. The following variables were analyzed: max\(\dot{V}O_2\) (l·min\(^{-1}\) and ml·kg·min\(^{-1}\)), maximal heart rate, max\(\dot{V}E\), and treadmill run time.
Respiratory data were collected using the Beckman Metabolic Measurement Cart which was calibrated before each test. Prior to the test, the subject's weight was recorded to the nearest 0.25 lb without shoes. The skin was prepared for electrocardiographic electrode placement determined by a clearly reddened skin due to abrasion of the area. The type of electrodes used were Medi-trace Offset Dx ECG silver/silver chloride (model number 8101). After skin preparation, the electrodes were placed in a lead III position with the following sites: right arm (RA), right leg (RL), left arm (LA), and left leg (LL).

With the headgear in place, the mouthpiece was attached by a tube to the Beckman Metabolic Measurement Cart for calculation of respiratory measurements. The subjects then performed a maximal treadmill test using the Modified Astrand Protocol (see Table 1).

During the course of the test, after a warm-up of five minutes at 2.5% grade and 3.5 miles per hour, the speed was maintained at six miles per hour with the elevation being increased 2.5% every two minutes after Stage I. The protocol was used as stated except for two tests where the speed of six miles per hour was beyond the capability of the subject. In these two instances the speed was adjusted to 5 and 5.5 miles per hour.

Heart rate was monitored with an IMC Viagraph
machine and determined by a 15 second ECG strip taken every minute after the five minute warm-up period. This was determined by measuring the R to R interval on the ECG strip. The R is a wave of the QRS complex on an ECG strip representing a single heart beat. Measurement of the distance between two R waves (R to R interval) indicates heart rate.

Table 1

Modified Astrand Protocol

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Speed</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>Warm-up</td>
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</tr>
<tr>
<td>Stage I</td>
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<td>6.0 mph</td>
</tr>
<tr>
<td>Stage II</td>
<td>2</td>
<td>6.0 mph</td>
</tr>
<tr>
<td>Stage III</td>
<td>2</td>
<td>6.0 mph</td>
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<tr>
<td>Stage IV</td>
<td>2</td>
<td>6.0 mph</td>
</tr>
<tr>
<td>Stage V</td>
<td>2</td>
<td>6.0 mph</td>
</tr>
<tr>
<td>Stage VI</td>
<td>2</td>
<td>6.0 mph</td>
</tr>
</tbody>
</table>

(Pollock et al., 1978 p. 292)

The peak $VO_2$ value obtained during the test was used as a max$VO_2$ value. Measurements were taken with the Beckman Metabolic Measurement Cart every minute including
the warm-up. The Beckman Cart consisted of a CO₂ analyzer (LB-2) and an O₂ analyzer (OM-11). Calibration of these analyzers was done with a known gas sample previously determined by the Scholander technique.

The researcher terminated the test when any of the following occurred: the subject's heart rate reached age adjusted maximal (220 minus age), oxygen consumption plateau or decrease with an increased workload, and when any subject requested termination due to fatigue. Subjects remained walking on the treadmill after the test for an appropriate cool-down period. Subjects were monitored on the Viagraph ECG until their heart rates returned to 100 beats a minute or below.

The researcher attempted to motivate each subject being tested at an equal level.

**Hydrostatic Weighing**

Subjects were hydrostatically weighed to determine pre and post percent body fat. These tests were conducted by a graduate student in the Adult Fitness/Cardiac Rehabilitation program of the University of Wisconsin - LaCrosse.

Subjects were instructed not to eat for 12 hours prior to the test. Residual volume was ascertained in a seated position outside the weighing tank using a Collins Nitrogen Analyzer (model number 21232) which analyzed the subject's inspired and expired air. The method of measuring residual
Subjects were asked to show the swimsuit. The subject then climbed into the hydrostatic tank and was seated on a light-weight polyethylene chair suspended from the autopsy scale attached to the ceiling. The orocedure of the test was explained and a nose clip, and a submersible seat.

Equipment used for the hydrostatic weighing included: a 4'x4'x4' S.S. Hydrotesting tank (model number 09771), a 15 kg autopsy scale (Chatillion and Sons, N.Y. model number 8-20961) in 25 gm increments, water thermometer, nose clip, and a submersible seat.

Subjects were asked to shower to remove dirt and oil from the skin. Tank water temperature was recorded in order to determine water density and the weight of the weighing apparatus in kilograms. The subject was also instructed to remove any air bubbles from the skin and on the swimsuit. The subject then climbed into the immersion tank and was seated on a light-weight polyethylene chair suspended from the autopsy scale attached to the ceiling. The procedure of the test was explained and a nose clip was placed on the subject. Just before submerging, the subject was asked to forcefully expire as much air as possible from their lungs. As smoothly as possible, the
subject then submerged under water while continuing to expel as much air as possible from the lungs. While the subject was completely immersed, the tester steadied the weight scale oscillations and recorded the six trials to the nearest 25 gm. After each trial the tester tapped the tank to signal the subject to surface.

The value obtained from the body density measurement was used to determine percent body fat using an equation developed by Brozek et al. (1963). The equation is as follows:

\[
\%\text{Fat} = (4.570/D - 4.042) \times 100
\]

where D is body density.

**Training Program for Jazzercise**

During the seven week period of the investigation, the subjects participated in Jazzercise classes held for 50 minutes, two or three times a week depending on their research group. The classes met in the Wittich Hall gym Mondays, Wednesdays, and Fridays at 12:00 p.m. Each class followed the structure as prescribed by Jazzercise, Inc. (see Appendix F). Specifically, each class consisted of 8 to 10 minutes of warm-up, 25 to 30 minutes of cardiovascular routines, and a 10 to 15 minute cool-down period. The normal Jazzercise class consists of 14 to 15 routines completed in one hour. Participants' class and work schedules prevented them from being available for the full
Each participant was given a Student Guide to Jazzercise outlining the program (see Appendix G). Included was safety tips on stretching and proper warm-up, proper body alignment, heart rate formula, and an explanation of the perceived exertion chart displayed at every class. This chart was adapted from Borg (1970) for Jazzercise classes and is used in each class to help students monitor their perceived exertion during class. An example of this chart is included in the Student Guide to Jazzercise.

Although structured heart rate monitoring is not normally done during a Jazzercise class, heart rates were monitored for this study during the cardiovascular segment of class. For the purposes of this study and to have a
quantitative measurement of intensity, heart rate monitoring was completed three times during the cardiovascular segment. Subjects were instructed on how to take a six second heart rate. Although ten second heart rates would have been preferable, six second heart rates were done in keeping with Jazzercise policy of not more than six seconds between cardiovascular routines. Heart rate monitoring was done after the fourth, sixth, and eighth routines. In the Jazzercise class structure, this would be after the first medium cardiovascular routine, after the heavy cardiovascular routine, and after the last light/medium cardiovascular routine performed prior to the routine used to descend to the floor for the toning and cool-down segment of the class.

The age-predicted heart rate method was used to prescribe the desired exercise intensity for each subject to attain during the training classes. This method uses a predetermined percentage (75%) of the difference in age and maximal heart rate. The subjects were instructed to work at 75% of their age-predicted maximal heart rates.

The same set of routines was used for the first three weeks of the training session. Routines were then periodically changed to maintain variety of music and movement (see Appendix H). This follows the pattern of most Jazzercise classes although routines are not switched too
frequently to allow for the learning effect, better performance, and feelings of success for the participants. Subjects were allowed to make-up missed classes off campus taught by local Jazzercise instructors. These classes were the same copyrighted program. This practice was minimally used by no more than four subjects and was not encouraged or generally announced. Make-up classes could not be made available at the University of Wisconsin - LaCrosse because of facility unavailability. Attendance at regularly scheduled classes was repeatedly encouraged.

Statistical Analysis

Upon completion of the post-test, the results were analyzed to determine whether or not significant changes had occurred due to the training program. The 0.05 level of confidence was used in analysis of all data. The data were analyzed using a mixed design 2-way ANOVA, group and test, to determine significance between the pre and post tests and between the groups. Also, an independent t-test was done to compare the average exercise heart rate intensities of both groups. Standard descriptive statistics were also calculated for all groups.
CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The purpose of this study was to compare the training effects of two-day per week versus three-day per week participation in a Jazzercise dance fitness program on the $\text{max} \dot{\text{V}}\text{O}_2$ and body composition of females.

The resulting pre and post-test ($T_1$ and $T_2$) data were statistically analyzed using a mixed design 2-way ANOVA, group and test to determine significance between groups and between pre and post-test as a result of the seven weeks of training. In addition, an independent t-test was utilized to compare the average exercise heart rate intensities of both experimental groups. The 0.05 level of confidence was used in analysis of all data. Standard descriptive statistics were also calculated for both groups.

This chapter includes the results, and a discussion of these results for the following variables: subject physical characteristics, percent body fat, lean body mass, intensity of training, $\text{max} \dot{\text{V}}\text{O}_2$, time on the treadmill, $\text{max} \dot{\text{V}}_E$, maximal heart rate, and respiratory exchange ratio ($R$).
Subjects

There were 44 initial volunteers who were screened before acceptance into the study. Of this group, 15 volunteers were not accepted due to school and work conflicts or for health reasons. After the initial screening, 29 subjects were pre-tested including six subjects in the two-day group and 23 subjects in the three-day group. Of the 29 subjects who were pre-tested, only 26 individuals actually began the training program. Five subjects in the two-day group and 21 subjects in the three-day group completed all the pre-tests. However, five subjects dropped out of the three-day group during the seven week training period due to illness and job conflicts. Therefore, the results of this study are based upon the five subjects in the two-day group and 16 subjects in the three-day group who completed the requirements of this study.

All the subjects were female students or staff on the campus of the University of Wisconsin - LaCrosse during the second semester of the 1984-1985 school year and ranged in age from 18 to 33 years old. All subjects fulfilled the requirement to attend at least 90% of the 14 or 21 training sessions depending on their group. Descriptive data for the post-tested subjects are presented in Table 2.
Table 2
Means and Standard Deviations of Subjects' Physical Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Pre</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two-Day (n=5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Height (cm)</td>
<td>170.8a</td>
<td>--</td>
<td>166.5</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2b</td>
<td>--</td>
<td>7.1</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Age (yr)</td>
<td>23.0</td>
<td>--</td>
<td>21.1</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.0</td>
<td>--</td>
<td>3.5</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Weight (kg)</td>
<td>60.5</td>
<td>60.5</td>
<td>62.7</td>
<td>62.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.7</td>
<td>3.9</td>
<td>7.4</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td>% Fat</td>
<td>23.6</td>
<td>22.0*</td>
<td>26.5</td>
<td>25.6*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.2</td>
<td>4.4</td>
<td>4.9</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>LBM (kg)</td>
<td>46.2</td>
<td>47.2</td>
<td>46.0</td>
<td>46.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2</td>
<td>3.5</td>
<td>5.0</td>
<td>4.7</td>
</tr>
</tbody>
</table>

a = mean  
b = standard deviation  
* = significant (p<.05) difference between pre and post test

Body Weight and Percent Body Fat

The body weight of the subjects in both groups were similar (p .05) to begin with and no significant (p .05) changes were found in total body weight from T1 to T2 over the seven week training period for either group. The body weight of the two-day group was identical, while there was
a less than one percent decrease in total body weight in the three-day group.

Body weight can be affected by dietary habits as well as exercise, making it difficult to control this variable in most training studies. There was no attempt to control the dietary habits of the subjects in this study.

A more important measure of body composition is percent body fat. There were no significant (p > .05) differences in body fat between groups at the start but there was a significant (p < .05) decrease in percent body fat between T1 and T2 for both groups (see Table 2). In addition, there was no significant (p > .05) interaction between groups as a result of the seven weeks of training. The two-day group had a 7% reduction in percent body fat, while the three-day group exhibited a 3.4% reduction. Although the training did not alter gross body weight it altered the subjects' body composition by decreasing percent body fat.

Furthermore, the two day groups' lean body mass increased from 46.2 kg to 47.2 kg, and the three-day group increased from 46.0 kg to 46.4 kg (see Table 2). Although both groups' lean body mass increased it was not significant. The decrease in percent body fat and slight increase in lean body mass may have accounted for the lack of change in gross body weight since a decrease in body fat and corresponding increase in lean body mass would balance out.
These changes may occur without altering the gross body weight.

Similar results have been reported by others who have concluded that positive body composition changes can be elicited through exercise at an appropriate intensity, frequency, and duration (ACSM, 1978; Noland & Kearney, 1978; Smith & Stransky, 1975). Eickhoff et al. (1983) found a significant reduction in percent body fat after a ten week, three day a week aerobic dance study. A 12 week study done on Jazzercise (Phillips, 1984) showed a significant decrease in percent body fat. Other training studies have also shown decreases in percent body fat (Moody et al., 1969; Pollock et al., 1969; Skinner et al., 1964).

In contrast, some training studies have reported no significant changes in percent body fat after training programs of seven weeks (Smith & Stransky, 1976), ten weeks (Dowdy et al., 1985), ten weeks (Vaccaro & Clinton, 1981), 16 weeks (Katch et al., 1969), and 16 weeks (Wallace, 1975). The lack of change reported in these studies may be due to differences in intensity, duration, and frequency of the training, as well as to the dietary habits of the participants. Lack of significance may also be attributed to subjects who fall into an optimal percent fat range before training and who again do not change dietary habits. These subjects usually fail to have significant decreases in
percent body fat (Katch et al., 1969; Wallace, 1975).

Although an absolute range for ideal or healthy percent body fat has not been clearly established, a suggested upper limit for females is in the range of 22 to 25%, with 30 to 35% fat considered obese (Brooks & Fahey, 1984; Pollock et al., 1978). The initial percent body fats in the present study of 23.6% for the two-day group and 26.5% for the three-day group were typical for females, although they were slightly above or in the upper end of the "ideal" range. Since the subjects of both groups were not in the optimal or lower end of the range for percent body fat this would support the likelihood that a significant decrease in percent fat might occur as a result of a short term training program.

Based on the results of this investigation, it would appear that regular participation in Jazzercise as an aerobic exercise mode may not elicit a change in gross body weight but does affect body composition by decreasing percent body fat and increasing lean body mass.

**Intensity of Training**

According to Fox and Mathews (1981) an improvement in maximal aerobic capacity (max VO₂) is directly related to the intensity of training. One of the most common methods used to determine training intensity is the heart rate method. The magnitude of the heart rate response to a specific
exercise load can be used as an indicator of intensity or the amount of overload being placed on the cardiorespiratory system, thus heart rate responses are used to indicate the intensity of exercise. In addition, heart rates can be used to prescribe exercise intensity.

For this study, the age-predicted heart rate method was used to prescribe the desired exercise intensity for each subject to attain during the training classes. This method uses a predetermined percentage (75%) of the difference in age and maximal heart rate. The subjects were instructed to work at 75% of their age-predicted maximal heart rates. For the two-day group the average training intensity of 75% of age-predicted maximal heart rate should have been 148 beats per minute, while the prescribed average heart rate for the three-day group should have been 149 beats per minute. The results indicated a range of 140 to 174 beats per minute, with an average intensity of 78.8% of their maximal heart rates for the two-day group. A range of 134 to 174 beats per minute with an average intensity of 77.3% were reported for the three-day group (see Appendix I). All heart rates were within the training sensitive zone.

An independent t-test was done to compare the average exercise heart rate intensities of both experimental groups over all the training sessions. No significance (p<.05) was found in the training heart rate intensities between
the two groups which verifies that both groups trained at the same relative intensity.

According to McArdle et al. (1981) aerobic capacity will generally improve if exercise is performed with enough intensity to increase the heart rate to approximately 70% of maximal heart rate. Furthermore, this intensity must be maintained for the recommended 15 to 60 minutes of continuous movement to elicit a training effect (ACSM, 1978). A threshold intensity is defined as the level above which significant improvements occur and below which improvements do not occur. Fox and Mathews (1981) indicate that this level varies individually and is affected by initial fitness levels. These authors further indicate that an individual who is not very cardiovascularly fit will benefit significantly from training at a lower intensity while the more fit individuals require a greater intensity of training to elicit improvement. This relates back to the principle of overload, which is a positive stressor that forces the system to respond and adapt and is necessary to elicit a training effect (Brooks & Fahey, 1984). In this particular study the initial aerobic capacity of the two and three-day groups were 39.8 and 40.1 ml·kg·min⁻¹, respectively. These values indicate good initial fitness levels which would require a greater level of intensity to show improvement from training than for an unfit individual (American Heart
Association, 1972; Katch & McArdle, 1983). A higher initial fitness level could also limit the percentage of improvement that might be attained from training (Brooks & Fahey, 1984).

It would seem that according to these results the Jazzercise program elicits an intensity to elevate participants' heart rates to a training sensitive zone.

**Maximal Performance Data**

The physiological responses to the max\(\dot{V}O_2\) test are presented in Table 3. In this study, the respiratory exchange ratio (R) was used as an indicator of attainment of a maximal effort for the treadmill test. The R is a ratio of the volume of carbon dioxide produced per minute to the volume of oxygen used per minute. This ratio changes with different metabolic states and tends to increase with increasing exercise intensity (Fox & Mathews, 1981). An R value greater than 1.00 is commonly used as an indicator of maximal effort or exhaustive exercise. In this study, all subjects attained R values of 1.00 or greater for both \(T_1\) and \(T_2\), indicating that a maximal effort was achieved during the max\(\dot{V}O_2\) tests. In addition, there was no significant (\(p > .05\)) differences in the R values between groups or between pre and post tests.

**Max\(\dot{V}O_2\)**

There were no significant (\(p > .05\)) differences in max\(\dot{V}O_2\) values between groups during either of the pre or post tests.
Table 3
Means and Standard Deviations of Physiological Responses to the MaxVO₂ Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Two-Day (n=5)</th>
<th>Three-Day (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>MaxVO₂ (ml·kg·min⁻¹)</td>
<td>39.8a</td>
<td>42.7*</td>
</tr>
<tr>
<td></td>
<td>5.4b</td>
<td>4.7</td>
</tr>
<tr>
<td>MaxVO (l·min⁻¹)</td>
<td>2.398</td>
<td>2.578*</td>
</tr>
<tr>
<td></td>
<td>.323</td>
<td>.331</td>
</tr>
<tr>
<td>Treadmill Run (sec)</td>
<td>770</td>
<td>807*</td>
</tr>
<tr>
<td></td>
<td>205</td>
<td>204</td>
</tr>
<tr>
<td>Max HR (bpm)</td>
<td>195.0</td>
<td>195.0</td>
</tr>
<tr>
<td></td>
<td>12.0</td>
<td>12.0</td>
</tr>
<tr>
<td>MaxVE (l·min⁻¹)</td>
<td>82.6</td>
<td>90.4</td>
</tr>
<tr>
<td></td>
<td>11.0</td>
<td>8.5</td>
</tr>
<tr>
<td>VE/VO₂ (ratio)</td>
<td>34.6</td>
<td>35.3</td>
</tr>
<tr>
<td>R</td>
<td>1.11</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>.08</td>
<td>.04</td>
</tr>
</tbody>
</table>

a = mean
b = standard deviation
* = significant (p<.05) difference between pre and post tests

Significant (p<.05) gains in both absolute (l·min⁻¹) and relative (ml·kg·min⁻¹) MaxVO₂ (see Table 3) occurred in both groups as a result of the training program. These
increases amounted to 0.18 and 0.14 l·min⁻¹ for the two and three-day groups, respectively. The relative increases ranged from 2.9 ml·kg·min⁻¹ for the two-day group to an average of 2.5 ml·kg·min⁻¹ for the three-day group. These correspond to a 7.4% relative increase and a 7.5% absolute increase in oxygen consumption for the two-day group with a 6.2% relative increase and a 5.7% absolute increase for the three-day group.

According to Brooks and Fahey (1984) improvements in oxygen consumption as a result of training may be limited and dependent on the current fitness level, type of training, and age. These authors concluded that most studies show that maxV\textsubscript{O}₂ can only be improved in a range of 10 to 20%. Fox and Mathews (1981) cited a range of 5 to 20% for improvement of maxV\textsubscript{O}₂ with training. Physiologically, the improvement in maxV\textsubscript{O}₂ can be attributed to a greater maximal cardiac output, and/or an increase in the arteriovenous oxygen difference (Astrand & Rodahl, 1977; Fox & Mathews, 1981).

The results of this study, while they fall in the range of potential maxV\textsubscript{O}₂ improvement of 5 to 20%, are lower than the results reported for similar aerobic training studies employing other training modes. Since the amount of training improvement is partially dependent on initial fitness level, a lower initial fitness level leaves more room for improvement. In contrast, those with higher initial levels
will elicit less improvement (McArdle et al., 1981). This is especially true when improvement is expressed in percentage values. The initial mean max\(\dot{V}O_2\) levels of the two and three-day groups were 39.8 and 40.1 ml·kg·min\(^{-1}\), respectively, placing these groups in the high average to good ranges for women (American Heart Association, 1972; Katch & McArdle, 1983). This would indicate that although improvement in max\(\dot{V}O_2\) which indicates increased aerobic capacity did occur, the subjects in this study with their good initial fitness levels, had less room for improvement from participating in any mode of aerobic training.

Other studies which used aerobic dance as the mode of training have also shown an improvement in max\(\dot{V}O_2\) (Cearly et al., 1984; Gatch et al., 1984; Hooper & Noland, 1984; Milburn & Butts, 1983; Rockefeller & Burke, 1979; Vacarro & Clinton, 1981; Watterson, 1984). These studies which varied in length and frequency, showed an increase in max\(\dot{V}O_2\) in the range of 10 to 13%.

Russell (1983) and Cearly et al. (1984) showed non-significant or minimal improvement in max\(\dot{V}O_2\) based on a two day a week participation in aerobic dance performed at above minimum intensity or at 75% of maximal heart rate, respectively. This would be in accordance with the ACSM (1978) guidelines for frequency per week of exercise to elicit a training effect. The results of the current study are in
contrast with these studies since the two-day group showed significant improvement in maxVO\(_2\). As obvious by the sample size (n=5) of the two-day group it was difficult to obtain two-day per week volunteers. This was most likely due to the fitness orientated atmosphere found at the University of Wisconsin - LaCrosse. Most of the two-day volunteers preferred to aerobically exercise three or more times per week but could not attend all three scheduled Jazzercise classes per week due to work and school conflicts. There is an outside chance, that some of the two-day subjects participated in other aerobic activity even when they agreed not to for the duration of this study. Although all the participants attended the required 90% of the training sessions, eight of the three-day subjects were absent two times while five subjects were absent once during the short training period of seven weeks. Two participants in the two-day group were absent one and two sessions of the 14 total classes. These absences also may have had an affect on the percentage of improvement in maxVO\(_2\) especially for the three-day group. The personal schedules of the participants allowed for only minimal make-up of classes.

Other training studies, using different modes of exercise such as biking and jogging, have also shown improvement in maxVO\(_2\) (Atomi et al., 1978; Eisenman & Golding, 1975; Flint et al., 1974; Fringer & Stull, 1974; Gettman et al.,
1976; Magel et al., 1975; Shire et al., 1977). The variations of mode, intensity, frequency, duration and initial fitness level of these studies make comparisons to the current study difficult in terms of percentage of improvement. They do indicate, however, that training done at an appropriate intensity, duration and frequency will elicit a training effect, one variable being improvement in maxVO$_2$.

Improvement in maxVO$_2$ is also affected by the aging process. Potential improvement in maxVO$_2$ reaches its peak between 18 and 25 years of age. After the age of 25 there is a steady decline in maxVO$_2$ so that by the age of 55, maxVO$_2$ is 27% below the average 20 year old (McArdle et al., 1981). The majority of participants in this study were in the age range of 18 to 25 years during which improvements in maxVO$_2$ are most likely to occur. This is supported by the significant increase in maxVO$_2$ found for both groups. This study may have produced different results in maxVO$_2$ with an older population as subjects.

Based on the results of the maxVO$_2$ test, it would appear that participation in Jazzercise as an exercise mode will elicit a training effect if done at 75% of maximal heart rate for seven weeks at least two times per week. With the significant improvement in maxVO$_2$ obtained in this study, it appears that the intensity attained during a standardized Jazzercise class is sufficient to elicit a
training effect thus improving the cardiovascular fitness levels of the participants in this particular Jazzercise program.

**Treadmill Run Time**

As with the max\(\text{VO}_2\) data, a significant \((p<.05)\) increase in mean treadmill run time from \(T_1\) to \(T_2\) occurred in both experimental groups (see Table 3). Again, both groups' run times were equal \((p>.05)\) initially. The two-day group showed a mean increase of 36 seconds (4.7%), while the three-day group showed a 56 second (7.4%) increase in treadmill run time.

Improvement in treadmill run time has been found in similar training studies (Cearly et al., 1984; Dowdy et al., 1985; Milburn & Butts, 1983; White et al., 1984). Milburn and Butts (1983) found a 20.7% increase for aerobic dancers in a seven week, four day a week study. White et al. (1984) found a 17.5% increase in a four day a week, six month study. Cearly et al. (1984) found a two percent increase for a two day a week group and a 14.5% increase for a three day a week group in a ten week aerobic dance study, while Dowdy et al. (1985) showed a 16% increase for a 10 week, three day a week aerobic dance study.

With the increase in max\(\text{VO}_2\) in the current study, the increase in treadmill run time is supportive of the improved work capacity of the subjects. The lower percentage of
increase in run time in this study compared to others may be related to the shorter length of the training period, less frequency per week, and to initial fitness levels of the participants as previously discussed.

**Maximal Ventilation (MaxV\textsubscript{E})**

There were no significant (p\textgreater{}0.05) differences in max\dot{V}\textsubscript{E} at the start between groups (see Table 3). Max\dot{V}\textsubscript{E} increased between the pre and post-tests for both groups, although these increases were not significant (p\textgreater{}0.05).

Some investigators (Cearley et al., 1984; Eisenman & Golding, 1975; Fringer & Stull, 1974; Milburn & Butts, 1983; Rockefeller & Burke, 1979) have reported increases in max\dot{V}\textsubscript{E} with training, while others (Vaccaro & Clinton, 1981) have not.

According to Fox and Mathews (1981), ventilation is not a limiting factor of max\dot{V}O\textsubscript{2}, therefore, any increase in max\dot{V}\textsubscript{E} is considered secondary to max\dot{V}O\textsubscript{2} increases.

Since both groups did show a significant increase in max\dot{V}O\textsubscript{2}, without a corresponding increase in max\dot{V}\textsubscript{E}, this might indicate an increase in ventilatory efficiency (\dot{V}\textsubscript{E}/\dot{V}O\textsubscript{2}). With increased ventilatory efficiency, the amount of air ventilated at the same oxygen consumption is lower for a trained individual compared to an untrained individual.

In this study, the two-day group slightly increased
their $\dot{V}_E/\dot{V}O_2$ ratio from 34.6 to 35.3 pre to post test, but this was not significant. In contrast, the three-day group exhibited a decrease in the ratio from 35.1 to 33.1 thus indicating a significant ($p<.05$) increase in ventilatory efficiency. Although significant increases in $\text{max}\dot{V}_E$ did not occur, the three-day group did elicit an improvement in ventilatory efficiency. The change exhibited in ventilatory efficiency between the two and three-day groups is the only significant difference found as a result of the seven weeks of training. The difference between the groups is due to the three-day group not exhibiting an increase in $\text{max}\dot{V}_E$. This group stayed at 87.5 liters, while the two-day group had an increase, although non-significant, of 82.6 to 90.4 liters. This explains why the three-day group exhibited an increase in ventilatory efficiency with a corresponding increase in $\text{max}\dot{V}O_2$. The three-day group had an increase in oxygen consumption without an increase in ventilation thus indicating an increase in ventilatory efficiency to extract this oxygen.

An explanation for why the three-day group exhibited an increase in $\dot{V}_E/\dot{V}O_2$ more than the two-day group may be that increases in ventilation are more influenced by frequency of training.

**Maximal Heart Rate**

The analysis of variance in this study revealed no
significant \((p > .05)\) pre to post test changes in maximal heart rates for either experimental group (see Table 3). Aerobic training is known to reduce both resting and submaximal heart rates (Astrand & Rodahl, 1977; Brooks & Fahey, 1984; White et al., 1984). Some investigators have also shown significant decreases in maximal heart rate after training programs (Dowdy et al., 1985; Milburn & Butts, 1983; Pollock et al., 1969).

As in the present study, Cearly et al. (1984), Eisenman and Golding (1975), and Vaccaro and Clinton (1981) found no significant change in maximal heart rate as a result of aerobic training. According to Brooks and Fahey (1984) training has a minimal affect on maximal heart rate with decreases usually only in the range of three beats. Fox and Mathews (1981) support this and suggest that the maximal attainable heart rate is either unchanged or only decreases slightly with training. These authors stated that decreases in maximal heart rate usually occur in athletes participating in endurance training or short-term training of previously sedentary subjects. The majority of authors agree that maximal heart rate is usually stable and tends to only decrease with age rather than with training.

Since there was also no increase in maximal heart rates from \(T_1\) to \(T_2\), this would be another indicator that a
true maximal effort was achieved by the participants for the treadmill run.

**Summary**

The statistical analysis of data from this study revealed a significant increase in max\(\text{VO}_2\) and a significant decrease in percent body fat for both experimental groups. There were no interactions between the two and three-day groups for all variables with the exception of ventilatory efficiency, indicating that either frequency of training is effective to produce positive physiological changes. There were no significant differences in the R or maximal heart rates used as indicators of a maximal effort attained for the max\(\text{VO}_2\) tests.

The results of this study indicate that Jazzercise as an aerobic training mode can elicit positive changes in body composition (percent body fat, lean body mass) and improvement in cardiovascular fitness (max\(\text{VO}_2\)) if performed two or three times per week.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to ascertain the training effects of participating in a Jazzercise dance fitness program, either two or three times per week for a seven week training period. The 21 subjects who completed the study were female volunteers ranging in age from 18 to 33 years old who had initial $\text{max} \dot{V}O_2$ values of 45 ml·kg·min$^{-1}$ or below. Five participants in the two-day group and 16 participants in the three-day group completed the study. The subjects participated in Jazzercise classes offered through the Intramural Program at the University of Wisconsin - LaCrosse.

Each subject underwent a pre and post maximal treadmill test using the Modified Astrand Protocol (Pollock et al., 1978), to determine $\text{max} \dot{V}O_2$ in l·min$^{-1}$ and ml·kg·min$^{-1}$, maximal heart rate, $\text{max} \dot{V}E$, and respiratory exchange ratio (R). In addition, each subject was hydrostatically weighed to determine pre and post percent body fat and lean body mass. During the seven-week training period, the subjects attended Jazzercise classes either two or three times per
week on Mondays, Wednesdays, and Fridays for 50 minutes. Each class consisted of 8 to 10 minutes of warm-up, 25 to 30 minutes of cardiovascular routines, and a 10 to 15 minute cool-down period. Subjects monitored their heart rates after the fourth, sixth, and eighth routines during the cardiovascular segment of the class. The two and three day a week groups worked at intensities averaging 78.8% and 77.3% of their maximal heart rates, respectively.

The statistical model used to determine significance between the groups and pre and post test results was a mixed design 2-way ANOVA, with repeated measures. Also, an independent t-test was done to compare the average exercise heart rate intensities of both experimental groups. The 0.05 level of confidence was used. There were no significant (p>.05) interactions between the two and three day a week groups with the exception of ventilatory efficiency (\( \dot{V}_E/\dot{V}O_2 \)). The three-day group had a significant (p<.05) increase in ventilatory efficiency, while the two-day group showed non-significance (p>.05). Significant increases (p<.05) were found in both groups for max\( \dot{V}O_2 \) (l·min\(^{-1}\) and ml·kg·min\(^{-1}\)), and treadmill run time. Significant decreases (p<.05) were found for percent body fat for both experimental groups. There were no significant (p>.05) differences found between pre and post tests of both groups for max\( \dot{V}_E \), R, maximal heart rate, body weight,
Conclusions

Based on the limitations of this study and the statistical interpretation, the following conclusions were offered:

1) The null hypothesis, stating that a seven week training session of Jazzercise comprised of a two day a week and a three day a week group will have no significant effect on cardiovascular fitness and body composition was rejected. The results indicated that the Jazzercise program did have a positive effect on cardiovascular fitness showing increases for both groups.

2) The null hypothesis, stating there will also be no significant differences between the responses of the two training groups, was accepted with the exception of ventilatory efficiency. The three-day group showed a significant increase in ventilatory efficiency, while the two-day group did not.

3) There were no significant differences in body weight for both groups. This lack of change in body weight may occur with training due to an increase although non-significant in LBM and a decrease in percent body fat, both of which occurred in this study.

4) There was a significant decrease in percent body fat for both groups indicating that Jazzercise as a
training mode can have an affect on body composition by reducing body fat.

5) There were no significant differences in the R for both groups. An R value was used to indicate achievement of maximal effort during testing. All subjects attained an R of 1.00 or greater indicating maximal effort was achieved during the maxVO₂ test.

6) There was a significant increase in maxVO₂ (l·min⁻¹ and ml·kg·min⁻¹) for both groups indicating an increase in cardiovascular fitness due to participation in Jazzercise.

7) There was a significant increase in treadmill run time for both groups. This increase was another indicator of improved aerobic capacity as a result of the Jazzercise training.

8) There were no significant differences found for maximal heart rates for both groups pre and post test. Changes in maximal heart rates do not necessarily occur with training.

9) Although initially there were no significant differences in maxVE for both groups, the three-day group had a significant increase in ventilatory efficiency.

10) Based on these results, Jazzercise can be used as an exercise mode for improvement of cardiovascular fitness and reduction of percent body fat if performed at an
appropriate intensity, frequency, and duration. In this study, an intensity of 75% of maximal heart rate and a frequency of two or three times per week elicited a significant increase in cardiovascular fitness as measured by max \( \dot{V}O_2 \) and a significant reduction in percent body fat.

In conclusion, the lack of significant differences between the two and three day a week groups that occurred in this study is not in agreement with most of the literature. Although significant increases have been found in max \( \dot{V}O_2 \) for two day a week training groups using different exercise modes (ACSM, 1978; Atomi et al., 1978), it is considered the minimum frequency to elicit any increase in max \( \dot{V}O_2 \). Russell (1980) found no significant improvement for two day a week participation in aerobic dance. In another aerobic dance study (Cearly et al., 1984), significance was found between the two and three day a week groups for max \( \dot{V}O_2 \) improvement with the three-day group eliciting more improvement than the two-day group. Although the two-day group in this study did show some improvement it was non-significant.

The lack of significant differences between the two and three-day groups as a result of seven weeks of training in this study may be related to uncontrollable influences. In the three-day group, four subjects actually had slight decreases in max \( \dot{V}O_2 \). In addition, three of these four
subjects had increases in body weight which is known to affect \( \text{maxVO}_2 \) values. One participant in the three-day group was recovering from the flu while another had a cold during post-test week. Several other subjects came to the post-test sessions with minimal sleep the previous night due to studying for mid-term examinations. Although all the subjects attended the required minimum of 90% of the training sessions, the two-day group had a better attendance record. Had these influences not been a factor, perhaps the three-day group would have shown significance from the two-day group.

Although the results of this study show that participation in Jazzercise two or three times per week will elicit a similar training effect, it is recommended that participants attend regular aerobic exercise more than two times per week. This would be in accordance with the ACSM (1978) recommendation for frequency of exercise per week to elicit a training effect. A greater weekly attendance would benefit musculo-skeletal conditioning for reduced injury incidence as well as contribute to greater psychological benefits known to be derived from regular participation in aerobic exercise, not measured in this study. The recommended three to five times per week frequency of aerobic exercise might also manifest greater cardiovascular fitness improvements and reduction in percent body fat.
It can be concluded from the results of this study that participants in a Jazzercise program will benefit with an increase in cardiovascular fitness and a potential decrease in percent body fat. Due to the small sample size (n=5) of the two-day group, and possible uncontrollable influences as well as the research that supports training of three or more times per week, it would be preferable to train at least three days per week when possible to receive optimal benefits from the training. If attendance three times per week is not feasible, participation two times per week will elicit positive cardiovascular responses.

**Recommendations**

In conclusion and based on the findings of this study, the following recommendations are offered for future research:

1) Due to the large number of participants in the Jazzercise program, a study should be conducted to determine any training effect to older females since the average age of Jazzercise participants is the middle-aged years. A study on children might also be done on the participants in the Junior Jazzercise program.

2) A longer study should be done with the use of a control group.

3) Heart rates, if monitored, would be more accurate if
taken for ten seconds instead of the six second counts used for this study.

4) Since Jazzercise uses the concept of perceived exertion to monitor intensity during class, this should be incorporated into a study as well as using the more quantitative heart rate method.

5) A study might be done with different instructors using the same routines to ascertain if different instructor personalities and techniques affect results.

6) More two day a week subjects should be used in a study to strengthen interpretation of the data. This researcher had a difficult time obtaining participants to volunteer to aerobically exercise only twice a week in such a fitness orientated environment as found at the University of Wisconsin - LaCrosse.

7) Since the mental aspects and benefits derived from participation in regular aerobic exercise are being recognized more and more, a psychological inventory to measure self-esteem or sense of well-being might be added to a study. Informally, participants in this study expressed a greater sense of well-being at their post-tests.

8) With increased emphasis on low-impact aerobics, a study should be done on the Jazzercise On The Lighter Side program to assess its affect on training.
REFERENCES CITED


APPENDIX A

SUBJECT QUESTIONNAIRE
Subject Questionnaire

Name ___________________________ Phone ___________________

Address ____________________________________________________________

Age ___________________________ Weight ___________________________

Level/Major _________________________________________________________

1) Are you currently participating in any type of regular aerobic exercise? ______ If yes, What? ______
   How many times per week and how long is each exercise session? ________________________________

2) Are you playing for any University athletic team?
   If so, what sport and when is your season? ________________________________

3) Are you a cigarette smoker? ______ If yes, how much? _____________________________

4) Have you participated in any dance fitness program before? ______ If so, which one, where, and when? ________________________________

5) Do you have any known physical problems that might prevent you from participating in or completing this study? ________________________________

6) How would you describe your current fitness level?
   ______ 1) poor physical condition (don't exercise)
2) fair physical condition (rarely exercise)

3) good physical condition (occasionally exercise)

4) excellent physical condition (regular exercise)
APPENDIX B

JAZZERCISE WAIVER FORM
JAZZERCISE WAIVER

The Jazzercise Dance Fitness Program is designed through dance routines to concentrate on the cardiovascular system, flexibility, balance, coordination, posture, muscle toning and endurance. The routines allow for an appropriate warm-up period and, during the course of the routines, students are advised to pace themselves.

The Jazzercise staff requests that each student enrolling in the program consult his/her physician with respect to any past or present illness, injury, cardiovascular problem, knee problem, or any other condition that may effect his/her ability to endure the exercise program.

I, the undersigned, acknowledge that I have read the above two paragraphs, that I understand them, and that I have discussed the Jazzercise Program and any physical and/or emotional illnesses or injuries I have with my physician.

I agree to be solely responsible for any and all costs, damages, and expenses incurred by me as a result of any injury sustained by me from participating in the Jazzercise Dance Fitness Program and further agree not to hold JAZZERCISE, INC., its staff and instructors responsible in any way for any such injury.

Signature: __________________________ Date: __________
APPENDIX C

SUBJECT CONSENT FORM
INFORMED CONSENT FOR THE JAZZERCISE STUDY

In conjunction with my participation in the University of Wisconsin - La Crosse Intramural Aerobic Activities/Jazzercise classes I, ______________________, am willing to participate in the Jazzercise training study conducted by Sue E. Martin, a graduate student in the Adult Fitness/Cardiac Rehabilitation program at the University of Wisconsin - La Crosse. I understand that participating in this study requires regular attendance for the 7-week training period as well as two or three visits to the Human Performance Laboratory at the University of Wisconsin-La Crosse for pre and post maxVO_2 tests and hydrostatic weighing.

I understand that the treadmill test consists of running to voluntary exhaustion on a motor-driven treadmill. After an initial warm-up of 3.5 mph at 2.5% grade, the speed of the treadmill will be 6 mph with a starting elevation of 0%; the grade will then be increased 2% every two minutes until exhaustion. During the test, heart rates will be monitored continuously through an electrocardiogram (ECG). This will involve the placement of electrodes on the skin’s surface. Oxygen consumption will also be monitored through the use of a Beckman Metabolic Cart. This will involve breathing through a mouth-piece so that expired air can be collected and measured. The increase in workload will continue until a maximal oxygen consumption is reached or until I feel I cannot continue any longer. In any testing situation some potential risk is involved. As with any exercise, the possibility of adverse reactions exists such as dizziness, staggering, difficulty in breathing, etc. In addition, I will feel tired at the end of the exercise. If any abnormal observations are noted, the test will be terminated immediately.

The hydrostatic weighing procedure consists of being briefly submerged underwater. Potential risks involved with a water environment include infection, accident and possible drowning. However, there has never been such an accident or report of infection as a result of hydrostatic weighing in the Human Performance Laboratory. I am free to stop any of the tests at anytime or withdraw from the study.

During the 7-week Jazzercise session I understand that I will be expected to work at a prescribed intensity.
throughout the study. In addition, I agree not to engage in any other cardiovascular activity on a regular basis.

In signing this consent form, I acknowledge that I have read the foregoing and understand it; any questions regarding my participation have been satisfactorily explained. The potential risks have been fully explained to me and I understand their implications. I hereby acknowledge that no representations, warranties, guarantees, or assurances of any kind pertaining to the procedures have been made to me by the University of Wisconsin - LaCrosse, the officers, administrators, employees, or by anyone acting on behalf of any of them. To my knowledge, I am not infected with any disease or have any limiting physical condition or disability, especially with respect to my heart, that would prevent me from participating in strenuous exercise or being underwater weighed.

Signed: ___________________________ Date: ______________

Witness: __________________________ Date: ______________
APPENDIX D

MAXVO₂ TESTING INFORMATION
MaxVO₂ Testing Information

1) Bring or wear shorts, a t-shirt or loose top and gym shoes.

2) Eat at least two hours prior to the test. A light meal is preferable.

3) Do not consume alcohol for at least 3 hours before the test.

4) Do not engage in heavy exercise 24 hours prior to the test.

5) Testing location: Human Performance Laboratory  
225 Mitchell Hall  
(2nd fl. - southeast side of the building)

Your treadmill test has been scheduled for ____________
_______________ at _______________. Please keep this appointment. Your promptness is appreciated. If for any reason you cannot make the test, please call me at 784-9107 (Home) or at 785-8685 (Lab) and leave a message for Sue Martin.
APPENDIX E

UNDERWATER WEIGHING INFORMATION
Underwater Weighing Information

1) Please bring a swimsuit and a towel.
2) Do not eat for 12 hours before your scheduled test.
3) Do not participate in any heavy exercise 8 hours prior to the test.

Your underwater weighing test has been scheduled for ______________ at ______________.

Please keep this appointment. Your promptness is appreciated. If for any reason you cannot make the test, please call me at 784-9107 (Home) or at 785-8685 (Lab) and leave a message for Sue Martin.
APPENDIX F

JAZZERCISE CLASS STRUCTURE
The following is a chart that describes the Jazzercise class in terms of physiological structure and work load on the heart.
APPENDIX G

STUDENT GUIDE TO JAZZERCISE
... the high energy workout that combines the total body conditioning benefits of aerobics with the fun of dance.
Dear Jazzerciser...

Welcome to Jazzercise...

Hi! Welcome to Jazzercise — a total body conditioning program that's going to make you feel great and look terrific!

I've put together this handy little booklet to help you discover what so many of our students already have — that there's much more to physical fitness than just good looks. There's a whole world of emotional fitness rarely discussed in the fitness journals that I feel is an integral part to the success of Jazzercise. The combination of movement, dance, music and fun releases us to experience a self-awareness on four different levels. First off, one becomes aware of the animal within — that we are by nature animals with keen instincts — that this basic fact is nothing to be ashamed of, but on the contrary, something to be proud of. This basic and essential part of us is infinitely complex, beautiful, and when outwardly acknowledged, very rewarding! Tune into your body, feel it, free it and appreciate it! Also, find the child within yourself. Do you remember once playing with no inhibitions, no competitiveness and no self-consciousness? Remember your willingness to take risks without fear of failure or ridicule? Jazzercise lets that child within you play again!

Creativity is another important aspect of Jazzercise that I bet you never thought of in conjunction with fitness, but that's where the pleasure of dance begins. Jazzercise lets you express creativity — to be an artist, using your body as a tool to express grace and rhythm — such movement is art and every Jazzerciser is an artist making his or her own physical poetry.

Lastly, but perhaps most importantly, Jazzercise makes you your own hero by giving you a physical challenge, allowing you to meet it and experience the pure pride and joy that come from personal achievement.

These four aspects of yourself — animal, child, artist and hero — will surface time and time again during the course of each Jazzercise class, and you too will come to understand that fitness should be an emotionally satisfying as well as a physically satisfying experience. I want Jazzercise to help you achieve your fitness goals, but remember, I've designed the program just for enjoyment too, so you'll love every step on your way to fitness.

Smiles,

Judi Sheppard Missett

This is your 55 minutes, so "leave your worries on the doorstep" and concentrate totally on yourself. Take this opportunity to work out frustrations and tensions, shed inhibitions, and have fun. Let go of the "serious adult" side of you and be a kid again! Jazzercise will put a smile on your face, a bounce in your step and will make you feel better both mentally and physically.

Each class begins with a warm-up period which consists of routines designed to prepare the body for the more strenuous movements to come. Next is a period of cardiovascular work with movement designed to increase your heart rate. Each class includes routines which descend to the floor and work on specific areas of the legs, thighs, derriere, stomach, upper torso and arms. The cool-down period begins on the floor and concludes with a standing dramatic routine as a finale.

Remember to work at your own pace. Tune into your body and determine whether you need to slow down or speed up. Because Jazzercise is non-competitive and you work at your own speed; anyone, regardless of age or level of fitness, can benefit from the program.

It is natural to feel a bit awkward in attempting any new activity. Don't be discouraged! It may take a few classes to feel comfortable with the routines. New routines are introduced approximately every eight weeks and are repeated enough times to allow you to become familiar with the movements and concentrate on getting the maximum benefit out of each one. Jazzercise is designed to improve flexibility, coordination and stamina while always providing new ways for you to challenge yourself.

If you have any medical problems, please consult your physician regarding your participation in Jazzercise. It is important that your physician approves of your exercise program and is able to monitor your condition. Jazzercise instructors are trained in CPR and always have basic first aid supplies such as band-aids and ice packs readily available. Do not hesitate to let me know if I can be of assistance.

Our goal in Jazzercise is to take the boredom out of exercise while promoting physical and mental well-being. So, take a great time while getting and staying in shape. I'll be right there working, sweating and smiling with you. Let me know how you are doing. I do care about you.

Thanks for joining us!

Your instructor
How Jazzercise is different from other programs...

Jazzercise is a unique total body conditioning program which is distinguished from other exercise programs by several key elements: jazz dance-based choreography, class structure, instructor training, theatrical styling and availability to all ages.

Judi Sheppard Missett began developing Jazzercise in 1969 and continues to choreograph all the Jazzercise routines. A professional dancer since the age of 14, Judi received her Bachelors Degree in Theatre/Radio-TV, specializing in dance, from Northwestern University and trained extensively with well-known master teacher/choreographer Gus Giordano. Judi was teaching traditional jazz dance classes when she realized that many of her students enjoyed dancing as exercise, but were intimidated by formal dance training. Judi revolutionized working out by combining her dance technique with exercise physiology to create a simple yet effective program. Today, Judi and Jazzercise are recognized worldwide. Judi is a member of the American College of Sports Medicine and spokesperson for the Presidential Sports Award and Fitness Festival Programs.

The 55 minute Jazzercise class is carefully balanced to total body fitness. Each class begins with a warm-up period which consists of stretching and jazz isolation movements that help maintain you with each portion of the body. A 25 minute aerobic, or cardiovascular, segment comes next, followed by routines that descend to the floor to work on specific areas of the legs, thighs, derriere, stomach, upper torso and arms. The floor is used as a tool to stretch for proper body alignment and more extensive muscle toning and flexibility. The final portion of the class allows you to cool down and stretch major muscles. A final routine brings you to standing position once again, allowing you to experience the exhilarating feeling that comes with a well-balanced workout.

The class structure always remains the same; only the choreographed routines and music vary monthly to keep the workout lively and enjoyable.

No exercise program can be safe or effective without top-quality instructors. Jazzercise has set the standard with a thorough training program. Potential instructors are carefully screened; only about one out of every eight applicants is certified. Instructors must pass an intensive training program which provides instruction in dance technique and terminology, human anatomy and physiology. They must also be CPR certified annually, and are continually monitored to ensure a high standard of instruction. Continued education, through regional workshops, training videocassettes, company newsletters and written materials keep instructors abreast of the latest information on exercise and dance physiology and safety. They are then encouraged to pass this knowledge on to their students.

Training videocassettes provide instructors with new routines as well as demonstrate theatrical styling. Videocassettes are also used by instructors to cue students carefully. For example, Jazzercisers are always reminded to keep their knees over their toes during a pile to prevent injury to that sensitive joint.

Because Jazzercise is based so solidly in dance, the performance or theatrical aspect of the program is one of its most unique features. The choreography is an integral and essential part of the music. A follow-the-leader teaching formula keeps students turned away from the mirror and helps them concentrate internally on the rhythm and movement of pure dance. Not only is this safer, it also keeps the students from harsh comparisons that often deflate their motivation. Students are encouraged to listen to their bodies and go at their own pace while enjoying the music and dance.

Jazzercise avoids the subjective categories of beginning, intermediate and advanced. This is because fitness levels are relative to an individual's physical potential and goals. Jazzercise is designed to have students of varying levels work side by side by tuning into their own bodies and working at their own pace. All ages can participate in Jazzercise because it is designed to be modified for people who are limited and to challenge exercisers who are already fit.

While most people can attend regular Jazzercise classes, there are Junior Jazzercise classes for children and teens, and Modified classes for seniors, expectant mothers and those with special health considerations. Jazzercise is designed to be enjoyable and varied, and to help people of all ages develop a lifelong habit which creates longer, healthier and more productive lives.

It's easy to see that all the reasons that make Jazzercise different from other programs are the very reasons that make Jazzercise so effective!
**Stretch-out & Warm-up!**

Before you start working out, it is important to loosen and limber up those muscles. You'll avoid injury and enjoy the physical movement more. Here are some excellent stretches you can start with. Remember, don't bounce! Bounce-stretch creates tensions and contracts the muscles which may result in injury. Stretch, relax, and hold these exercises for at least 15 seconds.

**Tips...**

**CLOTHING** — Wear comfortable clothing. Most women prefer leotards and stirrup-type tights. Shorts or sweat suits are also acceptable.

**SHOES** — Tennis, jogging or exercise shoes may be desirable on cement floors and for those who need a shoe for added support. No socks, stockings or tights (except stirrup-type) should be worn on bare floors since you might slip.

If you prefer to wear nothing on your feet, this is acceptable.

**EXERCISE MAT** — The 55 minute program includes a floor "workout." This means that we are physically on the floor, testing and exercising specific muscle groups (i.e., thigh, abdomen, upper torso, etc.). For this reason, we recommend that you bring with you an exercise mat, bathroom rug, or piece of carpeting. These are excellent because they provide a non-slip surface and remain stationary while you do the moving.

**CHILDREN** — Insurance regulations prohibit children in class unless they are registered and a release form is signed. Some classes provide babysitting for a nominal fee.

**PERSONAL BELONGINGS** — Please, do not leave personal belongings (purses, clothing, towels, etc.) where others may trip or stumble over them. We cannot be responsible for your personal belongings.

**DRINKS & FOOD** — If you wish to bring something to drink during class, place it out of the way to prevent accidents from spillage. Nonbreakable containers and covers are REQUIRED. No food or gum allowed in class.

**CHECK WITH YOUR DOCTOR** — If you are under a doctor's care for any reason, including pregnancy, please check with him/her before beginning any exercise program.

**TEACHER'S TIP** — Your instructor will periodically suggest safety points for preventing back and knee strain as well as tips designed to improve your overall execution of the movements and choreography. Listen carefully to these suggestions, especially if these are trouble areas for you.

**LISTEN TO YOUR BODY** — You are the best judge of what feels good to your body! If some movement does not feel "right" or causes pain while executing it, cease that activity, modify it or tone it down a bit.

**KEEP MOVING** — Cardiovascular routines (fast, continuous moving) should not come to a screeching halt! When the music stops, keep moving to sustain your Training Heart Rate or to allow the heart to gradually slow and recover.

**PACE YOURSELF** — Remember when the weather is warm, slow the tempo down a bit. When it's chilly outside, warm up adequately first, then pick up the pace a little. PACE YOURSELF during cardiovascular routines and slowly build yourself up. Keep moving but slow down the energy you're using if you become winded or breathless.

**COVER-UPS** — Upon completion of a strenuous (sweaty) workout, cover up with warm clothing which allows the body to cool gradually. In warm months, don't get in an air conditioned car... cool down gradually.
Do's & Don'ts

GENERAL RECOMMENDATIONS

DO: Stand with knees and hips locked to prevent back from arching. Keep hips gently tucked forward in square alignment with shoulders. Keep abdominals held firmly to control torso.

OVERALL MOVEMENTS

DO: Modify or slow down any movements for which correct posture is hard to maintain, but continue to work for improvement.

DO: Keep knees relaxed and bend knees whenever needed to avoid any excess pressure to the lower back.

DO: Make movements as large and controlled as possible. Keep the torso tilted tall, shoulders relaxed, abdominals held firmly, and arms and legs extended fully.

DON'T: Allow knees to slide inward or outward when stretching. Keep knees slightly bent and abdominals held firmly during a fat back.

DON'T: Breathe in a way that allows energy to flow freely through the body.

WARM-UP ROUTINES

DO: Release hips backward when stretching the neck. Roll or lift head to side instead.

DON'T: Release hips backward when stretching the neck. Roll or lift head to side instead.

DON'T: Squat, keep torso tilted tall. When stretching sideways with one or both arms overhead, keep arm(s) by side.

AEROBIC ROUTINES

DON'T: Allow ankles to roll inward or outward when supporting weight on one or both feet or in positions such as plie, relevé, lunge, etc. Hold ankles firm in alignment with feet and spine.

DON'T: Compare with anyone else in class.

DO: Listen to your body to tell you when to work harder or easier. Pace yourself.

DON'T: Ignore your feelings or listen to the music during the cardiovascular (aerobic) segment. Monitor your heart rate with the information provided by JazzyJingles. (See page 18).

DON'T: Try to warm up too quickly. Do warm-up exercises gently and fluidly. You'll avoid injuries and have more stamina for the duration of your workout.
**Do's & Don'ts...**

**JUMPING**

**DO** land gently on feet after springing upward. Land on the balls of the feet with knees slightly bent, then lower entire foot to floor whenever possible.

**FLOOR ROUTINES**

**DO** keep back straight and your abdominal muscles held firmly.

**DON'T** lift leg so high that hip rotates out of alignment in all-fours position. Keep back straight and shoulders relaxed so there is no hyperextension of either area when in an all-fours position on the floor. Keep hands in alignment with shoulders.

**DON'T** allow one hip or the other to lift from floor while sitting on the floor and stretching legs.

**STRETCHING**

**DO** keep the abdominal muscles held firmly and position the supporting leg so that the foot and knees are in front of the body. The back should not be arched or twisted.

**DON'T** lock elbows or arch back during pushing-up type movements. Keep abdominal muscles held firmly; keep hands in alignment with shoulders while head stays in alignment with spine.
Symptoms & Remedies...

**Extreme Breathlessness:** Exercise is too taxing to your cardiovascular system. You may be overexerting. Be sure that while you are exercising you are not too breathless to talk to a friend or sing to the music. If so, slow down.

**Prolonged Fatigue:** (Even after 24 hours) Exercise may be too vigorous. Increase level more gradually. Pace. Avoid overexerting.

**Shin Splints:** (Pain on the front or sides of lower leg: delayed): Inflammation of the fascia connecting the leg bones; or muscle tears where muscles of the lower leg connect to the bones. Tibial fracture may also be a cause. See physician if pain persists or is sharp and piercing. Shoes with a good arch support are recommended. Assist from pounding motion. Stretch calves. Use ice to massage the shin.

**Charley Horse/Muscle Cramps:** (Muscle contracts powerfully.) An injury or strain on muscles. Many causes: short leg muscles, poor nutrition, lack of exercise, dehydration. Massage to relieve. See physician.

**Muscle Pain While Exercising:** Results from the blood being unable to efficiently get to the muscle, thereby preventing the blood from eliminating the waste products in the muscle, which irritate the pain receptors. The better physical condition you're in the more work your muscles are able to do before they experience pain. Everyone has limits. Even the most finely conditioned athletes can experience discomfort, not pain, during grueling competition. Know the difference between the two.

**Muscle Stiffness and Soreness:** May occur immediately following the activity, or there may be delay until the next day. The commonly accepted theory is that microscopic tears occur in the muscle fiber causing inflammation, swelling, and pain. Exercise at a relaxed pace. Pace yourself. Stretch the sore muscles.

**Stitch in Side:** (A) Eating prior to exercise. (B) Gas in the upper portion of the descending colon (C) Cramps in the diaphragm or intercostal muscles due to lack of blood supply. Relax, don't eat a heavy meal less than 3-4 hours prior to exercise. Slow down. Relax the muscles of the rib cage by taking a deep breath and raising the chest.

**Dizziness, Light-Headedness, Nausea:** (During or immediately following exercises.) You are possibly exercising too vigorously or cooling down too quickly, or not at all. Slow down; exercise a little less vigorously and be sure to take a more gradual and longer cool-down.

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Exercise & your body...

Your Jazzercise program is designed for total body conditioning. You'll increase your flexibility, muscle tone, stamina, balance and coordination. You'll also increase your heart and lung strength through the cardiovascular exercises.

'You've heard the term "aerobic." Aerobic exercise is exercise which uses large muscle groups. It requires the body to intake and utilize oxygen, elevating heart rate to a certain level for a sustained period of at least 20 minutes. Aerobic exercise improves circulation and strengthens the heart and lungs.

Most experts agree that you need to work out at least three to four times per week and include at least 20-minutes of aerobic activity in your workout. Your Jazzercise workout will meet this need as well as condition your whole body.

We encourage you to get in the habit of checking your heart rate during class to monitor your exercise intensity. To check it, press lightly with your index and middle finger at either the carotid artery which lies just next to your Adam's apple in the neck, or on the radial artery which is located on the inside of your wrist just below the base of your thumb. Looking at a clock or watch, count the number of pulses felt in a period of 30 seconds. Then, multiply this ten-second count by six to obtain your heart rate (beats per minute).

To determine what your training heart rate should be, follow these simple steps:

1. **Determine your maximum heart rate by subtracting your age from 220.**
2. **Determine your resting heart rate by checking your pulse while at complete rest, preferably upon waking in the morning.**
3. **Subtract your resting heart rate from your maximum heart rate. Multiply this difference by .50 if you are at a low fitness level, by .60 if average, and .85 if fit.**
4. **Add the result to your resting heart rate. The number obtained is your training heart rate, the heart rate you should strive to maintain while exercising during the aerobic segment of Jazzercise.**

As an example, let's calculate the desired training heart rate for a 30 year old, beginning Jazzerciser.

1. **The maximum heart rate is 220 - 30 = 190 beats per minute.**
2. **Assuming a resting heart rate of 70, we subtract 190 - 70 = 120.**
3. **Now, multiply 120 by .50 for a beginning exercise** 120 x .50 = 62.
4. **Add this number to the resting heart rate:** 72 + 62 = 142.

During class this person should be working at an intensity that gets the heart beating at roughly 142 beats per minute (give or take 5 beats) If the pulse was taken following a routine and it was much lower than this, the workout should be a little harder. If it was well above 142, slow down.
1. Why are some Jazzercise classes so large? We have large classes as well as small ones. None of our classes is larger than 100 people in order to maintain instructor/student eye contact. Large groups offer a person an inconspicuous feeling. Many people wouldn't exercise at all if they had to be "noticed" in a group. From a financial standpoint, larger groups keep our class cost down and we are able to promote our philosophy that exercise is non-exclusive. We are one of the least expensive programs. Larger groups can also increase the energy level in a room and relax people so that they have more fun.

2. Why doesn't Jazzercise offer beginning, intermediate, and advanced classes? Our teachers are trained to help each student learn to pay attention to his/her body's signals and to adjust each routine to these needs. There are as many levels of fitness as there are people, and each person has different abilities in the different aspects of fitness. The "levels" approach instills competitiveness, not only between people, but within the same individual—implying that eventually everybody should be "advanced." Fitness and health are not competitions or sports with winners and losers. As long as you work at it, doing your best, you are a winner.

3. Why don't we stop to take pulse rates in Jazzercise? Half of the answer is in the question. In order to take a pulse rate we must stop. An effective aerobic workout is non-stop activity at Training Heart Rate for at least 20 minutes. We recommend you use the formula within this booklet to find your Training Heart Rate and the Perceived Exertion Chart to monitor your workout level. In this way you will come to know your own body and can work at a pace that is good for you.

4. How can a Jazzercise student know whether or not his or her body mechanics are correct in terms of safety without mirrors or the instructor physically moving the student's body? Some students are intimidated by personal contact or by looking at themselves. Many people enjoy Jazzercise because it's not being reminded continually of how they look. Instead, they are doing something about it. Jazzercise provides more of a service by getting people to move. Jazzercise instructors "mirror" how not to perform a movement by demonstrating an exaggerated version of the "don'ts." And that's more entertaining than looking at yourself in a mirror.

5. Why isn't the level of activity in Jazzercise classes harder? Jazzercise is as hard as the individual student cares to make it. If you say you need another type of program that works harder, consider what you're saying. There isn't a program in the world that works anyone. You work yourself. If Jazzercise has what it takes to motivate a student to move, the rest is built in. Jazzercise offers a warm-up, an aerobic section, isolated muscle strengthening, toning, stretching, and a cool-down period. That covers everything a workout should have according to the American College of Sports Medicine. If you need a more "serious" or a more sober approach to motivate you or to make you know that you are working, not playing, or if you have an above-average pain threshold, Jazzercise may not be your best fitness program. Our goal is to create a program you'll stick with and enjoy for the rest of your life, not one you will drag yourself to and eventually quit.

6. How can Jazzercise be cardiovascular if many of the routines don't have the student's feet leaving the floor? Cardiovascular, or aerobic, exercise is any exercise which makes the heart, blood vessels, and lungs all work at a higher capacity—specifically at the individual Target Heart Rate. In order to get the Training Effect the heart rate must be raised to your individual training level for a steady uninterrupted minimum of 20 minutes, three times a week. This does NOT require jumping up and down or traveling great distances, but it does require continuous movement, usually involving the large muscle groups. Any fitness expert will cite stationary bicycling, rowing, and swimming as excellent cardiovascular exercises. Jazzercise routines, which feature plies, lunges, and movement of the major muscle groups throughout the back and upper body, can put the student within Target Heart Rate range without subjecting joints and shins to the pressure and pounding of continuous jumping up and down.

Another reason movements vary in the Jazzercise sets is to add variety—to give a mental and physical "break." The classes avoid fatiguing one muscle group by offering enough movement for another major muscle group. Overly repetitious movement may make you feel as if you are really working, but it leads to muscle fatigue, and fatigue can lead to injury. It can also lead to boredom and to a loss of energy which can, in turn, drop the heart rate. Changing movements and routines are just two ways Jazzercise insures an exercise program that is not only beneficial but fun as well.
Perceiving your exertion level...

Jazzercise uses what is known as the perceived exertion scale to help students monitor their exercise intensity. The scale, developed by a Swedish physiologist, encourages students to tune into their bodies while exercising to determine how the exercise feels. The numbers of the scale each correspond to a specific description, ranging from very, very light to very, very hard.

During the Jazzercise class, students refer to a posted chart of the perceived exertion scale to choose the number and description that best describes how the exercise feels to them. The number chosen, when multiplied by ten, approximates the student's heart rate per minute.

For example, imagine during a routine you determine that the exercise feels "somewhat hard." Looking on the perceived exertion chart this description corresponds to the numbers 12 - 14. Your heart rate is probably in the range of 120 - 140 beats per minute.

Jazzercise has divided the perceived exertion scale into three color-coded zones: yellow, green, and red. Depending on the portion of the class, the instructor will remind you which "zone" you should be in. Learning to monitor your exercise intensity in this way will ensure that you get a safe and effective workout.

Warm-up: (Perceived as "Light") Stay in the "Light" (YELLOW) Zone, gradually elevating your heart rate. If you feel you are in the green zone during this segment, you need to ease up a bit in order to stay in the "Light" (YELLOW) zone and reap the benefits of warming up.

Peak-work: Try to pace yourself throughout this somewhat hard phase (GREEN). Breathing and talking should be performed somewhat comfortably during this segment. Avoid overexerting and climbing into the extreme "very, very hard" (RED) zone. The "very, very hard" zone correlates with anaerobic exercise which could invite overexertion, fatigue, and possible injury. Remember, fat is burned most efficiently in the zone which includes "Somewhat Hard," "Hard," and "Very Hard." If you are not in the green zone during the aerobic segment, you need to work a little harder.

Cool-down: In this portion of the class you should be back in the "Light" (YELLOW) zone again to effectively allow the body to cool down.
APPENDIX H

JAZZERCISE MUSIC AND ROUTINES
1. You're The Best Thing - Opening Warm-up
   Style Council
2. I Just Called To Say I Love You - Jazz Isolation Warm-up
   Stevie Wonder
3. Better Be Good To Me - Light Cardiovascular - 3:38
   Tina Turner
4. I'm So Excited - Medium Cardiovascular - 3:50
   The Pointer Sisters
5. Fame - Medium Cardiovascular - 3:48
   Irene Cara
6. Where Do The Boys Go? - Heavy Cardiovascular - 3:54
   Men Without Hats
7. Swept Away - Medium-Heavy Cardiovascular - 4:01
   Diana Ross
8. Who Wears These Shoes? - Medium Cardiovascular - 3:37
   Elton John
9. Let's Hear It For The Boy - Light Cardio/Descending -
    4:20 Deniece Williams
10. Caribbean Queen - Derriere (Gluteals)
    Billy Ocean
11. Treat Her Like A Lady - Abdominals
    Temptations
12. After All - Hamstrings, Calves, Quadriceps, Gluteals,
    Abdominals, Upper Torso Stretch, Ascending, Cool-down
    Al Jarreau
13. Penny Lover - Ending Cool-down
    Lionel Richie
JAZZERCISE MUSIC AND ROUTINES

Week 4

1. I Would Die 4 U - Opening Warm-up
   Prince
2. Love Light In Flight - Jazz Isolation Warm-up
   Stevie Wonder
3. Jamie - Light Cardiovascular - 4:10
   Ray Parker, Jr.
4. I'm So Excited - Medium Cardiovascular - 3:50
   The Pointer Sisters
5. Fame - Medium Cardiovascular - 3:48
   Irene Cara
6. Neutron Dance - Heavy Cardiovascular - 3:51
   The Pointer Sisters
7. Swept Away - Medium-Heavy Cardiovascular - 4:01
   Diana Ross
8. Infatuation - Light Cardiovascular - 4:03
   Rod Stewart
   Sheena Easton
10. Sweet Dreams Are Made Of This - Derriere (Gluteals)
    Eurythmics
11. Treat Her Like A Lady - Abdominals
    Temptations
12. After All - Hamstrings, Calves, Quadriceps, Gluteals,
    Abdominals, Upper Torso Stretch, Ascending, Cool-down
    Al Jarreau
13. My Love - Cool-down, Flexibility
    Lionel Richie
JAZZERCISE MUSIC AND ROUTINES

Week 5

1. I Would Die 4 U - Opening Warm-up
   Prince
2. Love Light In Flight - Jazz Isolation Warm-up
   Stevie Wonder
3. Misled - Light Cardiovascular - 4:03
   Kool and the Gang
4. Fame - Medium Cardiovascular - 3:48
   Irene Cara
5. Body - Medium Cardiovascular - 4:18
   Jacksons
6. Neutron Dance - Heavy Cardiovascular - 3:51
   The Pointer Sisters
7. Swept Away - Medium-Heavy Cardiovascular - 4:01
   Diana Ross
8. Sports - Medium Cardiovascular - 3:23
   Sparks
   Sheena Easton
10. Loverboy - Derriere (Gluteals), Outer Thighs
    Billy Ocean
    Huey Lewis and the News
12. Every Breath You Take - Ascending, Quadriceps Stretch, Hamstrings Stretch, Flexibility, Cool-down
    Police
13. You Can Do Magic - Ending, Cool-down
    America
JAZZERCISE MUSIC AND ROUTINES

Week 6

1. I Would Die 4 U - Opening Warm-up
   Prince
2. Love Light In Flight - Jazz Isolation Warm-up
   Stevie Wonder
3. Misled - Light Cardiovascular - 4:03
   Kool and the Gang
4. Belle of St. Mark - Medium Cardiovascular - 3:37
   Sheila E.
5. Body - Medium Cardiovascular - 4:18
   Jacksons
6. Neutron Dance - Heavy Cardiovascular - 3:51
   The Pointer Sisters
7. Through The Years - Medium-Heavy Cardiovascular - 3:49
   Tim Finn
8. Jamie - Medium Cardiovascular - 4:10
   Ray Parker, Jr.
   Sheena Easton
10. Loverboy - Derriere (Gluteals), Outer Thighs
    Billy Ocean
    Huey Lewis and The News
12. Every Breath You Take - Ascending, Quadriceps Stretch,
    Hamstrings Stretch, Flexibility, Cool-down
    Police
13. You Can Do Magic - Ending, Cool-down
    America
JAZZERCISE MUSIC AND ROUTINES

Week 7

1. I Would Die 4 U – Opening Warm-up
   Prince
2. Love Light In Flight – Jazz Isolation Warm-up
   Stevie Wonder
3. Like A Virgin – Light Cardiovascular – 3:33
   Madonna
4. Belle of St. Mark – Medium Cardiovascular – 3:37
   Sheila E.
5. Body – Medium Cardiovascular – 4:18
   Jacksons
6. Neutron Dance – Heavy Cardiovascular – 3:51
   The Pointer Sisters
7. Sports – Medium Cardiovascular – 3:23
   Sparks
8. Better Be Good To Me – Light Cardiovascular – 3:38
   Tina Turner
9. Misled – Light Cardio/Descending – 4:03
   Kool and the Gang
10. Loverboy – Derriere (Gluteals), Outer Thighs
    Billy Ocean
11. Walking On A Thin Line – Abdominals, Inner Thighs
    Huey Lewis and The News
12. Hello – Ascending, Hamstring and Quadriceps Stretch
    Lionel Richie
13. You're Looking Like Love To Me – Ending, Cool-down
    Peabo Bryson and Roberta Flack
APPENDIX I

TRAINING HEART RATES
### TRAINING HEART RATES*

(bpm)

#### Two-Day Group

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