1996

Exercise Walking for Obesity Management in Older Adult White Women

Mary I. Dallas
Grand Valley State University

EXERCISE WALKING FOR OBESITY MANAGEMENT IN OLDER ADULT WHITE WOMEN

By

Mary I. Dallas

THESIS

Submitted to the Department of Physical Therapy
at Grand Valley State University
Allendale, Michigan
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE IN PHYSICAL THERAPY

1996

EXERCISE WALKING FOR OBESITY MANAGEMENT IN OLDER ADULT WHITE WOMEN

EXERCISE WALKING FOR OBESITY MANAGEMENT IN OLDER ADULT WHITE WOMEN

ABSTRACT

The purpose of this study was to determine if a program of exercise walking would lead to any changes in the level of physical fitness for obese white women, aged fifty and over. Twenty-two women were recruited from three sites located in Holland, Michigan. The ten week program consisted of exercise walking three times a week for forty-five minutes at 60% to 70% maximum heart rate capacity. Subjects' weight, mean percentage of body fat, waist to hip ratio, body mass index, and the step test were found to decrease significantly between the pre- and post-test measures. As a result of this study it appears that exercise walking can lead to positive changes in the level of physical fitness of obese, white women, aged fifty and over.

ACKNOWLEDGEMENTS

I want to thank Evergreen Commons, Freedom Village, The Warm Friend, Rose Mc Daniels, Jennifer Schriver, Kelly Hollenbeck, Wendy Wigger and Michigan Alive, and all of the walkers and helpers for the opportunity to work with them, for their assistance, and for all they taught me.

I would like to thank, Dr. Jane Toot, Timothy Lesnick, James Scott, Dr. Glenda Taylor, Melodie Ward and all of my professors at Grand Valley State University for their expertise, guidance and support throughout my thesis experience.

Last, but most important, I want to thank my family who strengthened, encouraged, and without whom I would not have had this valuable learning experience.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Background to Problem

Studies show that there are 34 million overweight Americans (Miller, Taylor, Davidson, Hill & Krantz, 1990). Obesity is a significant health problem, especially with advancing age. Susceptibility to chronic disease is increased and length of life is decreased with increased obesity (Skinner, 1987). Many combinations of diet and exercise have been used as treatments for obesity with exercises being proven to play a very important part (Storlie & Jordan, 1984). In addition, the physiological and metabolic effects of exercise may help to reverse some complications observed in obese people (Franklin, Gordon & Timmis, 1989). "Regardless of chronological age, physical activity helps to slow the aging process" (Turner & Helms, 1989, p.379). Regular exercise maintains good health, improves cardiovascular endurance, promotes flexibility and reduces risk of cardiovascular disease (Turner & Helms).

Obesity can be considered the greatest single preventable cause of death in the United States (Storlie & Jordan, 1984). There is evidence that obesity increases the risk of diabetes, cardiovascular disease, hypertension, hypercholesterolemia, and cancer (Miller, 1990; Storlie & Jordan).

Efforts to control obesity through exercise are influenced by society. Statistics indicate that 60% of Americans do not exercise on a weekly basis and between 20% and 40% do not exercise at all (Dishman, 1988). However, participation in all types of exercise has increased 10% (Blair, et al. 1988). This increase is primarily in populations of young adults and those in higher socioeconomic groups. Populations that are not representative of those engaged in exercise programs are older individuals, predominantly women, the less educated, blue-collar workers, smokers, and overweight individuals (Blair, et al. 1988).

Significance of the Problem

Maintenance of weight loss has been associated with regular exercise (Miller, 1990). Both Blair and Dishman note that of those who begin or renew an exercise program, 50% will drop out within six months. Those who participate simultaneously in medical and prevention programs claim a better adherence, although 50% will fail to persevere after a year's time. This lack of adherence represents a real problem and an interesting challenge for the health profession in rehabilitation and guidance in making lifestyle changes.

An exercise program for the obese population must be regular, appropriate and successful for the individual. Physical fitness gained by an increased level of exercise

must be slow and deliberate, taking into account people's current lifestyles, their personalities, and the quality of their life (Storlie & Jordan, 1984).

A physical activity that is best suited for obese people is one that uses large muscle groups, such as walking (Franklin, et al. 1989). Walking involves all major muscle groups of the body and provides cardiorespiratory conditioning. Cardiorespiratory fitness assists to increase the proportion of high-density lipoprotein, strengthens the heart muscle and makes it more efficient, increases the capillary network of the body, improves circulation, stimulates bone growth, and aids in controlling body weight (Leon, et al. 1990; Payne & Hahn, 1992). Walking one mile requires the same energy as running one mile (Skinner, 1987) and the injury rate is less for walking. Therefore walking is safer for obese persons who are at a higher risk of joint injuries (Nieman, 1986).

For obese people, the best suited program could be a walking club. A walking program which meets three times a week, 30-45 minutes duration, walking at about 60% - 70% maximum heart rate capacity, can offer an informal exercise session that is fun, varied, and provides a feeling of personal success. It is hoped that these exercise sessions will, like other programs, lead both to reduced risk factors and healthier lifestyles (Leon, et al., 1990; Nieman, 1986).

This study is a progression from a previous study done by this investigator. The previous study, Exercise Walking For Obesity Management In Older Adult Black Women, was done in 1992 in Saginaw, MI.

Purpose of the Study

The purpose of this study was to determine if a program of exercise walking would lead to any change in the level of physical fitness for obese white women, aged fifty and over.

Definition of Terms

Energy The capacity for performing work, often measured in terms of oxygen consumption.

Exercise Physical activity, the purpose of which is to improve some component of physical fitness.

Exercise walking Walking for 30-40 minutes duration, at a level of 60% - 70% target heart rate, three times a week.

Lifestyle General patterns of living, including healthy and unhealthy behaviors.

Obesity The accumulation and storage of excess body fat. For the purpose of this study, obesity is defined as equal or greater than 30% body fat.

Physical activity Physical activity for this study will be the walking program, resulting in energy expenditure.

Physical fitness Optimal physical quality of life, which include components of body composition, flexibility, and cardiovascular endurance.

CHAPTER TWO

REVIEW OF LITERATURE

Obesity and Health Risks

Ample supportive literature exists regarding obesity and the resulting health risks but there is a lack of studies concentrating exclusively on obese, older females. Energy balance and caloric intake and expenditure concepts are used normally in the treatment of obesity. Exercise, specifically a walking program, as a weight management tool has had additional support in treatment for obesity and among older adult women. The following studies pertain to overweight older populations involved in walking programs and document the effects on body weight, blood pressure, and the cardiovascular system.

Strengths and Limitations of Studies

In a Japanese health care facility, a walking study was done on obese, middle-aged subjects (Ohta, et al., 1990). This five-month program consisted of a diet of 1500 calories per day and walking 10,000 steps per day. The walking steps were counted with a pedometer with pre and post testing done on a treadmill. Ohta concluded that a brisk walking program was effective in the treatment of obesity and hypertension in obese, middle-aged subjects.

The School of Public Health at Loma Linda University studied the effects of a walking program with 25-45 year old

females (Hinkleman & Nieman, 1993). Subjects, who were 110-140% of ideal body weight, walked on a treadmill for 45 minutes, five times a week for 15 weeks. Hinkleman found changes in total body weight with no loss in percent body fat. Concluding that a moderate walking program was not enough to effect body composition in overweight females unless a reducing diet is also adapted.

In a study at Deaconess Hospital (Boston) with Harvard Medical School, the amount of exercise of 25-45 year old obese, 41-45% body fat, was studied (Whatley, et al., 1994). Subjects walked either three or five times a week at 50-65% MHR for 12 weeks, in combination with weight training while on a liquid formula diet. It was concluded that those who exercised the most (five times a week) lost both body fat and body weight in a program of 12 weeks or longer.

An indoor walking program at Central Washington University was used to explore the relationship of exercise to body composition in women over 40 years of age (Bergman & Boyungs, 1991). Subjects walked 20-40 minutes at 75-80% MHR, four times a week for ten weeks. Changes in dietary intake were measured by a pre and post food frequency questionnaire. The study showed that during the ten week period percent body fat decreased, although there was no significant change in body weight without noticeable changes in dietary intake.

Gwinup studied patients who sought medical help for weight control (Gwinup, 1975). Thirty four subjects began a program of exercise alone, increasing the exercise period one minute per day. Only 11 women finished the one year program, all of whom used walking for their exercise. Findings showed that weight loss occurred only after walking exceeded 30 minutes per day and there was more body fat lost than weight loss. This study stressed that motivation leads to increased compliance in an exercise program which is a primary factor whether weight loss will occur.

At Florida Atlantic University effects were measured of a walking program among sedentary women, 61-81 years of age (Whitehurst & Menendez, 1991). The walking program consisted of three sessions per week for eight weeks. Testing revealed significant decreases in body weight, diastolic blood pressure, resting heart rate, and one-mile walk time.

The School of Medicine at the University of Florida investigated 70-79 year old men and women and the effects of exercise training (Cononie, et al., 1990). Subjects used resistance training with Nautilus machines or walked for endurance training, three times a week for six months. Results showed no changes in body weight, but a reduction in body fat and diastolic blood pressure with endurance training in normals or subjects with somewhat elevated blood pressure.

The University of Florida also studied the effect of exercise on older adults with hypertension (Hagberg, 1988). The program consisted of forty-five minutes of exercise at 50% - 70% maximum capacity. The method of testing was not discussed. This study found that low-intensity exercise lowers blood pressure approximately 10 mm Hg in hypertensive adults aged sixty and over, and that other risk factors may change favorably to reduce their risk for cardiovascular disease.

The University of Ottawa conducted a walking program for sedentary, middle-aged adults (Jette, Sidney & Campbell, 1988). The program consisted of walking/jogging for thirty minutes, three times a week, for twelve weeks. Treadmill testing was conducted at 60% maximal capacity. The study showed that an appropriate walking program was an effective, safe, and simple way to improve cardiorespiratory fitness for older and high-risk individuals.

Regular exercise not only improves cardiorespiratory fitness, but also helps to increase flexibility enabling adults to carry out routine activities. The University of Toronto and Brock University conducted a flexibility analysis of 45-75 year old adults (Shephard & Berridge, 1990). The eight month program consisted of a low intensity work site fitness class given once a week for forty-five minutes. The sit and reach test for flexibility was administered. It was concluded that the sit and reach test

was a reliable measure of trunk flexibility in aging populations.

Summary and Implications for the Study

This researcher will compare changes in obesity as measured by body weight, electrical impedance, waist to hip ratio, and body mass index to those found in the Ohta, et al.(1990), Hinkleman & Nieman (1993), Whatley, et al. (1994), Bergman & Boyungs (1991), Whitehurst & Menendez (1991), Gwinup (1975), and Cononie, et al. (1991) studies. Changes in cardiovascular fitness will be compared to all of the studies. Finally, flexibility results will be compared to the Shephard & Berridge (1990) study.

Benefits of regular exercise for the aged have been documented in literature. The elderly, participating in exercise training, are offered enhanced independence, a reduced need for health care and increased life expectancy (Hamdorf, Withers, Penhall & Plummer, 1993). These positive effects occur when exercise is made a part of one's lifestyle (Gwinup, 1975) and increases in importance in the older adult (Dishman, 1988). Therefore, adherence and behavior modification are primary goals in intervention programs. Because of this importance, the following section provides a detailed description of behavioral models and strategies that can be applied to exercise programs.

Behavior Modification

Models of Self-Destructive Behaviors

In analyzing the behavioral aspects of an exercise program, different behavioral models can be used. These are the rational model, the psychodynamic model and the social learning model as discussed by Teague in his book, Health promotion: Achieving High-Level Wellness in the Later Years (Teague, 1987).

Rational Model

In this model, Teague suggests that behavior is guided by thought. Given information about the health risks of various lifestyle habits, the individual will change behavior to preserve good health. Coping behaviors are weighed on the basis of the threat and/or danger of the behavior. Individuals need information about what it is they are trying to do, and also require a motivation to change, the skills necessary to change, and the ability to maintain change over time. Intervention for weight control would suggest receiving information about nutrition, exercise and physical activity, and specific diet plans.

Psychodynamic Model

In the psychodynamic model, Teague contends that within an individual there are conflicting tendencies among the instinctual, rational, and moralistic forces that were developed early in life. In this model, obesity may be due

to early life unconscious struggles about control over one's life and a learned inability to recognize hunger. This may be triggered by inappropriate parenting and use of food by the parents to satisfy the child's needs other than hunger.

Social Learning Model

In this model, Teague suggests that individuals engage in self-destructive behavior because they have learned that this behavior is an acceptable coping mechanism and is socially rewarding. Intervention strategies targeted at obesity would include knowledge of nutrition and energy consumption, and practical skills that the obese can use to manipulate their environment, that is, weight monitoring, self-reward strategies, and substitute behaviors.

Strategies of Motivation and Adherence to Exercise

The success or failure of any exercise program is directly related to the participants' degree of self-motivation and their degree of leanness. These are the most important factors influencing adherence (Williams, 1985). Generally speaking, adherence to an exercise program can be divided into personal factors, environmental-program factors, and behavioral factors.

Personal Factors

Participants must feel that the program is of personal value. The participants' age, sex, weight, self-perception, smoking status, past exercise experiences, and perception of their skill and ability must all be taken into consideration

to find a "fit" into the proper program. They may not want to be the only male or female in a class. They may feel out of shape and/or have a fear of looking ugly in shorts. They want to know what the program will do for them as an individual. The program needs to fill personal goals, such as weight loss.

The goal must be realistic. A program should help educate its participants so that they set goals that offer a reasonable chance of achieving success. The more the participant knows about exercise and what to expect, the better prepared they can be for setbacks. Perceived demands must be seen to be within their skill and ability level. A personal contract can help being patient and faithful to the program. Being realistic throughout the program would allow adapting the contract for a more successful program.

Personal involvement in formal and informal programs can be part of the social process of aging. A program can provide resources for older adults to maintain and improve quality of life (Birren & Schaie, 1990). Voluntary participation in programs is a major source of social participation and friendship networks. Networking is very strong among older females and may be related to quality of life, physical, and mental well-being (Birren & Schaie).

Environmental and Program Factors

Convenience, whether it is real or perceived, demands consideration. The participants need easy access to the

facility. This would include location, transportation, parking availability, distance to walk and stairs to climb to get to class. Time of day as well as days of the week must be adjusted to fit the schedules of the target group. The length of class time need be only forty-five minutes to one hour so as to pose few time constraints. Cost need not be a factor if, incentives are offered such as senior citizen discounts, spouse reduced memberships, or buddy discounts.

The exercise mode itself has to be convenient for participants. Required equipment or time consuming preparation should be a consideration for the type of exercise chosen. The location, time demands, costs, and type of exercise all must be taken into account during the early stages in helping the participants to develop an exercise habit.

Outside influences, such as friends and family, cannot be controlled by a program. However, support from family and friends can be a very beneficial, positive influence. Studies show that individuals with spouses who are neutral or unsupportive are more likely to drop out (Teague, 1987). Group cohesion and buddy systems both offer a social system of support. Exercising with a partner offers companionship, but care must be taken by the planner that it does not become competitive in nature. Nine out of ten people prefer group exercise as opposed to individual exercise (Teague,

1987). Socialization and support seem to be the reasons behind this attitude. As Teague points out, interpersonal influences have a dramatic impact on program compliance.

Important factors are the enjoyability and safety of the program. To be enjoyable the participants must be free of fear, injury, and pain. Especially with older adults, physical difficulties and/or emotional apprehensions are a possibility. The program should demonstrate a slow start and gradually progress (Foreyt & Goodrick, 1991). Activities with a lot of up and down motion may need to be avoided, so not to cause unnecessary joint trauma. Choosing the correct shoe for the activity would be especially important in cases of obesity. If the instructor becomes aware of any problems, he/she must then adapt the program to the participants so that the participants experience success.

The exercise program needs to be flexible, to offer variety as well as be fun, in order to avoid boredom. Overemphasized or regimented calisthenics often lead to monotony and boredom. Offering walking indoors or outdoors, or warm water pool exercise on an "off" day may be exciting alternatives. Music can facilitate a positive environment if chosen with care from the participants' interests.

A program can also become a social event. It can be a time to be with a friend, share an experience, or make new

acquaintances. There are many different possibilities to make an exercise program enjoyable.

Behavioral Factors

The shaping and adapting of one's behaviors becomes a personal exercise goal. Older adults especially enjoy a daily routine. Exercising at the same time of day promotes consistency. This habituation may start out as just showing up and develop into parking at the far end of the parking lot to get a little extra walk, or taking the stairs instead of the elevator. If exercise becomes an automatic routine activity, it can lead to what Dr. William Glasser refers to as "positive addiction" (Pollock, Wilmore & Fox, 1978). Positive addiction is when one becomes addicted to ones' exercise routine and if an injury or illness makes it impossible to exercise, the individual experiences withdrawal-like symptoms.

The more obese the individual is, the longer it will take to achieve that "feel good" feeling. The beginner stage will last longer and the rewards must begin early and remain constant. Rewards may come in many forms, such as opportunities for new friendships, praise or a pat on the back from instructors or aides, certificates for small achievements, or T-shirts for attendance. These rewards need to be based on accomplishments and need not be too costly.

Assessment can provide motivation and positive feedback in many ways. Assessment of testing and progress charts, as well as the measurements of miles walked, weight loss, reduced pulse, and reduced blood pressure are all positive motivators and good ways to reinforce health-related behaviors.

Hypothesis

The hypothesis for this study is as follows: A ten-week walking program consisting of forty-five minutes, three times a week, at 60%-70% maximum heart rate will change the level of physical fitness, as measured by flexibility (sit & reach test), body composition (body weight, circumference measures, bioelectrical impedance), and cardiovascular fitness (post-50 walk, post-50 step tests) as related to function (timed get-up & go test) for obese (greater than or equal to 30% body fat) white women aged fifty and over in Holland, Mi.

CHAPTER THREE

METHODOLOGY

Study Site and Subjects

Participants were selected from a convenience sample of members of Evergreen Commons, Freedom Village, and The Warm Friend located in Holland, Michigan. These facilities all had contact with this researcher's target population.

Evergreen Commons is a private non-profit, multi-purpose senior center, offering programs and services which promote independence, dignity, and improved quality of life to its 5,000 members. Evergreen opened ten years ago and is continually expanding senior services, adult day care center, and leisure enrichment classes to meet the needs of the community.

Freedom Village, located on the Macatawa River in downtown Holland, is a life care retirement community hosting 485 independent seniors. It is owned by the Freedom Group operating for seven years with seven facilities in Florida, Arizona, as well as Holland. Available on site is an extended care facility, the Inn of Freedom Village, providing assisted and skilled care for up to 65 residents. Freedom Village promotes independent lifestyles of its residents with a holistic approach to maintaining health. An extensive wellness program including blood pressure

checks, a wide variety of exercise classes held in the gym and pool, support groups for chronic ailments, as well as workshops and programs addressing the latest health issues provide opportunities for health enhancement on a daily basis.

The Warm Friend, owned by Resthaven Patrons, Incorporated, is the renovated Warm Friend Tavern and Hotel in downtown Holland. Offering 97 housing units with options varying from single units to fully equipped apartments with a full choice of meal plans. Nursing, housekeeping, and daily activities are available as well as a supportive care unit to meet the needs for a variety of independence levels.

Study Design and Sequence

Participants were recruited from the three facilities by newsletter, posters, community service announcements via local radio, and word of mouth. Those interested in the program reported for screening and pre-testing at Freedom Village. The testing was offered on three days to provide a maximum opportunity for participation.

Participants were offered the option of walking independently, or walking as a group at Freedom Village. Both options kept a walking log. Walking logs were turned in weekly when informational handouts on posture, shoes, etc., were distributed. Participants were encouraged to turn in the walking logs through drawings from the logs,

that were held at the five and ten week intervals, for donated prizes of a pedometer and a walkman radio. Walking compliance was determined from these logs.

The group met three times a week - Monday, Wednesday, and Friday mornings from 8 - 8:45am. This walking club continued for ten weeks through June, July, and August.

Instrumentation and Procedure

Pre and post measures for flexibility, body composition, and cardiovascular fitness were taken by several fitness measures and correlated to function by the "Timed Get-up and Go" test. The fitness tests described were chosen for a variety of reasons, as follows: Because of time constraints, the tests were quick with relatively simple instructions and involved very little practice time. The tests were all adaptable and possible for an older population that were identified as obese and with diverse physical capabilities. The tests and measures are as follows:

Changes in obesity were measured by body weight, circumference measures, waist to hip ratio, body mass index, and bioelectrical impedance.

Four anthropometric sites measured include: neck girth, taken just below the Adam's apple; left upper arm girth, taken at the midpoint of the upper arm; waist girth, at the level of the umbilicus; and hip girth, at the widest point.

To find the waist to hip ratio (WHR) the waist measure was divided by the hip measure. A healthy female should have a WHR less than .80. Studies show that females with greater than 1.0 ratio tend to have excessive fat around the waist. This ratio is important because of the connection to conditions such as diabetes mellitus, high cholesterol, high blood pressure and heart disease (Payne & Hahn, 1992).

Body mass index (BMI) expresses the relationship of body weight to height and is widely used in determining obesity. The formula for determining BMI is to divide the weight in kilograms by the height in meters, squared. A BMI greater than 27.3 for females reflects obesity (Payne & Hahn, 1992).

Body composition was measured using model BIA 103 from RJL Systems, which uses bioelectrical impedance. Bioelectrical impedance measures the length of time it takes for an electrical impulse to travel from one site on the body to another site on the body. Two sets of surface electrodes were placed on the same side of the body, at hand-wrist and ankle-foot sites. Therefore, the participant needed no preparation other than removing one sock and shoe, and lying down on a table. Because fat tissue resists the passage of electrical current much more than muscle tissue, the impulse takes less time to travel through muscle tissue than fat. With the aid of a computer program, this

information was translated into percent lean and fat composition.

Flexibility was measured by procedures adapted from Hoeger (1990) in a modified sit and reach test (see appendix A).

Both the "Post-50 Walk Test" and the "Post-50 Step Test" were administered as a measure of cardiovascular function. Cardiovascular function will be used to compare participants with those in other studies. Counseling by this researcher helped participants in deciding to complete either or both tests each time. These decisions were based on the participant's willingness, physical limitations, abilities, and personal comfort level. The walk and step tests (see appendix A) were administered as described by Adams (1990).

Change in flexibility, body composition and cardiovascular fitness and how they relate to function were measured by the "Timed Get-up and Go Test" (see appendix A) by Podsiadlo & Richardson (1991).

Program participants were made aware of the use of their data in the development of this thesis through an Informed Consent Form. Before any testing occurred, participants were asked to read and sign both the Informed Consent and a Physical Activity Readiness Questionnaire (see appendix B) used by Grand Valley State University (GVSU).

Data Collection Procedure

Those who expressed an interest in the walking program were contacted by this researcher to examine the feasibility of their participation. Subjects were given the choice of three dates for screening and pre-testing to allow maximum participation. The testing then took place in the fourth floor gymnasium of Freedom Village.

The gymnasium was set up with eight stations. Station One was the welcome table where subjects were instructed and then asked to sign the consent forms found in Appendix A. Here they also picked a randomly numbered envelope containing a data card to insure confidentiality. They then proceeded in any order to any of the remaining seven stations.

The stations consisted of: height and weight, blood pressure, circumference measures, bioelectrical impedance, sit and reach testing, step testing, and timed get-up and go testing. The testing was interrupted midway to conduct the walk test, allowing those who finished with all stations quickly, to leave early. Appropriately selected personnel were recruited and schooled in the performance of each station: A retired nurse took blood pressures, and this researcher conducted the bioelectrical impedance and the walk test. Post testing was conducted in the same manner with the same personnel at each station.

Statistical analysis of the study was done with descriptive statistics to present the results. Matched pair t-tests were used to test for the difference between pre- and post-test measures. Two sample t-tests were used to look for differences between the walking and control groups.

CHAPTER FOUR

RESULTS

Introduction

Obese white women, aged 50 and over, from Holland, Michigan participated in the walking group to improve levels of physical fitness. The walking group began with a convenience sample of 51 participants, 32 of whom fit all study criteria. Ten subjects dropped out for personal or health reasons, the remaining 22 completed the program. These 22 subjects had participation levels exceeding 90% compliance. Compliance was determined from the participants' self-report walking logs, using the number of days walked divided by the total number of days. This number was then multiplied by 100 to determine participation level. This study focused on the results of these 22 participants. The fitness variables used as outcomes can be found in Appendix C. A summary of the descriptive statistics for the variables of interest in the analysis follows in Table 1.

Descriptive Statistics

Age and Height

The mean age of the group was 76 years (+/- 7.95). The youngest was 60 years of age and oldest 90 years old. The

Table 1

Summary Statistics

Variable	N	Min.	Mean	Max.	Std.Dev.	Skew.	Kurt.	Msg.
PreFat Percentage	22	33.80	40.668	51.20	4.601	0.702	-0.146	0
PreLean Percentage	22	70.20	83.855	129.70	12.463	2.469	8.476	0
PreWeight (kg)	22	52.62	65.142	120.70	14.456	2.897	10.527	0
PreWaist/Hip	21	0.98	1.043	1.20	0.058	1.597	2.353	1
PreBlood Pressure	22	108.00	139.540	184.00	18.433	0.643	0.424	0
PreFlexibility	22	3.25	10.385	16.25	3.952	-0.239	-0.992	0
PreBMI	22	19.69	25.659	38.61	4.087	1.552	4.027	0
CNGWalk	16	-86.0	-14.310	39.00	33.220	-0.757	0.908	6
CNGBP	20	-34.0	-2.900	26.00	14.630	-0.159	0.497	2
CNGFat Percentage	21	-12.5	-2.390	2.80	3.307	-1.878	4.219	1
CNGLeanPercentage	21	-2.50	3.238	30.30	7.588	2.966	8.909	1
CNGWeight (kg)	21	-3.18	-0.950	1.13	1.362	-0.494	-0.702	1
CNGBMI	21	-0.49	0.359	1.46	0.530	0.477	-0.372	1
CNGStep	17	-9.0	11.882	43.00	14.504	0.453	-0.151	5
CNGGetup & Go	19	-1.87	-0.159	1.32	0.999	-0.135	-1.207	3
CNGWaist/Hip	21	-0.17	-0.026	0.04	0.049	-1.462	2.666	1
CNG Flexibility	19	-3.85	-0.004	7.35	2.903	1.331	1.599	3

**NOTE: CNG denotes the change in the pre and post measurements.

mean height of the group was 1.59 meters (+/- 0.08).

Body Composition

The mean pre weight was 65.14 kilograms (+/- 14.46). The mean post weight was 64.49 kilograms (+/- 14.62). The mean pre percent body fat was 40.67% (+/- 4.60). Post mean body fat was 38.08 % (+/- 4.21). The mean pre lean percentage was 83.86% (+/- 12.46). Post lean percentage has a mean of 86.70 % (+/- 18.69). The mean pre WHR was 1.04 (+/- 0.06) and the post mean WHR was 1.02 (+/- 0.03). The mean pre BMI was 25.66 kg/m2 (+/- 4.09). Post mean BMI was 25.35 kg/m2 (+/- 4.23).

Systolic Blood Pressure

The mean pre systolic blood pressure was 139.55 mmHg (+/-18.43). Post mean systolic blood pressure was 136.60 mmHg (+/- 15.95).

Sit-and-Reach Test

The mean pre sit and reach score used to assess flexibility was 10.39 (+/- 3.95) which was average according to Table 2. The mean post flexibility score was 10.20 inches (+/- 3.15) which remained average according to table 2. Fitness categories for the Modified Sit-and-Reach Test for age categories of 50+ year old subjects described by Hoeger (1988), are contained in Table 2. This was a standardized classification used for this age group.

Table 2

Percentile Ranks for the Modified Sit-and-Reach Test
Hoeger (1988)

PERCENTILE RANK	REACH IN INCHES	FITNESS CATEGORY
99	17.2	
95	15.7	
90	15.0	EXCELLENT
80	14.2	
70	13.6	
60	12.3	GOOD
50	11.1	
40	10.1	AVERAGE
30	9.2	
20	8.3	FAIR
10	7.5	
5	3.7	POOR
1	1.5	

Cardiovascular Fitness

Step Test

The mean score of the pre step test was 62.55 steps (+/- 15.63). The mean score of the post step test was 75.12 steps (+/-13.95). Aerobic fitness levels for the "Post-50 Step Test" as described by Adams (1990), are contained in Table 3. This was a standardized test used by this age group.

Table 3
Step Test Aerobic Fitness Category
Adams (1990)

	# of Steps in 2 Minutes			
AGE				
50-64	0-60	61-75	76-96	>96
65-74	0-55	56-68	69-90	>91
75-84	0-33	34-57	58-79	>80
85+	0-31	32-53	54-66	>67
FITNESS:	Low	Fair	Good	High

Walk Test

The mean pre walk time was 298.95 seconds (+/- 37.65), which was good according to Table 4. The mean post walk time was 278.81 seconds (+/- 37.48). Aerobic fitness levels for the "Post-50 Walk Test" as described by Adams (1990), are contained in Table 4. This was a standardized test for this age group.

Table 4
Estimating Aerobic Fitness Level from the Time for 400m Walk
Adams (1990)

AGE				
50-64	>5:06	5:05-4:15	4:14-3:56	<3:55
65-74	>5:43	5:42-4:37	4:36-4:17	<4:16
75-84	>7:01	7:00-5:30	5:29-4:57	<4:56
84+	>8:51	8:50-6:20	6:19-5:10	<5:09
FITNESS:	Low	Fair	Good	High

Get-up and Go Test

Mobility was measured by the Get-up and Go test. The pre mean score was 7.38 seconds (+/- 1.46). The post mean score was 7.21 seconds (+/- 1.72). The results of the Get-up and Go Test should be less than ten seconds according to Podsiadlo & Richardson (1991). A score of less than ten seconds indicates the individual is independent in ambulation, without the use of an assistive device. Note that all participants except two different individuals, one individual pre and one individual post, were well below the ten seconds.

Inferential Statistics

This study focused on the effects of a walking program on fitness levels of participants. A difference in physical fitness variables before and after program completion was the statistical question of most interest. The variables of weight, percent fat, percent lean, WHR, BMI, systolic blood pressure, and results of sit-and-reach, step, walk, and get-up and go testing were calculated to measure the differences between the values. Histograms and Kolmograv-Smirnov tests were conducted to determine normality of the variable distributions. The results indicated all distributions were consistant with the normal distribution. Matched pair t-tests were then run on each variable to determine if physical fitness levels were significantly different following the completion of the walking program. The null

hypothesis was as follows: No difference exists between the mean levels of physical fitness before and after the program ($m1 = m2$). The alternate hypothesis is: There is a difference between the two means ($m1 \neq m2$). Table 5 shows the results of the t-tests for the variables of interest.

Table 5
t-test for Differences in Pre and Post Variables

Variable	N	95%Confidence Interval-lower	95%Confidence Interval-upper	t-value	df	p-value
CNGWT	21	-3.462	-0.728	-3.20	20	0.005
CNGFAT	21	-3.896	-0.885	-3.31	20	0.003
CNGLEAN	21	-0.216	6.692	1.96	20	0.065
CNGWSTHIP	21	-0.048	-0.004	-2.45	20	0.024
CNGBMI	21	0.117	0.600	3.10	20	0.006
CNGBP	20	-9.748	3.948	-0.89	19	0.387
CNGFLEX	19	-1.403	1.395	-0.01	18	0.996
CNGSTEP	17	4.425	19.340	3.38	16	0.004
CNGWALK	16	-32.014	3.389	-1.72	15	0.105
CNGGETUP	19	-0.641	0.323	-0.69	18	0.497

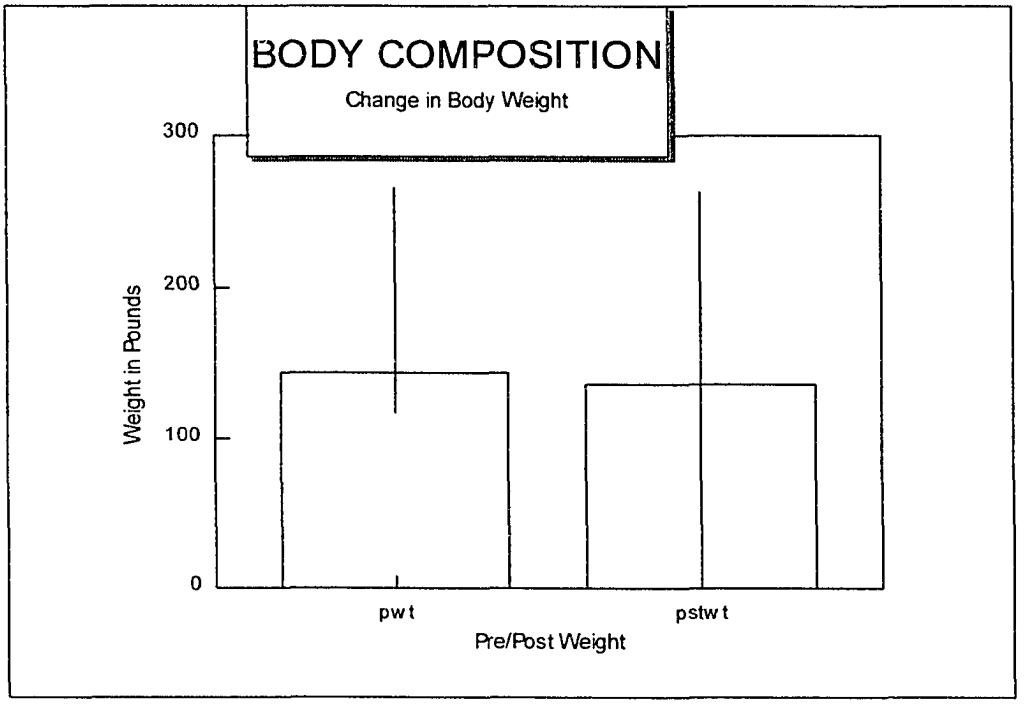
Body Composition

Body Weight

There was a significant difference in the mean weight of the women before and after the exercise program with a

mean loss of 0.65 kilograms (+/- 1.36). The p-value was 0.005, which was less than a 0.05 confidence level and leads to rejection of the null hypothesis of no difference. Therefore, the loss of an average of -2.09 kilograms was significant. As illustrated in Figure 1, the verticle lines represent range and the bars represent the mean.

Figure 1.



Bioelectrical Impedance

There was a significant difference in the mean percentage of fat body mass before and after the exercise program with a loss of 2.39% (+/-3.31). The p-value was 0.003. Thus, the mean difference in body fat percentage of

-2.39 was significantly different from zero. See Figure 2 in Appendix D.

There was no significant difference in the mean percentage of lean body mass before and after the exercise program with a gain of 3.24% (+/-7.59). The p-value was 0.065, which was greater than 0.05. Therefore, the null hypothesis was not rejected as there was no significant difference in lean body mass percentage before and after the study. See Figure 3 in appendix D.

WHR

There was a significant difference in the mean WHR before and after the exercise program with a loss of 0.03 inches (+/- 0.05). The p-value was 0.024. Therefore, the mean loss of -0.03 was significant. See Figure 4 in Appendix D.

BMI

There was a significant difference in the mean BMI before and after the exercise program with a decrease of 0.36 kg/m2 (+/- 0.53). The resulting p-value was 0.006. Since the p-value was less than 0.05, the null hypothesis was rejected. The average difference in mean BMI was 0.36, which was significant. See Figure 5 in Appendix D.

Systolic Blood Pressure

There was no significant difference in the mean systolic blood pressures before and after the exercise program with a reduction of 2.90 mmHg (+/- 14.63). The

p-value was 0.387. This large p-value (>0.05) means the null hypothesis was not rejected. See Figure 6 in Appendix D.

Sit-and-Reach Test

There was also no significant difference in the mean levels of flexibility before and after the exercise program with a decrease of 0.004 inches (+/- 2.90). The change in the mean levels of flexibility remained in the average category (see Table 2), according to Hoeger (1988). The p-value was 0.996. Therefore, the null hypothesis was not rejected. See Figure 7 in Appendix D.

Cardiovascular Fitness

Step Test

There was a significant difference in the mean results of the step test before and after the walking program (p = 0.004). The mean difference in the results of the step test before and after the exercise program was an increase in the number of steps by 11.88 (+/- 14.50), which showed significance. Therefore, the null hypothesis was rejected and it was concluded that the means are not equal. See Figure 8 in Appendix D.

The number of participants in each category according to Adams (1990) from Table 3 are described in Table 6. Improvements in the post-testing left one participant in the

low category, one was fair, 11 were good, and four were in the high category. Note not all participants completed the post step test and therefore this table focused on those who completed the post-test.

Table 6
Aerobic Fitness Category Of Participants In The Step Test
Adams (1990)

Pre-test----->Post-test = Number of Participants			
low--->low = 1			
low----------->good = 2			
fair--->fair = 1			
fair-------->good = 2			
fair---------->high = 2			
good--->good = 7			
good---------->high = 2			
Post-test Totals: 1	1	11	4
Fitness Category: LOW	FAIR	GOOD	HIGH

Walk Test

There was no significant difference in the mean results of the walk test before and after the exercise program with a decrease of 14.31 seconds (+/-33.22). The p-value was 0.105. Therefore, the null hypothesis was not rejected and that the two means are equal. See Figure 9 in Appendix D.

The number of participants in each category according to Adams (1990) from Table 4 are described in Table 7. Differences in the post-testing showed no participants in the low category, five were fair, three were good, and eight were in the high fitness category. Note not all participants completed the post walk test, and therefore this table focused on those who completed the post-test.

Table 7
Aerobic Fitness Category Of Participants In The Walk Test
Adams (1990)

Pre-test--->Post-test = Number of Participants
fair--->fair = 5
fair----------->good = 1
fair----------->high = 1
good--------->high = 2
high->high=5
2 = good <----------high

Post-Test Totals:			
0	5	3	8
Fitness Category:			
LOW	FAIR	GOOD	HIGH

Get-up and Go Test

Finally, there was no significant difference between the mean results of the Get-Up and Go test before and after the walking program with a decrease in time of 0.16 seconds

the walking program with a decrease in time of 0.16 seconds (+/- 7.38). The p-value was 0.497. Therefore, the null hypothesis was not rejected and that the two means were equal. See Figure 10 in Appendix D.

In Addition

Two sample t-tests were run on all dependent variables to determine if the pre test values had an effect on the change between the pre and post-test variables. This procedure demonstrated that percent fat, percent lean, BMI, systolic blood pressure, flexibility, and weight did not significantly influence the change between the pre and post-test variables. Appendix D gives the results of homogeneity, normality, and variance. This assumption of proximal normality was tested and appeared to be reasonable.

The last area of interest was the effect of preweight on the changes in the variables. It may have seemed possible that a person with a larger weight would experience larger changes in measures. It was found that pre-weight did not impact the effects of the walking program.

CHAPTER FIVE

DISCUSSION AND CONCLUSIONS

Discussion

The pre testing took place in June 1995, with the post testing taking place ten weeks later in August 1995. This allowed sufficient time to show significant changes in the levels of physical fitness. Table 9 includes a comparison of the pre and post group means with the established criteria from Payne & Hahn (1992), Nieman (1986), Hoeger (1988), Adams (1990), and Podsiadlo & Richardson (1991).

Table 9
Comparison Of Pre And Post Means With Established Criteria

TEST	GROUP MEAN PRE	POST	ESTABLISHED CRITERIA*
Systolic Blood Pressure	139.5	136.6	< 140
Body Mass Index (BMI)	25.7	25.4	< 27.3
% Body Fat	40.7	38.1	< 27.0
Waist to Hip Ratio (WHR)	1.04	1.02	< 0.80
Sit-and-Reach Test	10.4	10.2	> 11.1
Post-50 Walk Test	299	279	≤ 255
Post-50 Step Test	63	75	≥ 75
Get-up and Go Test	7.4	7.2	< 10.0

*Established criteria for systolic blood pressure - Payne p. 306, BMI - Payne p. 153, % fat mass - Nieman p. 375, WHR - Payne p. 152, Sit-and-Reach - Hoeger p.133, Post-50 Walk Test - Adams p. 242, Post-50 Step Test - Adams p. 243, Get-up and Go Test Podsiadlo p. 146.

The mean post scores indicate the group is within healthy limits for the established criteria for systolic blood pressure, BMI, step and get-up and go tests. The group, although obese to begin with, still needs improvement to be within healthy limits for percent body fat, WHR, flexibility, and the walk test.

Comparison with Other Studies

Body Composition

After ten weeks, the group as a whole had improved considerably with a total reduction of 3% body fat, from 41% to 38%. The weight and body fat loss were both statistically significant improvements. An improvement might illustrate that the walking group made changes in the level of physical fitness. Although 38% is still considered obese, statistics support that the average older American female is 32% body fat (Nieman, 1986). It is important to note that this is the average, and not what the established criterion is to be "healthy," which for this study was 27% body fat.

Both pre and post BMI were within the established healthy range, and also showed a significant improvement. WHR indicated that the group made significant improvements but still needs to decrease inches according to the established criterion.

This study agrees with Ohta, et al. (1990) that a walking program could be effective in the treatment of

obesity. However, this study involved walking at 60% to 70% maximum heart rate while Ohta's study involved "brisk" walking and this study did not incorporate a dietary component which was included in Ohta's study.

This study disagrees with the Hinkleman & Nieman (1993) that a moderate walking program was not enough to effect body composition in overweight females unless a reducing diet was also adapted. This study found a significant change in body weight and a significant change in body fat while Hinkleman found changes in body weight with no loss in body fat.

This study agrees with the Whatley, et al. (1994) study in that exercise at a moderate heart rate assists in the loss of both body weight and body fat. Although this study consisted of walking three times a week with no dietary component and the Whatley study supported exercise five times a week with a dietary component.

This study agrees with the Bergman & Boyungs (1991) study showing that exercise aids in reducing body fat, but disagrees with the relationship of exercise and body weight, this study showing a significant weight loss and Bergman who showed no significant change in body weight.

This study agrees with the Gwinup (1975) study who also walked more than 30 minutes a day which resulted in a loss in body fat and weight loss. However, this study did not contain a psycho-social component and Gwinup stressed that

motivation was a primary factor whether weight loss will occur.

This study agreed with the Whitehurst & Menendez (1991) study revealing significant decreases in body weight. Both studies walked three times a week, this study for ten weeks and Whitehurst for eight weeks.

This study agreed with the Cononie, et al. (1990) study showing a significant reduction in body fat. However, this study also showed a significant reduction in body weight where the Cononie study showed no change in body weight.

Systolic Blood Pressure

This group lowered their systolic blood pressure three mmHg from 140 to 137 mmHg. both of which are within the established criterion healthy range. Some of the participants were hypertensive and on blood pressure medication and therefore would not be expected to demonstrate any change.

Blood Pressure was difficult to compare to other studies. The Ohta, et al. (1990) and Hagberg (1988) studies referred only to a reduction in hypertension. The Whitehurst & Menendez (1991) and Cononie, et al. (1990) studies focused on diastolic blood pressure.

Flexibility

Although the group improved their flexibility, they remained 0.9 inches short of the acceptable range within

established criterion. According to Hoeger (1998), the group currently is in the "average" fitness level category.

For this study change in flexibility showed no significance. Flexibility was measured with the sit-and-reach test which Shephard & Berridge (1990) confirms as a reliable measure of trunk flexibility in aging populations.

Cardiovascular Endurance

Cardiovascular endurance was measured for this study by the walk test and step test. The group improved their walk time by 20 seconds, however not a significant difference, and still needs improvement of 24 seconds to meet the established criterion. According to Adams the group is in the "good" category for their age.

Although the step test appeared to be the most physically demanding test, those who participated brought the mean post test score to an acceptable level which was significant. According to Adams the group is within the "good" category for their age.

This study agreed with the Bergman & Boyungs (1991) and Jette (1988) studies that walking may improve cardiovascular fitness. This study did not show a significant difference in walk test results however, Whitehurst & Menendez (1991) revealed a significant decrease in one-mile walk time.

While the group means for this study were in an acceptable categories for blood pressure and the step test, not all participants achieved "acceptable" in these

categories. Five participants did not complete the post testing for the step test and six did not complete the walk test. Even though many of the group changes were not significant, there were individual improvements.

Function

Mobility was measured by the Get-up and Go test. The group improved their score by 0.2 second while not significant, both pre and post measures showed functional independence.

Comparison to an Unpublished Study

A study done by this author, Dallas (1992) with obese black women, aged fifty and over, showed many similarities as noted in table ten. The previous Dallas study was similar but included a dietary component. Systolic blood pressure in both studies, showed a decrease, however not significant, and was within established criteria for both pre and post-test means. In both studies, while showing a significant loss of three percent in body fat, the participants remained well above the established healthy range. The WHR in both studies showed a significant decrease, however, is still above the established healthy range. In both studies the walk test showed a non-significant decrease in walking time, but remains above the established criterion for both pre and post test means. In the step test, both studies improved twelve steps and met the established criterion.

Table 10

Comparison Of Post Means And Criteria
With Previous Dallas (1992) Study

TEST	GROUP MEAN IN STUDIES PREVIOUS	CURRENT	ESTABLISHED CRITERIA*
Systolic Blood Pressure	134.00	137.00	< 140.00
BMI	35.60	25.40	< 27.30
% Body Fat	40.00	38.00	< 27.00
WHR	0.84	1.02	< 0.80
Sit-and-Reach	8.30	10.20	> 11.10
Walk	275.00	279.00	≤ 255.00
Step	77.00	75.00	≥ 75.00

* See references from Table 9

Behavior Modification

This study did not focus on behavior modification, but perhaps, the changes in the fitness variables are due to behavior modification. The majority of this group were residents of Freedom Village, an independent living center. This living situation would seem to have an affect on behavior by itself, however this was not addressed in the review of literature or in this study. In reviewing Teague's (1987) three behavior models: the rational model, the psychodynamic model, and the social learning model, a

combination of the rational and social learning models seemed to apply the best in this study.

Teague's rational model states that behavior is guided by thought (Teague, 1987). Participants in this study seem to be a highly educated group. With 91% of the group responding to a questionnaire, 75% have had some college, or more education. They have been given information on health risks and healthy behavior. This may be why they lead active lives. With 91% responding, 80% state that they are either active or very active, and joined the walking program.

The social learning model suggests that individuals engage in self-destructive behavior because it is used as a coping mechanism and is socially rewarding (Teague, 1987). This might suggest that people have behaviors weighing exercise with food rewards, cost versus benefits. Walking as a social function, or the poor choice of food rewards could be used in balancing the costs. Others may have participated only if their spouse or group of friends also decided to join the program, as opposed to joining because of perceived value to their physical well-being. These could have been possible reasons for the changes observed in the data.

Limitations of the Study

The uniqueness of this sample of women limited the generalizability of this study. This population had a

higher social-economic status than the norm. Responding to a questionnaire, 64% reported an average of $25,000+ annual income, which is in the top 33% of the population for this geographical area according to the Statistical Abstract of 1995 (see Appendix D). They had an increased social support network by virtue of living as a unit. Many were already involved in exercise programs and lead active lives.

Statistically, the number of participants is relatively small. Internal validity may have been compromised with no known behavioral or dietary modification components.

Future Research

Future research needs to be done with a greater number of participants and a control group to be able to generalize. A psycho-social study or behavioral modification study to parallel a walking study could be beneficial to explore attitudes and outcomes towards exercise, motivation, and testing. Future studies of interest may include studies with other high risk populations, a walking study done with an underwater treadmill, a study of walking with a pet, studies using computer technology for self-testing, immediate feedback and self-motivation, and studies comparing racial or ethnic groups.

Conclusion

The ten-week walking program did change the level of physical fitness for obese, white women, age 50 and over in

some areas. There was a significant difference in weight loss, mean percentage of body fat, waist to hip ratios, BMI, and the step test. The level of physical fitness did appear to improve based on these variables.

However, the ten-week walking program did not change the level of physical fitness for the subjects in other areas. There was not a significant difference in the mean percentage of lean body mass, systolic blood pressure, flexibility, the walking test, nor in the Get-Up and Go test. The level of physical fitness as measured by these variables does not appear to be significantly different after the program was completed.

The change in the level of physical fitness was not affected by the values of the measurements before the program, except for the WHR. In other words, the mean changes were not significantly different for groups with high and low pre-test variables, except for WHR. The results of the t-test for the change in mean pre-WHR indicate there is a significant difference between the high and low groups. Finally, preweight has no impact on the change in the level of physical fitness.

As a result of this study it appears that exercise walking can lead to positive changes in the level of physical fitness of obese, white women, aged fifty and over. The positive changes that could be expected would include weight loss, decreased percentage of body fat, decreased

WHR, decreased BMI, and increased aerobic fitness according to the step test.

REFERENCES

Adams, G. M. (1990). Exercise Physiology Laboratory Manual. (pp.242-243). Dubuque, Ia.: William C. Brown.

Bergman, E. A. & Boyungs, J. C. (1991). Indoor walking program increases lean body composition in older women. Journal of the American Dietetic Association, 91 (11), 1433-1435.

Birren, J. E. & Schaie, K. W. (1990). Handbook of The Psychology of Aging. (pp.103-119, 171-182, 183-197). San Diego, Ca.: Academic Press, Inc.

Blair, S. N., Gibbons, L. W., Painter, P., Pate, R. R., Taylor, C. B. & Will, J. (1988). Resource Manual For Guidelines For Exercise Testing and Prescription. (p.335). Philadelphia, Pa.: Lea & Febiger.

Cononie, C. C., Graves, J. E., Pollock, M. L., Phillips, M. I., Summers, C. & Hagberg, J. M. (1991). Effect of exercise training on blood pressure in 70- to 79-yr-old men and women. Medicine and Science in Sports and Exercise, 23 (4), 505-511.

Dallas, M. I., (1992). [Exercise Walking for Obesity Management in Older Adult Black Women]. Unpublished Bachelor's Thesis.

Dishman, R. K., (1988). Exercise Adherence. (pp.1, 237-267). Champaign, Il.:Human Kinetics Books.

Foreyt, J. P. & Goodrick, G. K. (1991). Factors common to successful therapy for the obese patient. Medicine and Science in Sports and Exercise, 23(3), 292-297.

Franklin, B.A., Gordon, S. & Timmis, G. C. (1989). Exercise in Modern Medicine. (pp.156-165, 222). Baltimore, Md.: Williams & Wilkins.

Gwinup, G. (1975). Effect of Exercise Alone on the Weight of Obese Women. Archives of Internal Medicine, 135(5), 676-680.

Hamdorf, P. A., Withers, R. T., Penhall, R. K. & Plummer, J. L. (1993). A Follow-up Study on the Effects of Training on the Fitness and Habitual Activity Patterns of 60- to 70-Year-Old Women. Archives of Physical Medicine and Rehabilitation, 74(5), 473-477.

Hagberg, J. M. (1988). The Effect of Exercise and Training on Older Men and Women With Essential Hypertension, Academy Papers, 22, 186-193.

Hinkleman, L. L. & Nieman, D. C. (1993). The effects of a walking program on body composition and serum lipids and lipoproteins in overweight women. The Journal of Sports Medicine and Physical Fitness, 33 (1), 49-58.

Hoeger, W.K. (1988). Principles and Labs For Physical Fitness and Wellness. (pp. 131-135). Englewood, Co.: Morton Publishing.

Jette, M., Sidney, K. & Campbell, J. (1988). Effects of a Twelve-Week Walking Program On Maximal And Submaximal Work Output Indices In Sedentary Middle-Aged Men and Women. The Journal of Sport Medicine and Physical Fitness, 28(1), 59-66.

Leon, A. S., Certo, C., Comoss, P., Franklin, B. A., Froelicher, V., Haskell, W. L., Hellerstein, H. K., Marley, W. P., Pollock, M. L., Ries, A., Sivarajan, E. F. & Smith, L. K. (1990). Scientific Evidence of the Value of Cardiac Rehabilitation Services with Emphasis on Patients Following Myocardial Infarction - Section I: Exercise Conditioning Component. Journal Of Cardiopulmonary Rehabilitation, 10(3), 79-87.

Mathias, S., Nayak & Issacs. (1986). Balance in Elderly Patients: The "Get-up and Go" Test. Archives of Physical Medicine and Rehabilitation, 67(6), 387-389.

Miller, N. H., Taylor, C. B., Davidson, D. M., Hill, M. N. & Krantz, D. S. (1990). The Efficacy of Risk Factor Intervention and Psychosocial Aspects of Cardiac Rehabilitation. Journal Of Cardiopulmonary Rehabilitation, 10(6), 198-209.

Miller, W. C. (1991). Introduction: obesity, diet composition, energy expenditure, and treatment of the obese patient. Medicine and Science in Sports and Exercise, 23(3), 273-274.

Miller, W. C. (1991). Diet composition, energy intake, and nutritional status in relation to obesity in men and women. Medicine and Science in Sport and Exercise 23(3), 280-285.

Nieman, D. C. (1986). The Sports Medicine Fitness Course. (pp. 300-327, 375). Palo Alto, Ca.: Bull Publishing Co.

Ohta, T., Kawamura, T., Hatano, K., Yokoi, M., Uozumi, Z., Okamoto, N., Mizuno, Y., Iwatsuka, T. & Hashimoto, S. (1990). Effects of Exercise on Coronary Risk Factors in Obese, Middle-Aged Subjects. Japanese Circulation Journal, 54(11), 1459-1464

Payne, W. A. & Hahn, D. B. (1992). Understanding Your Health. (pp. 152-154,306). St. Louis, Mo.: Mosby-Year Book, Inc.

Podsiadlo, D. & Richardson, S. (1991). The Timed "Up & Go": A Test of Basic Functional Mobility for Frail Elderly Persons. Journal of American Geriatric Society 39, 142-148.

Pollock, M. L., Wilmore, J. & Fox, S. M. (1978). Health and Fitness Through Physical Activity. (p.247). New York: John Wiley & Sons.

Shephard, R. J. & Berridge, M. (1990). On the Generality of the "Sit-and-Reach" Test: An Analysis of Flexibility Data for an Aging Population. Research Quarterly For Exercise and Sport, 61(4), 326-330.

Skinner, J. S. (1987). Exercise Testing and Exercise Prescription for Special Cases. (pp. 69, 149, 163). Philadelphia, Pa.: Lea & Febiger.

Storlie, J. & Jordan, H. A. (1984). Evaluation and Treatment of Obesity. (pp.1-17, 35, 113-121, 132). New York: Spectrum Publications.

Teague, M. L. (1987). Health Promotion: Achieving High-Level Wellness in the Later Years. (pp. 86, 162-165). Indianapolis, In.: Benchmark Press.

Turner, J. S. & Helms, D. B. (1989). Contemporary Adulthood. (pp.379-381). Orlando, Fl.: Holt, Rinehart and Winston, Inc.

Ward, M. (1996). [The Effects of Exercise on Obese, White Women Over 50, a statistical report]. Unpublished Report.

Whatley, J. E., Gillespie, W. J., Honig, J., Walsh, M. J., Blackburn, A. L. & Blackburn, G. L. (1994). Does the amount of endurance exercise in combination with weight training and a very-low-energy diet affect resting metabolic rate and body composition? American Journal of Clinical Nutrition, 59(5), 1088-1092.

Whitehurst, M. & Menendez, E. (1991). Endurance Training in Older Women. The Physician and Sportsmedicine, 19(2), 95-103.

Williams, M. H. (1985). Lifetime Physical Fitness (p. 284). Dubuque, Iowa: Wm. C. Brown Publishers.

APPENDIX A

MODIFIED SIT-AND-REACH TEST

ADAPTED FROM HOEGER (1988) P.133

1. A yardstick is placed on top of a box approximately twelve inches high.

2. The participants are properly warmed up prior to the first trial.

3. Participants, removing their shoes, sit on a table with their backs and heads against a wall, legs fully extended and feet flat against the box.

4. The subjects place their hands one on top of the other and reach forward as far as possible without letting the head and back come off the wall. The technician places the yardstick along the top of the box until the end of the indicator touches the participant's fingers. The indicator is then held firmly in place throughout the rest of the test.

5. The participant's head and back can now come off the wall. The subject then gradually reaches forward three times, the third time stretching forward as far as possible on the yardstick, and holding the final position for at least two seconds. Being sure during the test the back of the knees are kept flat against the table. The final number of inches reached, to the nearest one-half inch, is recorded.

6. The subject is allowed two trials and an average of the two scores is used as the final test score.

THE POST-50 WALK TEST (ADAMS, 1990, P.242)

1. A 400 meter distance was established on the indoor track at Freedom Village, Holland, MI.
2. Timing started the walk on the first movement.
3. Walking proceeded at a pace within each individual's comfort zone.
4. Time to cover the 400 meter distance was recorded in minutes and seconds.

THE POST-50 STEP TEST (ADAMS, 1990, P.243)

1. The starting position was a standing position with or without a hand support such as the back of a chair or another person.
2. The time began as soon as the subject lifted their right foot.
3. Each step raised the knee parallel to hip level; (as close to 90 degrees as possible) touching a yardstick held at that height by two helpers.
4. The stepping intensity was kept within the individual's personal comfort zone.
5. The number of left-foot contacts was counted within a two minute period.

THE TIMED GET UP AND GO TEST (Podsiadlo & Richardson, 1991)
*(Adapted from Mathias, et al., 1986)

1. A standard arm chair (approximate seat height of 46 cm.) is placed with a distance of 3 meters marked off.

2. The participant is seated with his back against the chair, arms resting on the chair arms, and instructed to begin on the command "GO".

3. The participant stands up, walks the 3 meters, turns, walks back to the chair, and sits down again.

4. Timing begins with the "go" command, and ends with sitting back down and is recorded in seconds.

APPENDIX B

INFORMED CONSENT

The following two tests (both have a pre- and post-test) will be performed;

EXPLANATION OF THE POST-50 WALK TEST:

1. This is a 400 meter distance walk on a level terrain.
2. Proceed walking at a pace within your personal comfort zone.
3. Record the time in minutes to cover the 400 meter distance.

EXPLANATION OF THE POST-50 STEP TEST:

1. The starting position is a standing position with or without a hand support such as the back of a chair or another person.
2. Each step should raise the knee parallel to hip level.
3. The stepping intensity should be within a personal comfort zone.
4. Record the number of left-foot contacts counted within a two minute period.

RISKS AND DISCOMFORTS:
It is possible to have any of the following occur during the tests; muscle soreness, leg cramps, shortness of breath, dizziness or feeling faint, numbness or coldness of the fingers, overheating, abnormal blood pressure, overexertion and in rare instances, heart attack, stroke, or death. Every effort will be made to minimize these risks by evaluating the participants health and fitness and by observations during testing.

BENEFITS TO BE EXPECTED:
The aerobic fitness level of the participant will be determined and given to each individual for use in prescribing appropriate exercise.

INQUIRES:
The participant understands that they may ask any questions about the exercise tests or the interpretation of the tests.

FREEDOM OF CONSENT:
The participant understands their permission to perform these tests is voluntary. They are free to deny consent or discontinue a test at any point if they so desire. They understand that as a participant any information from their tests may be used for reports and research publications. They understand that their identity will not be revealed. They have read this form and they understand the test procedures that they will perform. They consent to participate in this test.

_____ Signature of Investigator

RELEASE

As a voluntary participant in the walking program I give my permission to be photographed and videotaped for future use.

_____

Signature of Investigator Date

Signatures of Participants:

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)
A SELF-ADMINISTERED QUESTIONNAIRE FOR ADULTS

PAR-Q is designed to help you help yourself. Many health benefits are associated with regular exercise, and the completion of PAR-Q is a sensible first step to take if you are planning to increase the amount of physical activity in your life.

For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them.

Common sense is your best guide in answering these few questions. Please read them carefully and check the yes/no that applies to you.

____yes ____no Has your doctor ever said you have heart trouble?
____yes ____no Do you frequently have pains in your heart and chest?
____yes ____no Do you often feel faint or have spells of severe dizziness?
____yes ____no Has a doctor ever said your blood pressure was too high?
____yes ____no Has your doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
____yes ____no Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
____yes ____no Are you over age 65 and not accustomed to vigorous exercise?

IF YOU ANSWERED:

YES TO 1 OR MORE QUESTION

If you have not recently done so, consult with your personal physician BEFORE increasing your activity and/or taking any fitness tests. Tell him what exercise questions you answered YES on PAR-Q, or show him your copy.

PROGRAMS

Seek advise from your physician as to your suitability for:
-unrestricted physical activity probably on a gradually increasing basis.
-restricted or supervised activity to meet your specific needs, at least on an initial basis.

NO TO ALL QUESTIONS

If you answered PAR-Q accurately, you have reasonable assurance of your present suitability for:
-A GRADUATED EXERCISE PROGRAM. A gradual increase in proper

promotes good fitness development while minimizing or eliminating discomfort.
-AN EXERCISE TEST. Simple tests of fitness or more complex types may be undertaken if you so desire.

POSTPONE

If you have a temporary minor illness, such as a common cold.

With this notification Freedom Village, 145 Columbia Ave., Holland, Michigan, 49423, acknowledges the following:

That Mary Dallas is preparing a thesis titled **EXERCISE WALKING FOR OBESITY MANAGEMENT IN OLDER ADULT WHITE FEMALES.**

That Mary Dallas, operating as an investigator, has the permission and cooperation of Freedom Village to collect data on members of Freedom Village for use in preparing her thesis.

That member participation is voluntary and no prior physical screening has been requested or required by Freedom Village.

That Mary Dallas may use the data collected for her thesis and it's presentation. All data will remain confidential.

_____ _____

Signature
Freedom Village
145 Columbia Ave.
Holland, MI 49423
(616) 393-8778

Date

_____ _____

Signature of Investigator
Mary Dallas
3622 Pawnee Dr. S.W.
Grandville, MI 49418
(616) 530-3207

Date

APPENDIX C

RAW DATA

PARTICIPANT NUMBER	WEIGHT (#) PRE / POST		HEIGHT (INCHES)	BODY COMPOSITION PRE / POST (% FAT)	
1	116.5	115	60.5	38.3	38.2
2	175	170	61.5	47.9	45
4	156	157.5	66	41.2	40
10	133	135	57.5	47	45.4
12	122	115	66	33.8	28
16	130	N/T	61	43.6	42
18	117	116	63	35.6	34.8
21	126	125	59	41.4	41
22	140	133	65	39.9	38.6
29	163	156	69.5	40.9	39.4
30	138	136	61	40.8	39
31	116	114.5	62.5	36.4	34
34	139.5	139	63	39.5	42.3
36	130	123	58	36	34.8
37	145	145	61.5	39.1	37.8
38	157	157	62.75	47.2	34.7
40	136	135	62	39.7	38.2
41	135	137.5	60	37.6	37
44	164	161	64.5	44.8	N/T
47	122.5	123	61	35.3	34.5
49	266	263	69.6	51.2	41.9
54	132	129	62	37.5	33.1

PARTICIPANT NUMBER	BODY COMPOSITION PRE / POST (% LEAN)		CIRCUMFERENCE (IN.) PRE / POST (WAIST/HIP)	
1	71.5	71.1	31.5/37.25	30.5/36.75
2	91.2	93.0	40/45	40.5/45.5
4	91.7	94.0	40.25/43	34.5/43
10	70.2	72.7	36/43	34.25/42
12	80.8	82.0	36.75/39	30.5/35.75
16	73.4	75.3	38.25/40	37/39.75
18	75.4	75.6	30.75/38	30.25/36
21	73.9	73.2	35.5/39.25	N/T
22	84.1	81.6	38.75/41.25	38/41
29	96.3	94.6	38.75/43.75	34.5/42.25
30	81.6	82.0	41.5/43.5	40.75/43.25
31	73.8	76.0	36/38.25	36.75/38
34	82.3	80.0	39.75/41	38/40.75
36	78	80.0	37/39.75	35/38
37	88.3	90.0	37.5/42	35.5/42
38	82.9	102.4	43.5/46.25	44/46.5
40	82	83.4	35.5/40.25	33/38
41	84.2	86.9	38.25/40	38.5/41
44	92.1	N/T	34.25/41.75	34.25/41.75
47	78.9	80.6	30.5/39.25	30.25/37.75
49	129.7	160	46.5/55	46/54.25
54	82.5	86.3	36/38.75	34.75/39

PARTICIPANT NUMBER	BLOOD PRESSURE PRE / POST		FLEXIBILITY PRE / POST INCHES	
1	132/64	N/T	11.60	N/T
2	122/58	116/60	11.00	8.25
4	172/84	138/74	6.40	8.00
10	148/90	N/T	15.10	12.65
12	126/74	136/74	5.52	6.00
16	120/74	146/66	3.25	9.25
18	156/76	146/64	9.60	10.25
21	184/102	180/110	15.00	N/T
22	142/80	130/66	8.25	6.50
29	130/72	126/74	5.00	8.25
30	130/66	148/72	10.30	7.75
31	146/66	146/60	12.80	11.25
34	108/60	114/64	3.90	11.25
36	144/72	144/76	13.00	12.00
37	136/88	124/76	15.25	14.50
38	138/86	108/70	9.00	8.75
40	150/66	140/60	15.25	14.00
41	164/80	154/70	8.00	2HIP*
44	140/82	138/84	16.25	16.50
47	118/76	126/76	9.50	5.65
49	144/82	136/76	14.00	14.50
54	120/68	136/68	10.50	8.50

PARTICIPANT NUMBER	STEP PRE/POST #STEPS	WALK PRE/POST IN MINUTES	GET-UP+GO PRE/POST IN SECONDS
1	70/NT	5:70/NT	7.59/NT
2	60/79	4:55/4:35	6.28/7.01
4	52/84	4:29/3:50	4.67/3.87
10	52/80	5:34/5:23	7.88/7.62
12	87/95	4:04/3:50	6.52/4.65
16	52/71	4:19/NT	5.53/5.64
18	37/62	6:08/5:50	7.75/8.62
21	56/NT	5:47/NT	8.88/NT
22	74/65	4:51/5:22	8.37/8.11
29	78/(HIPS)	4:53/4:45	7.32/8.26
30	72/79	4:13/4:15	8.04/7.86
31	37/NT	5:47/NT	10.54/9.17
34	65/80	6:00/4:34	8.91/10.17
36	65/75	4:11/4:25	7.55/6.23
37	80/74	4:28/4:00	6.20/5.76
38	70/77	4:55/NT	5.99/NT
40	53/96	5:40/NT	9.33/9.95
41	60/(HIPS)	4:37/5:16	6.73/8.05
44	72/63	4:38/4:23	4.74/5.42
47	79/82	5:11/3:53	7.55/6.08
49	78/80	4:48/4:45	8.32/7.00
54	27/35	5:10/5:15	7.74/7.48

HIPS = hip problems that prevented completing the test

DEMOGRAPHICS

PARTICIPANT NUMBER	AGE	INCOME	EDUCATION	ACTIVITY LEVEL
1	86	-	COMPLETE BA	ACTIVE
2	78	-	COMPLETE HS	VERY ACTIVE
4	66	25-35,000	POST BA	ACTIVE
10	82	-	SOME COLLEGE	VERY ACTIVE
12	71	25-35,000	COMPLETE BA	ACTIVE
16	90	-	SOME COLLEGE	VERY ACTIVE
18	81	-	COMPLETE HS	VERY ACTIVE
21	84	-	-	-
22	75	35+	COMPLETE HS	MILD
29	64	25-35,000	COMPLETE BA	MODERATE
30	80	25-35,000	COMPLETE HS	ACTIVE
31	80	15-25,000	POST BA	VERY ACTIVE
34	86	35+	SOME COLLEGE	VERY ACTIVE
36	76	35+	SOME COLLEGE	VERY ACTIVE
37	71	35+	POST BA	VERY ACTIVE
38	75	-	-	-
40	81	25-35,000	COMPLETE BA	VERY ACTIVE
41	79	-	SOME COLLEGE	ACTIVE
44	60	25-35,000	SOME COLLEGE	ACTIVE
47	71	UNDER 10	COMPLETE BA	ACTIVE
49	64	35+	COMPLETE BA	MILD
54	72	UNDER 10	NO HS	MODERATE

RESPONSES:

ALL SELF-REPORT:

AVERAGE AGE: 76

INCOME:	UNDER $10,000	2
	$10,000 - $15,000	-
	$15,000 - $25,000	1
	$25,000 - $35,000	6
	$35,000 - AND UP	5
EDUCATION:	NOT COMPLETED HIGH SCHOOL	1
	COMPLETED HIGH SCHOOL	4
	SOME COLLEGE	6
	COMPLETED BA	6
	POST BA	3
	COMPLETED MASTERS	-
	COMPLETED DOCTORATE	-
ACTIVITY LEVEL:	MILD	2
	MODERATE	2
	ACTIVE	7
	VERY ACTIVE	9

APPENDIX D

Excerpt from; Statistical Report on The Effects of Exercise on Obese, White Women over 50

Ward (1996)

"One can look at the effect of the exercise program on the mean differences in the fitness variables based on the values of the measurements before the program. The variables of interest were divided at their median value, and placed in low or high categories. For example, prefat precentage was divided at 39.8 (the median) into high prefat percentage (≥ 39.8) and low percentage (<39.8). Two-sample t-tests were then run on the variables to determine if the size of the values before the exercise program had an affect on the change in the variables. Table 8 gives the results of these t-tests, based on equality of variances. If the results of the F-test in the following table suggest that the variances are not equal (Ho: m1= m2 v/s Ha: m1 $\neq$ m2), the results of the t-test for the mean difference between the groups have been reported using the t-test results for unequal variances. Those variables with unequal variances were also analyzed for normality. If the assumption of homogeneity or equality of variance has been violated and the assumption of normality is also violated, one should use a nonparametric test to determine the effect of preweight on the results. One can assess normality by looking at a histogram and computing the Kolmogrov-Smirnov test for normality. If the Kolmograv-Smirnov test shows the pretest

variables are consistent with a normal distribution, the t-test for unqual variances is reported. If the distributions were not normal, the Wilcoxon Rank Sum test should be used. However, the table indicates all distributions were consistent with the normal distribution and therefore, only the assumption of equal variances has been violated.

The F-test suggests that the high and low groups of prefat percentage have equal variances (F=2.643, p=0.12). The results of the t-test indicate that the change in mean body fat percentage of the sample is not significantly different for the low and high groups (t=-1.38, p=0.185).

The F-test suggests that the high and low groups of both prelean percentage and pre WHR do not have equal variances (F=10.511, p=0.004; F=5.640, p=0.028 respectfully). Histograms of both variables indicate that the outlier may be effecting the results. Since the assumption of equality of variances has been violated, one should check for normality using the Kolmogrov-Smirnov test. The results of this test show both prelean percentage and pre WHR are cconsistent with a normal distribution (p=0.255, p=0.286 respectively). Therefore, one can use the unequal variances t-test for equality of means. The results of the t-test indicate that the change in mean lean percentage of the sample is not significantly different for the low and high groups (t=1.30, p=0.225). However, the results of the

t-test for the change in mean pre WHR indicate there is a significant difference between the low and high groups (t=-3.87, p=0.002).

The F-test suggests that the high and low groups of pre BMI have equal variances (F=0.195, p=0.663). The results of the t-test indicate that the change in mean BMI for the sample is not significantly different for the low and high groups (t=-0.98, p=0.341).

The F-test suggests that the high and low groups of preblood pressure have equal variances (F=3.265, p=0.088). The results of the t-test indicate that the change in mean blood pressure for the sample is not significantly different for the low and high groups (t=-2.01, p=0.060).

The F-test suggests that the high and low groups of preflexibility do not have equal variances (F=6.762, p=0.019). Since the assumption of equality of variances has been violated, one should check for normality using the Kolmogrov-Smirnov test. The results of this test show preflexibility is consistent with a mormal distribution (p=0.9662). Therefore, one should use the t-test for unequal variances for equality of means. The results of the t-test indicate that the change in mean preflexibility for the sample is not significantyly different for the low and high groups (t=-1.94, p=0.079).

Finally, the high and low groups of preweight have equal variances (F=0.007, p=0.934). The results of the t-

test indicate that the change in mean weight for the sample is not significantly different for the low and high groups (t=-0.57, p=0.579)." (Ward, 1996, p. 6-8).

Table 8
High t-Tests For The Difference In Means Based On Low & High Variables
Ward (1996)

				HOMOGENEITY OF VARIANCE		TEST FOR NORMALITY		COMPARISON OF MEANS		
Variable	N	Mean	StdDev	F-Value	P value	K-S Z value	2tail p-value	t-value	df	Sig.
CNGFAT%										
PreFat≥39.8	10	-3.14	4.066	2.643	0.12			-1.38	19	0.185
PreFat <39.8	11	-1.46	2.238							
CNGLEAN%										
PreLean≥82.1	10	5.56	10.733	10.511	.004	1.0141	0.255	1.30	9.17	.225
PreLean <82.1	11	1.127	1.089							
CNGWHR										
PreWHR≥1.03	10	-0.059	0.05	5.640	0.028	0.9854	0.286	-3.87	13.5	.002
PreWHR <1.03	11	0.004	0.02							
CNG BMI										
PreBMI≥25.027	11	0.2508	0.585	0.195	0.663			-0.98	19	.341
PreBMI <25.027	10	0.4774	0.463							
CNG BP										
PreBP≥139	10	-9.000	9.854	3.265	0.088			-2.01	18	.060
PreBP <139	10	3.200	16.498							
CNGFLEX										
PreFlex≥10.4	9	-1.222	1.116	6.762	0.019	0.4964	0.9662	-1.94	10.8	.079
PreFlex <10.4	10	1.093	3.595						9	
CNGWT										
PreWt≥61.462	11	-2.4545	2.8680	.007	0.934			-0.57	19	.579
PreWt <61.462	10	-1.700	3.251							

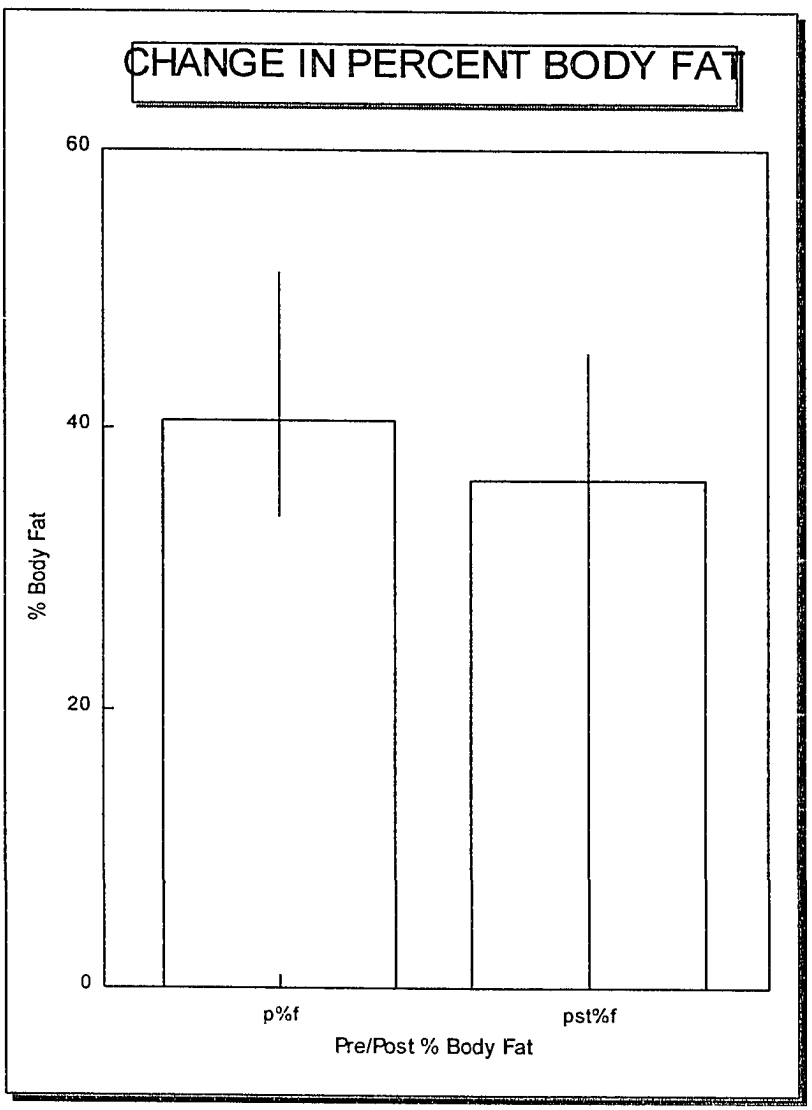
STATISTICAL ABSTRACT OF THE UNITED STATES

1995

under $5,000	5.0%
$5,000 - 10,000	21.0%
10,000 - 15,000	17.4%
15,000 - 25,000	22.5%
25,000 - 35,000	13.6%
35,000 - 50,000	9.9%
50,000 - 75,000	5.7%
75,000 +	4.4%

FIGURE 2.

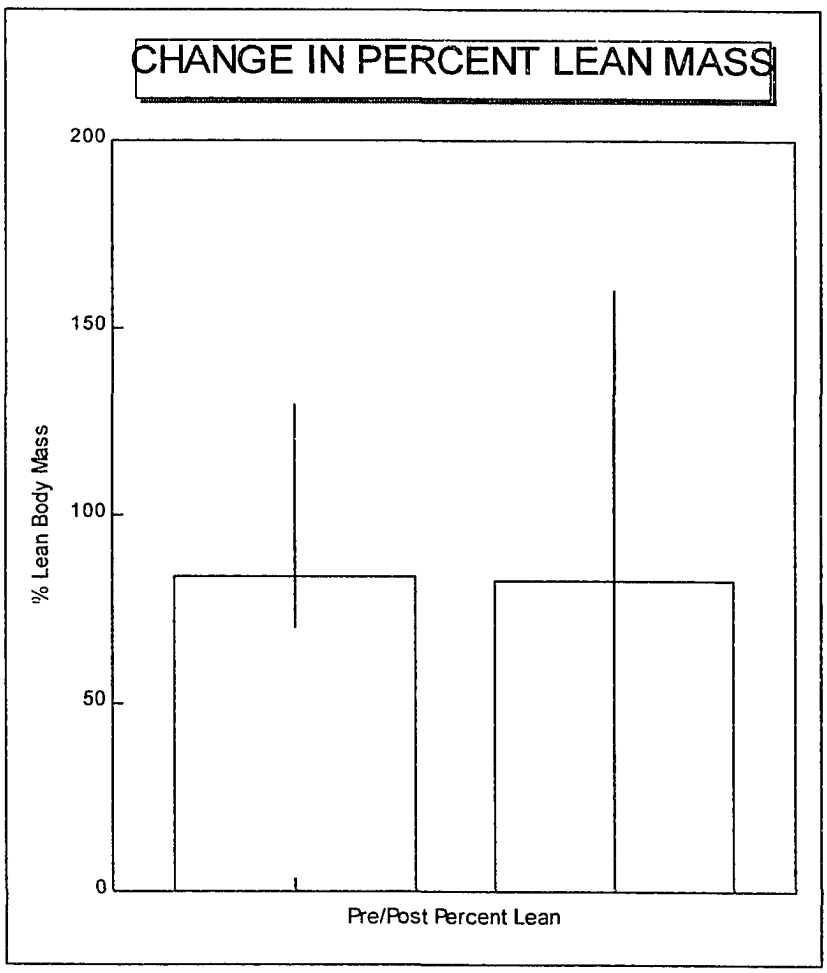
CHANGE IN BODY COMPOSITION



*verticle lines represent range
bars represent the mean

FIGURE 3.

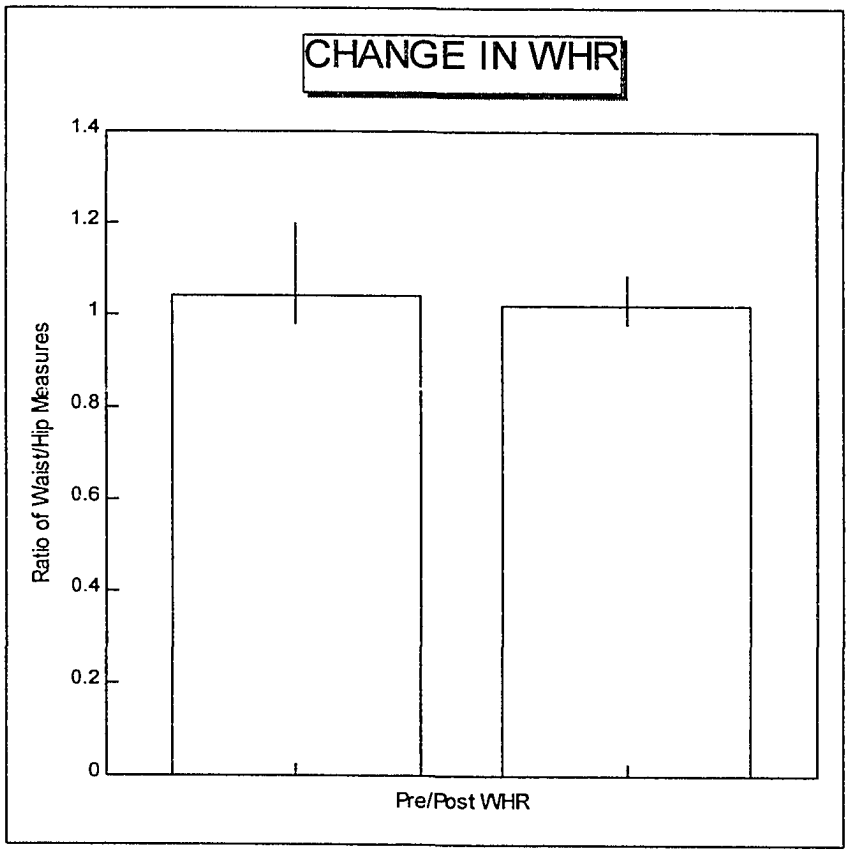
CHANGE IN BODY COMPOSITION



*verticle lines represent the range
bars represent the mean

FIGURE 4.

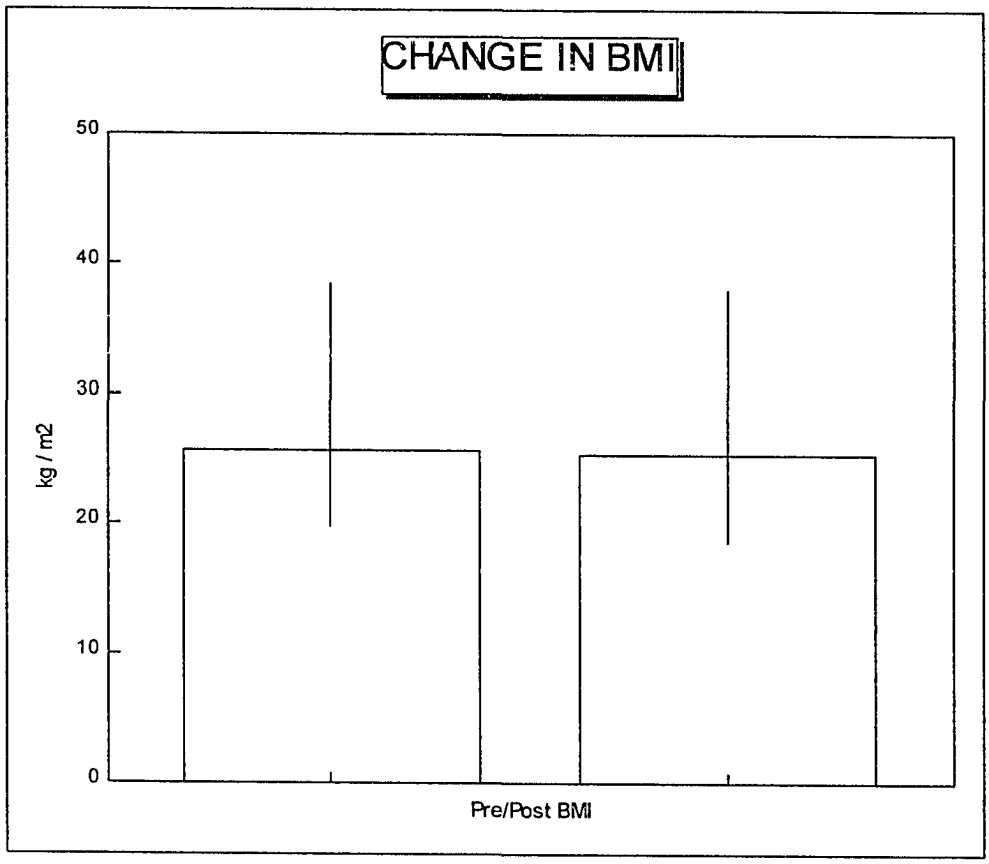
CHANGE IN BODY COMPOSITION



*verticle lines represent the range
bars represent the mean

FIGURE 5.

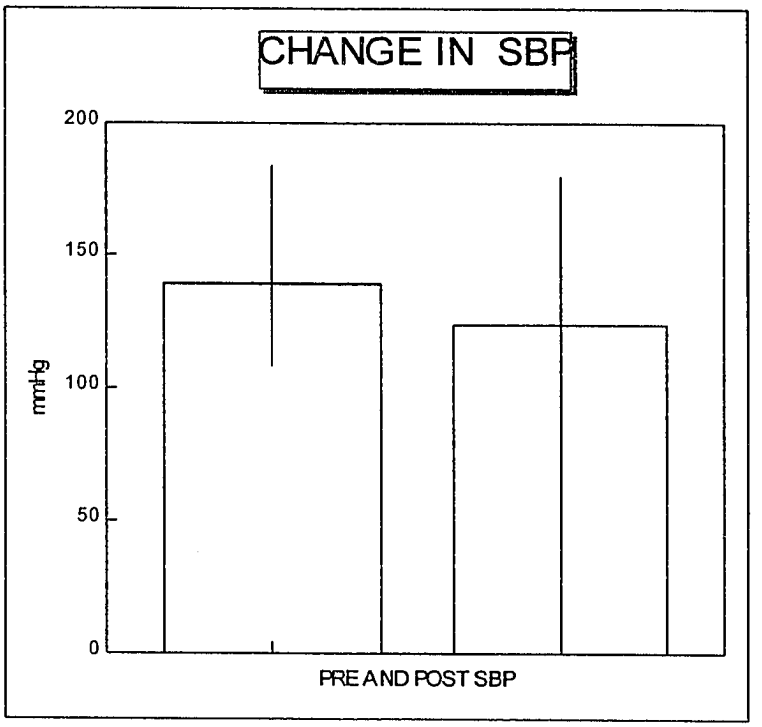
CHANGE IN BODY COMPOSITION



*verticle lines represent the range
bars represent the mean

FIGURE 6.

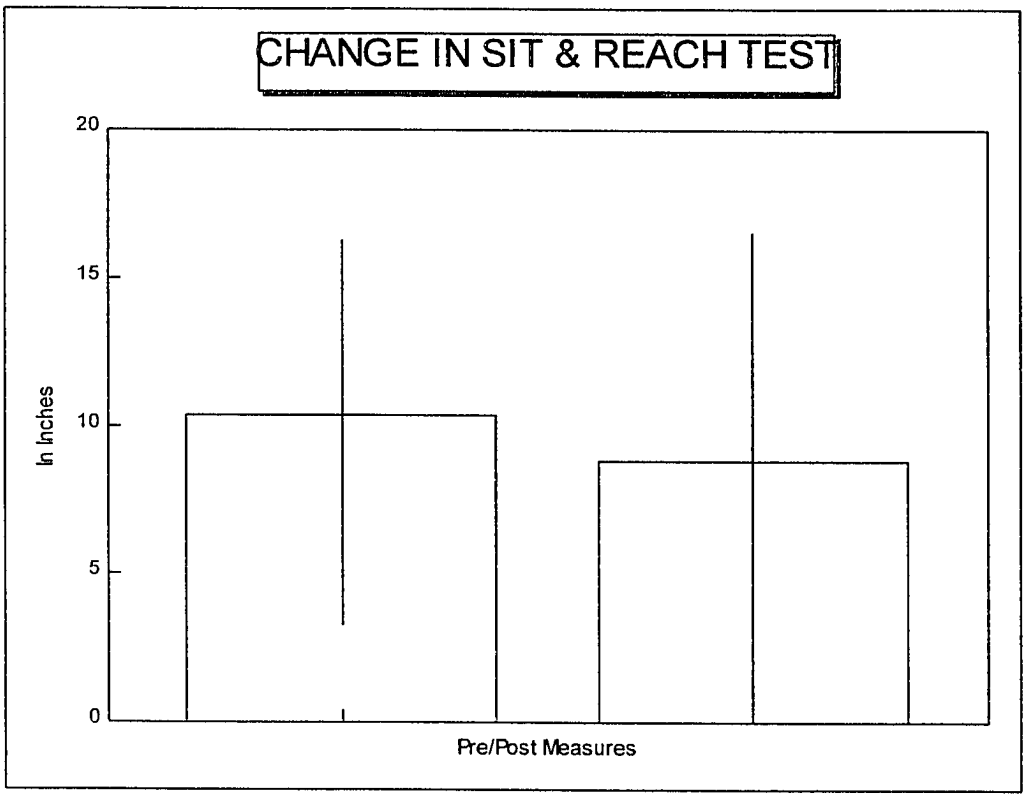
CHANGE IN SBP



*verticle lines represent the range
bars represent the mean

FIGURE 7.

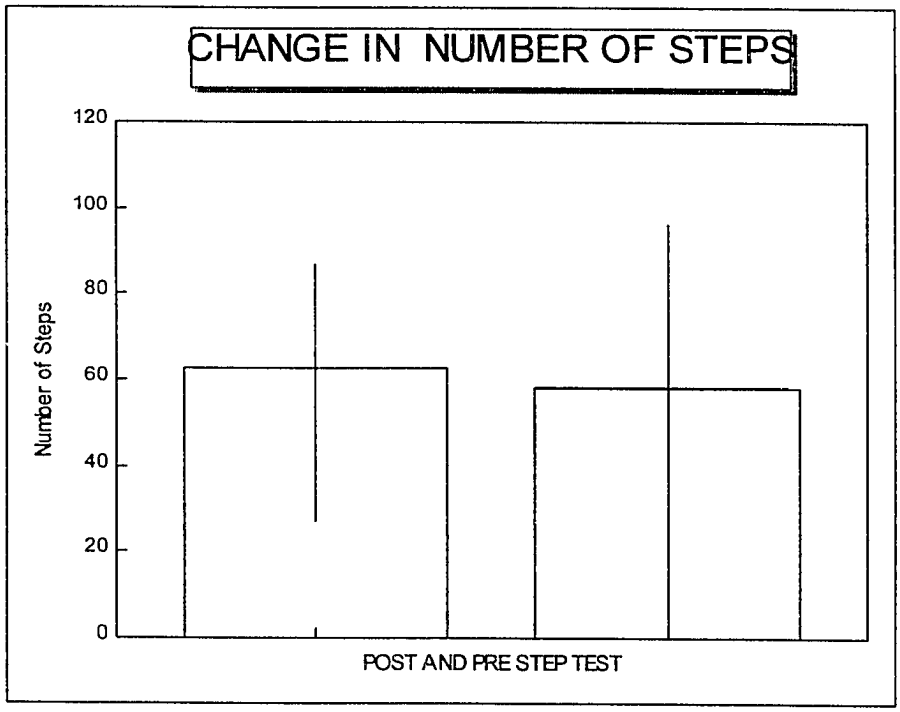
CHANGE IN FLEXIBILITY



*verticle lines represent the range
bars represent the mean

FIGURE 8.

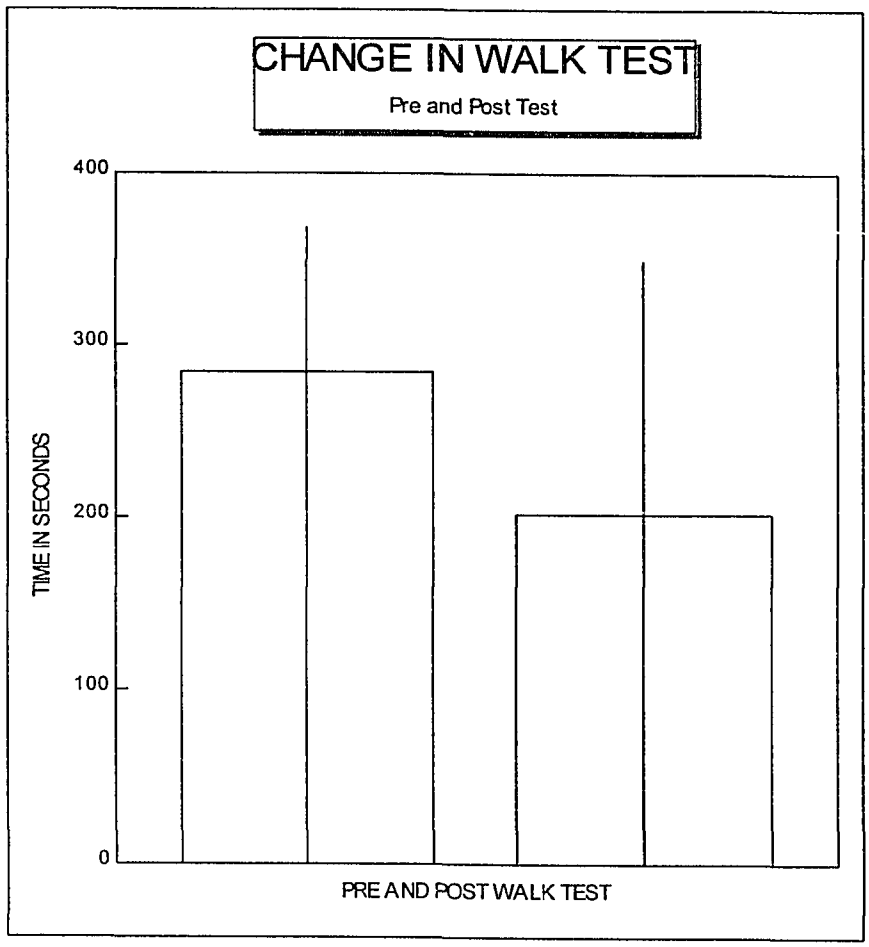
CHANGE IN CARDIORESPIRATORY FITNESS



*verticle lines represent the range
bars represent the mean

FIGURE 9.

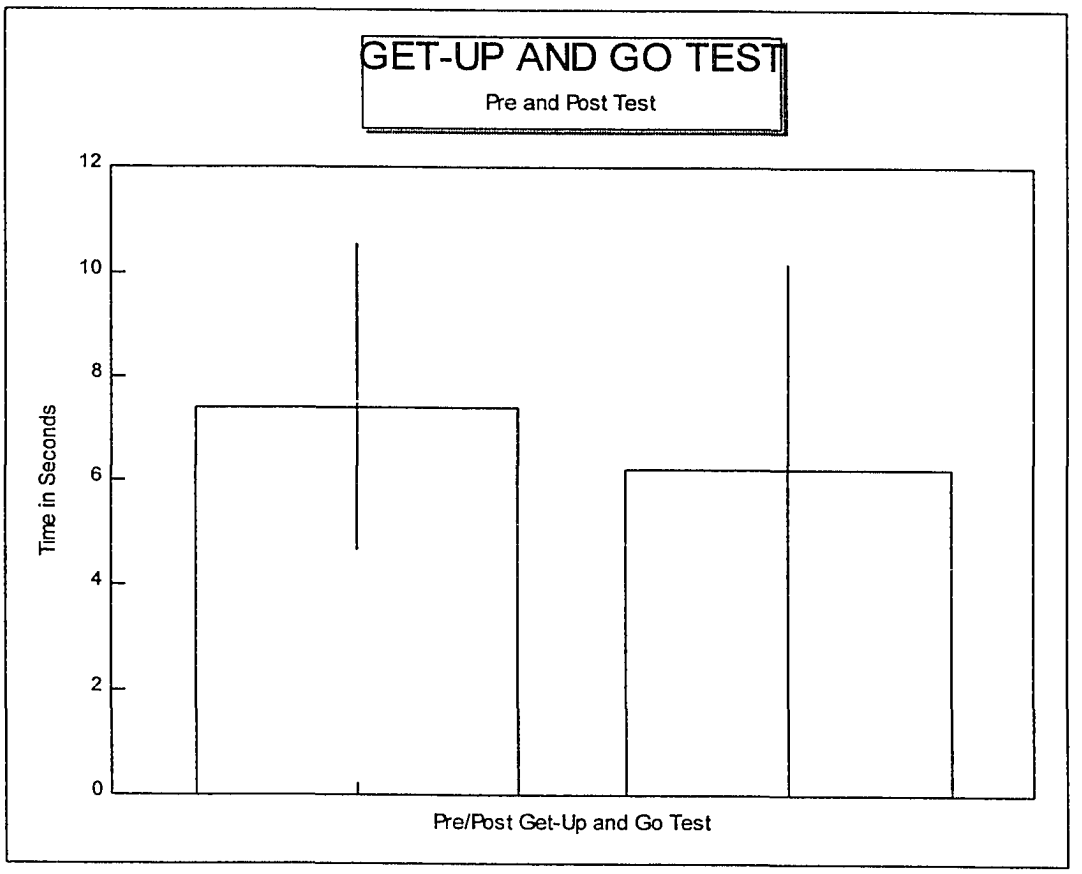
CHANGE IN CARDIORESPIRATORY FITNESS



*verticle lines represent the range
bars represent the mean

FIGURE 10.

CHANGE IN FUNCTION



*verticle lines represent the range
bars represent the mean