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Comparative effects of exercise reduction and relaxation training on Type A behavior and dysphoric mood states in habitual aerobic exercisers

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COMPARATIVE EFFECTS OF EXERCISE REDUCTION AND RELAXATION TRAINING ON TYPE A BEHAVIOR AND DYSPHORIC MOOD STATES IN HABITUAL AEROBIC EXERCISERS

by

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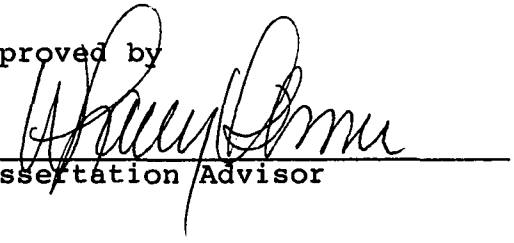

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This study investigated the comparative effects among habitual (chronic) aerobic exercisers of aerobic exercise reduction to comply with American College of Sports Medicine (ACSM) guidelines and relaxation training on four psychological variables: Type A behavior pattern (TABP), anxiety, depression and hostility. Fifty-seven adult male and female subjects who had averaged at least 6 weekly hours of aerobic exercise for a period of at least one year were interviewed and pretested for Type A behavior using the Jenkins Activity Survey and for anxiety, depression and hostility using the Profile of Mood States. After matching for amount of exercise, gender and age, subjects were randomly assigned to either a control group, an exercise reduction group (5 hours per week or less) or a 5-session relaxation-instruction group. Using pretest scores as covariates, a multivariate analysis of covariance (MANCOVA) procedure was used to test for mean group post-test differences 10 weeks later. No statistically significant differences were found. Reducing exercise to comply with ACSM recommendations for frequency, intensity and duration of exercise had neither positive nor negative effects in terms of TABP or dysphoric mood states. Nor did 5 sessions of instruction in application of relaxation techniques have a statistically significant effect on these variables.

However, one-third of the exercise reduction group decreased hostility scores and 40 percent increased Type A scores by .5 standard deviation or more. Implications for health and counseling professionals are discussed.

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CHAPTER 1

Introduction

The benefits of regular aerobic exercise are well documented (Hughes, 1984; Stern & Cleary, 1981; Taylor, Sallis, & Needle, 1985; Troxler & Schwertner, 1985). Regular, systematic aerobic exercise has been shown to increase muscle mass, lower percentage of body fat, lower resting heart rate, increase maximal oxygen uptake and improve endurance (Lamb, 1984). Aerobically trained individuals have lower heart rates during equivalent work loads, greater stroke volume, faster return to basal heart rate after exercise, less accumulation and faster elimination of lactic acid from the bloodstream, lower norepinephrine and cortisol levels in response to increased workload and generally lower plasma glucose and insulin levels than do the untrained (Sinyor, Schwartz, Perronet, Brisson, & Seragonian, 1983). Physical fitness has been shown to be independently associated with healthful levels of triglycerides, high density lipoproteins and total cholesterol (Gibbons, Blair, Cooper, & Smith, 1983; Hayden & Allen, 1984). In addition, increased activity levels have been associated with amelioration of hypertension and osteoporosis and reduced risk of coronary heart disease through alteration of both primary and secondary risk

factors (Caspersen, Christenson, & Pollard, 1986; Martin & Dubbert, 1982).

Currently, physical inactivity is considered a secondary risk factor in coronary artery disease (CAD). In epidemiological comparison studies, physically active persons who expend 400-500 kilocalories above the normal daily sedentary expenditure level have a significantly lower prevalence of CAD (Morgan, 1981; Troxler & Schwertner, 1985). Little difference has been found in mortality from CAD between former athletes and nonathletes. Since benefits derived from exercise rapidly disappear upon resumption of a sedentary lifetyle, it is universally recognized that to retain these benefits one must remain active throughout one's lifetime. Results of eight national surveys conducted in the United States and Canada between 1972 and 1983 indicate that a maximum of 20 percent of the population exercises at a level sufficient to derive cardiovascular benefit (Stephens, Jacobs, & White, 1985).

In the popular literature physical fitness is recognized to be positively associated with mental health and a general sense of well being. Anecdotal reports and cross-sectional and quasi-experimental research claim benefits from exercise ranging from enhanced popularity to increased sexual satisfaction (Buffone, 1984; Hughes, 1984; Taylor et al., 1985). Claims for the reduction of anxiety and depression through exercise and a general phenomenon of

"feeling better," though widespread in the literature, are not consistently supported by test scores or experimentally designed studies (Sachs, 1984). A primary consideration in the inconsistent findings may be the brief duration of most studies (6 weeks to 3 months). A minimum of 10 weeks is considered necessary for psychological and physiological adaptations to occur (Dishman, 1984).

Among persons who are exercise-dependent, missing even one daily exercise session has been shown to result in withdrawal symptoms, including anxiety, depression, tension, guilt, nervousness and twitching muscles (Harris, 1981; Summers, Sargent, Levey, & Murray, 1982; Thaxton, 1982). Only one study has dealt with the effects of several weeks cessation of exercise on mood (Bahrke, Thompson, & Thomas, 1986). In this study 7 lifestyle exercisers were deprived of aerobic exercise for 6 weeks. Total mood disturbance, as measured by the Profile of Mood States, increased 171 percent in the withdrawal group and decreased 79 percent in the control group.

The Type A (coronary prone) behavior pattern (TABP) is "an overt behavioral syndrome or style of living characterized by extreme competitiveness, striving for achievement, aggressiveness, impatience, haste, restlessness and feelings of being challenged by responsibility and under pressure of time" (Jenkins, Zyzanski, & Rosenman, 1979, p. 3). TABP has been shown to

be an independent risk factor for coronary heart disease (CHD) and atherosclerosis (Chesney, Black, Chadwick, & Rosenman, 1981; Haynes, Feinleib, & Kannel, 1980; Stevens, Turner, Rhodewalt, & Talbot, 1984). Simply put, it is a collection of behaviors thought to characterize future cardiac patients. When challenged, persons exhibiting the Type A behavior pattern have been found to exhibit widespread physiological reactivity (increased arousal of the autonomic nervous system). This excessive arousal in Type As when encountering routine performance challenges may play an important part in the pathogenesis of CHD (Corse, Manuck, Cantwell, Giordani, & Matthews, 1982; Matthews, 1982; Matthews, Glass, Rosenman, & Bortner, 1977). Interestingly, Type As tend to underreport physical symptoms, including health problems, fatigue and indices of general autonomic arousal (Matteson, Ivancevich, & Smith, 1984; Schlegel, Wellwood, Copps, Gruchow, & Sharratt, 1980; Schwartz, Burish, O'Rourke, & Holmes, 1986).

The psychological dimensions underlying Type A behavioral characteristics have not been identified (Matthews, 1982). A growing body of evidence exists, however, that establishes a connection between the potential for generalized hostility and anger and severity of coronary disease (Dembroski, MacDougall, Williams, Haney, & Blumenthal, 1985; Ragland, Brand, & Rosenman, 1986; Williams, Haney, Lee, Kong, Blumenthal, & Whalen,

1980). Recently it has been proposed that anger and hostility may be better predictors of coronary prone behavior than the Type A pattern (Haynes et al., 1980).

By definition, Type As tend to expend more effort in challenging situations than do others. Studies suggest, however, that this struggle is not indiscriminate; rather, Type As work hardest in situations where they perceive they may gain or regain control (Schwartz et al., 1986). Matthews (1982) suggested that striving for control may be the method by which Type As regulate their self esteem. It has been suggested that the Type A's tendency to underreport symptoms may carry over to the psychological realm (Matteson et al., 1984). Chesney and colleagues (1981), in a study of 384 Lockheed employees, found Type A subjects significantly less motivated than others to seek counseling intervention.

The description of TABP does not address the origins of the pattern, its purpose, or even its pathogenic components. To date there is an absence of comprehensive theory to explain the presence of the construct (Schwartz et al., 1986). Glass (1977) suggests the following sequence of events. Generally speaking, western society rewards the ability to master one's environment. Failure to achieve such environmental control results in anxiety. The Type A attempts to ward off this anxiety through ever greater attempts at mastery, often leading to aggressive

and hostile behavior and concommitant physiological and psychological arousal. Failure to attain mastery may lead to depressive symptomology. Although Type As in general report leading joyless existences and are 2 to 3 times more likely to die prematurely from CHD, they remain resistant to changing their behavior (Burke, 1983).

Attempts to reduce Type A behavior and concommitant disphoric mood have focused on aerobic exercise, counseling and various relaxation interventions, primarily deep breathing, progressive relation, cue-conditioning, autogenic training, systematic desensitization, cognitive restructuring and assertiveness training (Blumenthal et al., 1988; Blumenthal, Williams, Williams, & Wallace, 1980; Charlesworth, Williams, & Baer, 1984; Gilbert, 1983 Jasnoski, 1983; Lobitz, Brammell, Stoll, & Niccoli, 1983; Neddo, 1984; Powell, Friedman, Thoresen, Gill, & Ulmer, 1984; Roskies, 1987; Roskies, Spevak, Surkis, Cohen, & Gilman, 1978). In a study of 27 Type A men, Roskies et al. (1978) found Jacobsonian relaxation effective in lowering serum cholesterol and systolic blood pressure and increasing general satisfaction. Hazaleus and Deffenbacher (1986) reported that after 6 one-hour sessions of cognitive or relaxation coping skill training, college students displayed significantly fewer manifestations of anger than did controls. Likewise, Jenni and Wollersheim (1979) found both cognitive therapy and stress management training to be

effective in reducing self-perceived levels of Type A behavior among persons under stress from responsibilities, time and job pressures.

One way in which the Type A may seek environmental and psychological control is through exercise. The optimal work environment for the Type A has been described as controllable, fast-paced and extremely challenging (Ivancevich & Matteson, 1984), all characteristics of a vigorous exercise regimen. TABP has been associated with non-adherence to programmed exercise (Hughes, Crow, Jacobs, Mittelmark, & Leon, 1984; Oldridge, 1982). Studies of exercise adherence in Type As enrolled in cardiac rehabilitation programs have produced inconclusive results. What has been demonstrated, however, is that Type As exercise more intensely (at a higher percentage of heart rate) than others, may be more prone to ignore disease-related symptoms, are slower to recognize symptomatic pain and suppress fatigue in order to maintain a high performance level (Rejeski, Morley, & Miller, 1984; Schlegel et al., 1980). In studies of disease-free males and females, higher Type A scores have been associated with higher intensity exercise and increased incidence of exercise-related injury for both sexes (Diekhoff, 1984; Fields, Delaney, & Hinkle, in press; Folsom et al., 1985). On the other hand, Hinkle, Lyons, and Burke (1988) found no significant differences on hard-driving behaviors between

Type A and Type B runners completing an 8 kilometer road race except on the variable "running when not motivated."

In addition, Blumenthal and colleagues (1980) found that healthy Type As significantly lowered their Type A scores (as measured by the Jenkins Activity Survey) after a 10-week fitness program. In a later study addressing exercise as a means of lowering Type A scores, Blumenthal et al. (1988) compared aerobic and anaerobic exercise treatments in healthy middle-aged men. Both groups significantly lowered scores on the hostility component of the Structured Interview and the Hard-driving subscale of the Jenkins Activity Survey (JAS), but no other components changed. A third study by Lobitz et al. (1983) compared the effects on TABP of 7-week programs of aerobic exercise and anxiety management training. Both groups lowered systolic blood pressure and the fitness group significantly lowered JAS scores.

In sum, evidence for the use of exercise to reduce Type A behavior is meagre. Moreover, persons exhibiting TABP have not traditionaly gravitated to a regular exercise regimen, perhaps because of time constraints. However, for that percentage of Type As, however small, which does exercise, excessive physical activity may represent a transfer of characteristic behaviors to a recreational setting. Contemporary society currently rewards highly

motivated, even compulsive athletes. Lean bodies are the fashion, as are memberships in spas, YMCA's and other athletic organizations. For some, aerobic exercise may provide an acceptable outlet for aggressive, hostile, compulsive, competitive and hard-driving behavior and may ameliorate feelings of anxiety and depression. For others, it may develop into an exercise addiction whereby persons exercise well beyond the higher limits recommended by organizations such as the American College of Sports Medicine (American College of Sports Medicine [ACSM], 1978; Kagan & Squires, 1985; Oglesby, 1981; Sachs, 1981 (a); Sachs, 1981 (b); Sachs, 1984).

Statement of the Problem

Although regular aerobic exercise in moderation is considered a healthful behavior, there may be a point at which the risks outweigh the benefits. It is possible that aerobic exercise in excess of recommended standards for cardiovascular fitness not only increases the likelihood of musculoskeletal injury but also contributes to dysphoric mood and Type A behavior pattern. Although at least one study found increased injury among runners to be associated with high Type A scores but not with increased mileage (Fields et al., in press), there is a clear association between Type A behavior and both higher exercise intensity and exercise-related injury (Diekhoff, 1984; Folsom et al., 1985). Likewise, the bulk of medical literature indicates

an increase in injury with increases in intensity, frequency and duration of exercise (Diekhoff, 1984; Estok & Rudy, 1986, Pollock et al., 1977; Valliant, Bennie, & Valiant, 1981). Chronic exercise may become an unhealthy dependence or addiction with the attendant disfunctional behaviors characteristic of all additions: loss of work time, disregard for personal relationships, poor eating habits and withdrawal symptoms upon cessation of the addictive behavior. To date, few research studies have examined the relationships among Type A behavior pattern, dysphoric mood (anxiety, depression, and hostility) and excessive chronic exercise. Moreover, although several studies have examined the effects of exercise interruption on mood (Harris, 1981; Sachs, 1984; Summers et al., 1982; Thaxton, 1982), only one has investigated the effects of exercise cessation (Bahrke et al., 1986) and none has dealt with the reduction of exercise to recommended levels in persons exercising in excess of American College of Sports Medicine guidelines.

Purpose of the Study

Upon examination of the literature regarding exercise, relaxation training, Type A behavior and mood states, questions regarding their interrelationships arise. The purpose of this study is to examine the comparative effects of relaxation training and aerobic exercise reduction on anxiety, depression, hostility and Type A behavior pattern.

Research Questions

The following research questions have been formulated. Among adults who normally exceed the American College of Sports Medicine guidelines for aerobic exercise

1. Does Type A behavior pattern, as measured by the Jenkins Activity Survey (JAS), change when exercise is reduced for a 10-week period to recommended levels?

2. Does the propensity to experience anxiety, depression and hostility, as measured by the Profile of Mood States (POMS), change when exercise is reduced to recommended levels?

3. Does Type A behavior pattern, as measured by the Jenkins Activity Survey, decrease after a 10-week program of relaxation training?

4. Does the propensity to experience anxiety, depression and hostility as measured by the Profile of Mood States, diminish after a 10-week program of relaxation training?

Research Hypotheses

From these research questions the following hypotheses were formulated. Among adults who normally exceed the American College of Sports Medicine Guidelines for aerobic exercise

1. Type A behavior pattern, as measured by the Jenkins Activity Survey, will be affected by a 10-week reduction in exercise to recommended levels.

2. The propensity to experience anxiety and tension, as measured by the Profile of Mood States, will be affected by a 10-week reduction in exercise to recommended levels.

3. The propensity to experience depression and dejection, as measured by the Profile of Mood States, will be affected by a 10-week reduction in exercise to recommended levels.

4. The propensity to experience anger and hostility, as measured by the Profile of Mood States, will be affected by a 10-week reduction in exercise to recommended levels.

5. Type A behavior pattern, as measured by the Jenkins Activity Survey, will decrease after a 10-week program of relaxation training.

6. The propensity to experience tension and anxiety, as measured by the Profile of Mood States, will decrease after a 10-week program of relaxation training.

7. The propensity to experience depression and dejection, as measured by the Profile of Mood States, will decrease after a 10-week program of relaxation training.

8. The propensity to experience anger and hostility, as measured by the Profile of Mood States, will decrease after a 10-week program of relaxation training.

The first four hypotheses are non-directional. The paucity of literature provides few clues to possible effects of exercise deprivation among regular exercisers. The researcher can imagine two opposing scenarios. First,

having become dependent on exercise for relief of uncomfortable psychological symptoms (feelings of depression, hostility, tension, or anger), the chronic exerciser, when deprived of this coping mechanism, experiences an increase in symptomology and a resumption of aggressive, impatient behaviors. Second, upon reducing exercise to a more healthful level, the exerciser feels better, experiences less fatigue and pain and has more opportunity to develop and use other, neglected coping mechanisms to discharge negative emotions. Because these hypotheses have heretofore been unexamined, their directionality is largely a matter of speculation. With regard to the last four hypotheses, the bulk of the research points in the direction of positive psychological responses as a result of relaxation training. Only a few studies, however, have specifically investigated the effect of relaxation therapies on Type A behavior.

Definition of Terms

In researching the literature for this study, it was necessary to draw from the fields of exercise physiology, psychology, medicine and education. For purposes of clarity and understanding it is therefore appropriate to provide brief, working definitions of technical terms to which the reader can readily refer. Many of these terms are discussed in detail in the review of literature.

Physical activity is defined as any bodily movement produced by skeletal muscles that results in physical activity (Caspersen, Powell, & Christenson, 1985). One measure of this energy expenditure is the kilocalorie (kcal), the heat required to raise the temperature of 1 kilogram of water 1 degree Celsius under specified conditions (Lamb, 1984). Exercise is a subcategory of physical activity in which repetitive body movement is structured and planned to improve or maintain some component of physical fitness. To come full circle, physical fitness is a set of attributes that people may have or achieve which relates to a person's performance of physical activity. Physical fitness is generally considered to be composed of three facets: strength, endurance and flexibility. Strength refers to the amount of external force a muscle can exert. Endurance describes the ability of a muscle group to exert external force over a period of successive repetitions or exertions. Flexibility refers to the range of motion of a given joint (Caspersen et al., 1985).

Exercise may be either aerobic or anaerobic. Aerobic exercise is that which increases the endurance of the pulmonary and cardiovascular systems (that which uses oxygen) while anaerobic exercise involves the maintenance or repetition of strenuous muscle contraction and does not use oxygen as its primary energy source. Aerobic

(cardiorespiratory) endurance, then, is the ability to persist in physical activity relying primarily on oxygen for energy production (Lamb, 1984; Ledwidge, 1980). Aerobic capacity refers to the maximum amount of oxygen the body can process during a specific time period (Berger, 1984). A single exercise session is termed an acute bout of exercise; chronic exercise refers to exercise accomplished over time and many distinct sessions.

Exercise is often described in terms of its frequency, intensity, and duration. Frequency refers to the number of distinct bouts of exercise accomplished in a given period, usually a week. Intensity describes the determination of one's exertion level during a given exercise period through measurement of heart rate or individual perception. Duration refers to the length of a single exercise session. Heart rate refers to the number of strokes or beats the heart needs to perform the current activity. Resting heart rate is the heart rate at the time of awakening from sleep. Rate of perceived exertion (RPE) is an individual rating scale measuring relative fatigue or physical exertion. The amount of blood pumped from the heart's ventricles with each beat is referred to as stroke volume while cardiac output is the product of heart rate times stroke volume, the volume of blood pumped through a ventricle per unit of time. When one is no longer able to maintain a given level of physical performance, fatigue results (Lamb, 1984).

Metabolic equivalents (METS) are an expression of energy relative to an individual's resting energy expenditure. MET capacity, then, is the individual's upper limit of energy expenditure in relation to rest.

The autonomic nervous system controls the involuntary mechanisms of the body, including cardiac function and production of body chemicals and hormones. Of these chemicals, several have bearing in this paper. Norepinephrine and epinephrine, a class of chemicals known as catecholamines, serve to increase cardiac output, vasoconstriction (narrowing of the blood vessels through contraction of the muscles in the vessel walls) and blood pressure. Cortisol, a hormone secreted by the adrenal cortex, works to conserve carbohydrate stores in the body of the expense of fat and protein. Insulin, a pancreatic hormone, increases glucose (blood sugar) uptake by bodily tissues, thus lowering plasma glucose levels.

Individuals are variously categorized according to their general activity levels. For purposes of this paper, persons who report virtually no physical activity are referred to as sedentary. Persons exercising with an intensity and frequency generally recommended for cardiovascular benefit (that is, of benefit to the heart and blood vessels) are considered regularly active (Casperson et al., 1986; Stephens et al., 1985; Lamb, 1984). Those persons exercising at levels above those

standards are referred to as chronically active. Adherence to an exercise program consists of participation in that program at some minimal level sufficient to ensure cardiovascular and/or psychosocial benefits.

The American College of Sports Medicine (ACSM) (1978) has established recommendations for the quantity and quality of exercise needed to develop and maintain physical fitness in healthy adults. According to these standards one should exercise 3 to 5 days per week at an intensity of 60 to 90 percent of maximum heart rate (or 50 to 85 percent of maximal oxygen uptake) for a period of between 15 and 60 minutes. Duration of activity is dependent upon exercise intensity such that lower intensity activities should be performed for longer periods than high intensity activities. Maximum heart rate is the greatest number of beats per unit of time which the heart can produce while maximum oxygen uptake (VO_{2max}) refers to the greatest volume of oxygen used by the body's cells per unit of time. Intervals between exercise sessions are know as rest or recovery periods (Lamb, 1984).

As one develops fitness, one expects certain physical changes to occur. The adaptive response by the circulo-respiratory system to exercise that results in increased capacity of the body or body part is known as the training effect. This is accomplished through the principle of overload whereby one increases work to improve

fitness. Training or target heart rate is that heart rate during exercise sufficient to produce a training effect. Lean body mass, the proportion of non-fat tissue in the body, increases and the body composition, the relative proportion of lean and fat components of the body, shifts in favor of muscle. One may also expect changes in systolic and diastolic blood pressure, that is, the pressure the volume of blood exerts on the arteries when the heart is in contraction and when it is at rest. Hypertension refers to chronically high arterial blood pressure (Lamb, 1984).

Exercise is also related to levels of blood cholesterol, the incidence of fat in the blood. Cholesterol is related to the various lipoproteins in the blood. High density lipoproteins (HDL) are heavy complexes of fat and protein associated with reduced incidence of coronary heart disease. Low density lipoproteins (LDL), lighter complexes, are associated with the heart disease, and very low density lipoproteins (VLDL) are very light fat-protein complexes which are highly associated with coronary artery disease. Lipid means fat; triglycerides are fats composed of three molecules of fatty acid and one of glycerol (a carbon compound) (Lamb, 1984). Hyperlipidemia is a condition of the blood characterized by an excess of lipids.

Other physiological terms are used throughout this paper. Physiology itself is the biological science of the vital processes of an organism. Lactate, a by-product of anaerobic metabolism, is thought to cause muscle soreness. The protein found in red blood cells that combines with oxygen is known as hemoglobin. Pulmonary ventilation (VE) is an individual's breathing capacity. Osteoporosis is a loss of bone mineral density particularly prevalent in post-menopausal women (Lamb, 1984). Galvonic skin response is a measure of skin conductance. Persons who menstruate regularly after menarche are considered to be eumenorrheic while those who menstruate infrequently are amenorrheic.

An artery is a vessel that transports blood away from the heart. When at least one major artery in the heart (coronary artery) is more than 75 percent obstructed or occluded by these fatty deposits, the individual may be diagnosed as having coronary artery disease (CAD), also referred to as coronary heart disease (CHD). Coronary atherosclerosis, on the other hand, refers to the disease process throughout the arterial system (Schocken, Greene, Worden, Harrison, & Spielberger, 1987). Ischemia refers to a lack of blood flow to an area of the body. A myocardial infarction (heart attack, coronary occlusion, coronary thrombosis) is the death of a portion of the heart muscle caused by a blockage of a coronary artery. Angina pectoris is defined as severe chest pain related to myocardial

ischemia. Angiography is a medical procedure designed to determine the extent of coronary occlusion.

Risk factors in CHD are those particular characteristics of individuals which are associated with the premature onset of heart disease. In order of importance primary, or most potent, risk factors are family history, gender, hypertension, high cholesterol level, cigarette smoking and lack of exercise. The propensity of a risk factor to diminish in power after an individual reaches a certain age is called a survival effect. Secondary risk factors include obesity (a male body fat level above 20 percent or a female above 30 percent) and the Type A (coronary prone) behavior pattern (Lamb, 1984; Martin & Dubbert, 1982; Matthews, 1982). The Type A behavior pattern (TABP) is defined as an "overt behavioral syndrome or style of living characterized by extremes of competitiveness, striving for achievement, aggressiveness ...haste, impatience, restlessness, hyperalertness, [explosive] speech, [tense] facial muscles, and feelings of being under pressure of time and challenge of responsibility" (Jenkins et al., 1979). Type B behavior is that characterized as easy-going and relaxed.

Several mood states have been found to be associated with the Type A behavior pattern. Anxiety refers to a state of motor tension, autonomic hyperactivity, apprehensive expectation and/or hypervigilance (American

Psychiatric Association [APA], 1980). Depression is a complex pathological condition characterized by loss of interest in usual activities, appetite or sleep disturbances, decreased energy, loss of concentration and feelings of helplessness and guilt (APA, 1980). Anger refers to an emotional response to threat characterized by physiological changes indicative of the "fight" response, ranging from irritation to rage. Hostility is defined as "a durable predisposition to evaluate people or events negatively, often in a suspicious, distrustful, cyncical or even paranoid fashion" (Roskies, 1987, p. 197). Stress is defined as response to a stimulus that is greater than required (Franks, 1983/84 (a)).

In an effort to ameliorate the effects of the Type A behavior pattern, its associated mood states and general stress, several behavior interventions have proved effective (Lichstein, 1988). Deep breathing refers to the process of repeatedly inhaling and exhaling deeply for a period of approximately two minutes. Progressive relaxation is the process of alternately tensing and relaxing particular muscles or muscle groups while attending to the internal sensations experienced. Cognitive therapy refers to the teaching of cognitive restructuring as presented in Ellis' A-B-C model. Cognitive restructuring is the 5-step process of ridding oneself of unproductive thoughts or beliefs in favor of

more constructive ones (Jenni & Wollerstein, 1979). Likewise, cue conditioning replaces old responses to particular stimuli with new, more effective ones. Systematic desensitization substitutes muscle relaxation for a hierarchy of anxiety-producing states. Assertiveness training is the learning to stand up for personal rights in regard to expression of thoughts and feelings. Autogenic training is "a combination of meditation, self-suggestion similar to hypnosis, and deep relaxation techniques designed to reduce tension and stress" (Stone, 1980). Anxiety Management Training (AMT) uses imagery to precipitate stress, identify signals of muscular stress response and allow bodily relaxation (Suinn & Bloom, 1977). Stress Management Training (SMT) combines progressive relaxation with AMT.

Summary

Regular aerobic exercise is generally considered to be a healthful activity, resulting in many physiological and psychological benefits. Among them are a protective effect against premature coronary heart disease and an amelioration of negative mood states. It appears, however, that with increasing frequency, intensity and duration of exercise a point of diminishing returns is reached where physical and psychological risks outweigh benefits. There is some question concerning whether persons who engage in chronic exercise behavior exhibit high levels of Type A

behavior pattern, a circumstance which may offset the protective cardiac effects ascribed to aerobic exercise. In essence, does frequent, intense exercise serve to curb aggressive, competitive, hostile tendencies or to exacerbate them? Likewise, does chronic exercise lower tendencies toward anxiety and depression or does it increase them? To take the issue a step further, if chronic exercisers were to decrease their exercise levels to more accepted levels, what effects, if any, would be observed on the variables of Type A behavior, anxiety, depression and hostility? Finally, how would exercise reduction compare to applicaton of relaxation techniques in their effects on these variables?

This study presents an investigation of those persons who are chronically active (who exceed generally accepted fitness guidelines) and the extent to which each demonstrates Type A behavior pattern and dysphoric mood (anxiety, depression and hostility) initially and after 10 weeks of exercise reduction or relaxation training. In the following chapter current research on these topics will be reviewed.

CHAPTER II

Review of the Literature

In the United States today, only 15 to 20 percent of the population exercises at a level sufficient to produce cardiovascular fitness (Martin & Dubbert, 1982). Because the primary concern of health professionals is motivating individuals to adhere to a healthful exercise regimen, little attention has been paid to those persons who exercise beyond what is necessary for cardiovascular fitness, thus risking physical injury and negative psychological outcomes. To date, the population of chronic exercisers has not been well described. Little experimental research has dealt with the psychological profile of exercisers who have demonstrated what may be considered a propensity toward chronic physical activity. Few studies have investigated the presence or absence of the Type A behavior pattern (TABP) in chronic exercisers or the effect of exercise reduction on either Type A behavior or mood.

The following review of literature is drawn from the fields of medicine, exercise physiology, public health and psychology. Because of the complexity of the subject matter and the interrelationships of physiological and psychological phenomena, the review is organized in the following manner. First, the benefits and risks of

exercise, including the effects of aerobic exercise on mood and hypotheses to explain these effects will be discussed. Second, the Type A behavior pattern (TABP), its concommitant moods, potential modifiers and its relationship to exercise will be presented. The final topc of interest will be the use of relaxation techniques in the reduction of dysphoric mood states and Type A behavior. A common thread linking the discussions of aerobic exercise and Type A behavior, coronary heart disease, will be discussed throughout.

Physical Benefits of Aerobic Exercise

Prior to the American running craze in the 1970's, little was known about the health-related benefits of aerobic exercise. As interest in the topic grew, well-controlled research studies demonstrated that a systematic pattern of aerobic exercise increases muscle mass, lowers percentage of body fat, lowers resting heart rate, increases maximal oxygen uptake and improves endurance (Eickhoff, Thorland, & Ansorge, 1983; Jones & Weinhouse, 1979; Lamb, 1984). Aerobically trained individuals have greater stroke volume, better central and peripheral circulation, faster return to basal heart rate after exercise, lower heart rates during equivalent work loads, less accumulation and faster elimination of lactic acid from the bloodstream, lower epinephrine and cortisol levels in response to increased workload and generally

lower plasma glucose and insulin levels than do the untrained (Folkins & Sime, 1981; Sinyor et al., 1983; Stern & Cleary, 1981). Increased activity levels have been associated with reduced risk of coronary heart disease and amelioration of hypertension and osteoporosis (Casperson et al., 1986).

Cardiovascular diseases, of which coronary heart disease is the predominant type, constitute the leading cause of death in this country, accounting for 51 percent of total mortality (Pollock, Wilmore, & Fox, 1984). Alterable risk factors for coronary heart disease are broken into two categories: primary and secondary. Primary risk factors include hypertension, cigarette smoking and elevated blood cholesterol levels. Secondary factors include obesity, inactivity, diabetes, emotional stress and Type A behavior pattern. Genetic factors, including race, age and family history of heart disease, comprise a class of risk factors which are unalterable. Approximately 85 percent of one's physiological makeup is genetically determined; however, aerobic (endurance) training can alter the remaining 15 percent over which the individual exercises some discretionary control.

With resting level increases of systolic and diastolic blood pressure (hypertension), risk of premature cardiovascular disease (CVD) and death rise dramatically. Endurance training tends to reduce hypertension independent

of sodium reduction or dietary control. This reduction is moderate to substantial in degree with systolic pressure being most affected. Mild or borderline hypertensives benefit the most; for more serious cases, drug therapy is the treatment of choice (Martin & Dubbert; Pollock et al., 1984). In addition, aerobic exercise may lower the risk of developing hypertension by decreasing elevated plasma catecholamine levels and controlling body weight (Blair, Jacobs, & Powell, 1985).

Total mortality from all causes of death combined is twice as high for smokers compared to nonsmokers (Pollock et al., 1984). Frequency of heart attack increases according to the number of cigarettes smoked as does the risk of lung cancer. Persons who cease smoking have less risk of CHD than those who continue. While aerobic exercise is negatively associated with cigarette smoking, the nature of that relationship remains unclear. A U.S. Public Health Service collaborative study (Taylor et al., 1985) found no significant differences in quit smoking rates between exercisers and controls after one year. Indeed, smokers are more likely to stop exercising than to stop smoking, although at least one study found that men who increased their physical fitness levels were just as likely to continue smoking as those who did not improve (Blair et al., 1985; Dishman & Ickes, 1984; Hughes et al., 1984; Wood, 1983). It is also well-established that

persons who smoke are less apt to begin or adhere to a program of regular aerobic exercise (Martin & Dubbert, 1982; Oldridge, 1979). In addition, cigarette smoking has been associated with increased fatigue after exercise (Hughes et al., 1984). However, Harris (1981) in a survey of 411 runners found that smoking less was one of the secondary benefits of running reported by those surveyed. Although evidence is sketchy, there are many reports that endurance training helps some people withdraw from cigarette smoking (Pollock et al., 1984).

High levels of blood cholesterol have also been demonstrated to increase the likelihood of premature coronary heart disease. Cholesterol is transported through the bloodstream in the form of lipoproteins. High-density lipoproteins contain the highest ratio of protein to fat (lipid) and appear to be the medium for transporting cholesterol away from the arterial walls to the liver for metabolization and excretion. Low-density lipoproteins transport approximately 65 percent of plasma cholesterol and are associated with high risk of CHD. Endurance training has been shown to alter cholesterol percentages in the body resulting in low concentrations of very low density lipoproteins, relatively low concentrations of low density lipoproteins and high concentrations of high density lipoproteins. Plasma triglyceride concentrations typically lessen with exercise and total cholesterol is

often, but not always, low in aerobically trained persons. The final triglyceride-related benefit in warding off CHD is that the ratio of total cholesterol to HDL is considerably reduced through exercise. Acute bouts of aerobic exercise have not been found to lower serum cholesterol concentrations. High aerobic fitness has been consistently associated with lower cholesterol concentrations, but the association may be due in part to dietary and body fat factors (Goldberg & Elliot, 1985; Leon, 1985; Martin & Dubbert, 1982; Pollock et al., 1984).

Current data suggest that more active individuals consume more calories on average than do the inactive. However, there appears to be little difference in type of foodstuffs consumed between groups. It is reasonable to assume that higher activity levels require greater caloric consumption, thus the observation that most overweight persons are underexercised rather than overfed. Exercise when combined with modest caloric decreases results in weight loss as well as greater ratio of lean muscle tissue to body fat (Blair et al., 1985; Pollock et al., 1984). It is important to note, however, that with obese subjects endurance training without caloric reduction does not result in decreased body weight. In a 3 month study by Mandroukas et al. (1984), obese subjects who trained aerobically without food restrictions gained strength and endurance, decreased blood pressure and increased maximal

oxygen uptake. They did not, however, alter body weight, body composition or the number or size of fat cells.

Physical inactivity is considered a secondary risk factor in the development of coronary heart disease and is independently associated with HDL-cholesterol, total cholesterol, triglycerides, blood pressure and cigarette smoking (Gibbons et al., 1983). The average healthy man has a 20 percent chance of suffering a myocardial infarction before the age of 60 (Leon, 1985). In epidemiological comparison studies of physically active persons, those who expend 400-500 kilocalories above the normal daily sedentary level have a significantly lower incidence of CHD (Pollock et al., 1984). Troxler and Schwertner (1985), in a study of school classmates, found that men with a physical activity index of less than 2000 kcal per week suffered a rate of heart attacks 64 percent greater than their more active classmates. This preventive mechanism was studied by Hayden and Allen (1984), who found that aerobic exercise enlarges the diameter and pliability of blood vessels, increases hemoglobin levels and decreases cholesterol and triglycerides associated with heart disease. Moreover, cross-sectional data from both genders show an inverse relationship between metabolic fitness, the ability to metabolize foodstuffs efficiently, and CHD risk factors. Because metabolic fitness is enhanced by exercise training, regular moderate exercise is

generally prescribed as an adjunct to diet and insulin therapy for diabetics (Martin & Dubbert, 1982). Since physical fitness benefits cannot be stored and rapidly dissipate upon resumption of a sedentary lifestyle, little difference has been found in CAD mortality between former athletes and nonathletes (Pollock et al., 1984). However, aerobically trained persons who do suffer heart attacks have an increased chance of survival following myocardial infarction (Rudy & Estok, 1983). These findings have not been shown to apply to anaerobic exercise training (Gibbons et al., 1983; Leon, 1985; Pollock et al., 1984; Troxler & Schwertner, 1985).

In summary, aerobic exercise may be said to have a positive effect on both primary and secondary alterable risk factors in coronary heart disease. Hypertension, cigarette smoking, elevated cholesterol levels and inactivity, all associated with CHD, are ameliorated by regular aerobic exercise. Other secondary risk factors, emotional stress and Type A behavior pattern, will be discussed in subsequent sections of this paper.

Exercise Prescription

In any study concerning the effects of exercise, it is important to establish what kind of exercise and how much of it is needed to attain physical benefit. Exercise permitting rhythmical contraction of large muscle groups moving the body against gravity or over distance produces

the greatest health benefits and the largest increase in energy expenditure with the least fatigue (Katch & Katch, 1984). Such exercise is referred to as "aerobic," requiring oxygen for energy production. Aerobic activities include walking, jogging, biking, swimming and cross country skiing. Anaerobic metabolism requires no oxygen and is called into use primariy during brief, intense activities such as sprints, leaps and strength maneuvers. Static or heavy resistance exercise, which is primarily anaerobic, produces pressure rather than volume loads on the cardiovascular system, resulting in local as opposed to systemic muscle adaptations and rapid muscle fatigue at relatively low energy expenditure rates.

Most forms of exercise use both aerobic and anaerobic glycolysis (energy production) (Katch & Katch, 1984). The contribution of each, however, varies according to the individual's fitness level as well as type and intensity of exercise performed. The first 10 to 30 seconds of any intense activity is provided by the anaerobic system with carbohydrate being its fuel and lactic acid its by-product. After 2 to 3 minutes of vigorous exercise, the metabolic requirements are met in approximately equal amounts by the two systems. After 10 minutes of continuous exercise, aerobic glycolysis supplies around 85 percent of the body's energy needs. Interestingly, during rest and light exercise, aerobic mechanisms supply the body's energy requirements.

Persons who regularly perform even small amounts of exercise appear to have a greater degree of cardiovascular fitness than do sedentary individuals (Leon, 1985). In order to develop and maintain cardiovascular fitness, a moderate fat to lean body tissue ratio and an appropriate weight to height ratio, guidelines for frequency, intensity, duration and mode of exercise have been developed. Most experts currently recommend performing aerobic activity every other day at an energy expenditure rate of 300 kcal per exercise session or 7.5 kcal per minute for a 150 pound person. Most healthy adults have the capacity to expend 400 to 700 kcal in an hour of aerobic exercise so sufficient energy to fulfill health requirements can be expended within 30 to 45 minutes of continuous vigorous activity. Exercise modes such as walking or gardening do not produce large increases in aerobic capacity, the ability of the cells to use oxygen; however, if performed for periods of an hour or more, these less intense exercise forms will facilitate weight control, bone mineral retention and glucose tolerance (Pollock et al., 1984). Exercise beyond 2000 kcal per week (equivalent to 20 miles of jogging or walking) produces little further benefit and increases the propensity for injury (Leon, 1984).

A position paper issued by the American College of Sports Medicine (1978) sets optimal training frequency for

aerobic exercise at 3 to 5 days per week for between 15 and 60 minutes per session. Training intensity recommendations range between 60 and 90 percent of maximum heart rate reserve or 50 to 85 percent of maximum oxygen uptake. The College further recommends that for beginners and "nonathletic adults" exercise prescriptions of low to moderate intensity but longer duration serve to prevent injury and enhance compliance.

The ability to persist in prolonged, rhythmic exercise depends largely on the potential of the cardiovascular system to deliver oxygen to the muscles and on the potential of those muscles to use the oxygen for aerobic metabolism (Lamb, 1984). Vigorous exercise will stimulate adaptations in cardiovascular and muscular function that will enhance aerobic endurance. Thus, aerobic training is accomplished by overloading the cardiovascular system so that physical adaptations can occur. As the body adapts to one level of stress, further increases in fitness can be accomplished only by further increases in workload.

The two principle methods of inducing overload are the training by heart rate and training by maximal oxygen uptake. Using heart rate, the individual chooses a working heart rate between 60 and 90 percent of maximum and trains at that level. As the body adapts, the amount of work performed at a given heart rate increases. Because women have smaller hearts, less hemoglobin in the blood and less

efficient oxygen transport than men, women in general must work at higher heart rates to achieve a given proportion of maximum oxygen uptake (VO_{2max}). Thus, a heart rate of 128 beats per minute may represent a VO_{2max} of 50 percent in healthy young males as opposed to 42 percent in similar females. Trainees who begin a conditioning program with a relatively high capacity to use oxygen may achieve only minor improvements while sedentary, unfit individuals may expect increases of 15 to 30 percent. Training by VO_{2max} consists of exercising at about 80 percent of maximal speed performance (an equivalent of 95 percent of maximum heart rate) for a given distance. It is not necessary to train at this intensity to achieve some improvements in VO_{2max}; persons using this method are generally elite athletes looking for maximum improvement. At the point in a training program where VO_{2max} has been increased to its hereditary limit, further benefits can only be achieved by increasing training distances (Lamb, 1984; Pollock et al., 1984; Wells, 1985).

Although many benefits of aerobic exercise are in place after 4 to 6 weeks, conditioning cannot be stored. Aerobic exercise, therefore, is a lifelong enterprise. Interestingly, however, it takes less activity to maintain a given level of fitness than to acquire it. It appears that a given level of fitness can be maintained with a little as 2 or 3 practice sessions per week at an exercise

load equivalent to that used to build that fitness level. Upon cessation of exercise, improvements in VO_{2max}, heart rate response to submaximal exercise, post-exercise recovery rate and resting heart rate are lost within several weeks (Lamb, 1984; Leon, 1985).

Psychosocial Benefits of Aerobic Exercise

Personality, Mood, and Aerobic Exercise

Aerobic exercise has long been thought to produce psychosocial as well as physical benefits. Claims for the psychological benefits of exercise for both clinical and nonclinical populations have included improved mood, sexual functioning, self confidence, work efficiency, intellectual functioning, body image and emotional stability (Taylor et al., 1985). Sachs and Buffone (1984) identified over 1000 articles dealing with mental health in sports and exercise; however, most were fraught with methodological difficulties limiting the integrity of the data. Physical activity has been demonstrated to positively alter self confidence in adolescents and children, improve social skills among the mentally retarded, diminish some aspects of the stress response and coronary-prone (Type A) behavior and be of benefit in substance abuse programs (Taylor et al., 1985). Fitness training also has been shown to improve cognitive functioning in geriatric patients. Although results with other populations have been mixed, mental functioning appears to be more acute during and immediately after a

bout of exercise and after as little as 10 weeks of physical conditioning (Butler, 1969; Folkins & Sime, 1981). There is also evidence to indicate that physical exercise is an important adjunct in sleeping behavior (Baekeland, 1970; Paxton, Trinder, & Montgomery, 1983). Finally, studies of alpha-wave amplitude following submaximal and maximal exercise have demonstrated a relaxation effect occurring in the cortical and spinal areas of the central nervous system (Dishman, 1985).

Studies have consistently shown athletes to possess more favorable personality profiles than nonathletes (Hagberg, Mullin, Bahrke, & Limburg, 1979; Morgan, 1981). Other studies have attempted to distinguish between types of athletes on the basis of personality factors (Daus, Wilson, & Freeman, 1986; Riddick, 1984; Valliant et al., 1981). However, establishing causal relationships between aerobic exercise and changes in personality or mood has proved difficult for researchers. Findings in the area have been inconsistent and designs problematic; difficulties regarding subject selection, adherence, expectation and control plague the research. Sachs and Buffone (1984) identified four classes of mediators which impede the identification of exercise as the causal agent in personality or mood change. First, persons participating in an exercise program may have certain expectations for improvement or, in some cases, for harm

that may engender effect. Individuals may experience changes as a result of their expectations rather than their exercise training (Jasnoski, Holmes, Soloman, & Aguiar, 1981). Thus, if true control is to be achieved, controls must be given expectations for change similar to exercising subjects. Second, persons who discover the joys of exercise may change other habits in their lives. They may cease smoking, eat more nutritionally, change sleeping behavior or develop new social relationships. In the face of what may well be a new lifestyle, it is difficult for the researcher to attribute any personality changes to exercise alone (Finnegan & Suler, 1985). Third, an examination of the previous discussion of the benefits of aerobic exercise would suggest that there may be both peripheral and systemic biochemical changes that influence temperament. Finally, individual perceptions of physical changes occurring with exercise may affect one's concept of self, body image, sense of mastery or locus of control. These in turn may mediate subsequent effects on both state and trait factors.

Attempts to measure differences in personality and mood between aerobically active and inactive persons have met with limited success. In an examination of factors predisposing men to participate in aerobic exercise, Renfrow and Bolton (1979) administered the 16 Personality Factor Questionnaire to 23 exercisers and 23 controls. The

active group was found to be more reserved, suspicious, forthright, liberal, expedient, self-sufficient, alert and independent than the control group. Controls had greater superego strength and discretion scores as measured by the Minnesota Multiphasic Personality Inventory (MMPI). Using the same design with women, however, Bolton and Renfrow (1979) found only three marginally significant differences between groups, the active group being more stable, less tense and less anxious. Comparisons of active and sedentary groups have shown greater general well-being, greater happiness and less depression among the physically active (Carter, 1977; Goldwater & Collis, 1985; Lobstein, Mosbacher, & Ismail, 1983; Wilson, Morley, & Bird, 1980). Hayden and Allen (1984) compared self reports of committed runners with those of active non-runners and inactive persons. Significant others for all subjects also were surveyed. The first two groups reported significantly less state and trait anxiety and depression than did the sedentary group, although they did not vary from one another. Family informants confirmed these differences.

Other studies have found elite athletes to possess more extraversion, emotional stability and vigor than controls (Dishman, 1981; Dishman, 1984; Sharp & Reilley, 1975; Wilson et al., 1980). A study of psychological differences between marathoners and joggers described

marathoners as more reserved, tender-minded, imaginative, intelligent and self-sufficient (Valliant et al., 1981). Estok and Rudy (1986), however, found no differences between marathon runners and nonmarathon runners on variables of anxiety, self-esteem, addictive behaviors and family relationships. Using the Profile of Mood States in numerous groups of elite athletes, Morgan (1980) has reported what he termed an "iceberg profile" where these athletes tended to score below the 50th normative T-Score on tension, depression, fatigue and confusion and above the 50th T-Score on vigor. Other researchers (Gondola & Tuckman, 1982) have found the profile to apply to lifestyle exercisers who are not world class, thus suggesting that this population may receive as many psychological benefits from training as world-class athletes.

Exercisers often describe a feeling of general well-being as a result of physical exertion. Although reports of "feeling better" after adoption of an exercise regimen abound in the literature, the relationship of this phenomenon to exercise has not been established (Harris, 1981; Sachs, 1984). In a pair of typical studies (Berger and Owen, 1983; Berger, 1986), the Profile of Mood States was administered to two class sections of swimming and one of lecture-control before and after class. Swimmers, but not controls, reported significantly less tension, depression, anger, confusion and more vigor after swimming

than before. Similar results have been demonstrated for youthful offenders (Hilyer et al., 1982) and college students (Ewing, Scott, Mendez, & McBride, 1984) following a single exercise session. Proponents of exercise as a therapeutic adjunct suggest that individuals gain a sense of mastery and accomplishment from physical activity. It is speculated that exercise is a form of meditation which triggers an altered state of consciousness providing distraction from anxiety producing situations (Folkins & Sime, 1981). Such effects, if verified, may have important implications for mental health professionals. Exercise may some day be considered an important form of self-therapy used by individuals to increase positive mood and self confidence, either alone or with counseling.

Most research in the area of exercise psychology examines differences between fit/unfit or normal/abnormal groups and does not address the issue of change brought about through exercise (Folkins & Sime, 1981). Furthermore, the existing literature is plagued with methodological problems and tends to be anecdotal. Enough data are available, however, to point to some psychological differences between the physically active and the sedentary. The question arises whether differences among the active and inactive are inherent and predispose people to exercise or are acquired, resulting from the exercise itself. It may be that maladjusted or psychologically

distressed individuals do not choose to participate in vigorous physical activity (Blumenthal, Williams, Needels, & Wallace, 1982). Few studies have examined the issue. Morgan (1980, 1981, 1985) found that exercise adherents presented a more favorable personality profile both initially and after 32 weeks of an exercise program. Similarly, a study of sleep characteristics between training and control groups matched for initial fitness found favorable sleep patterns in the athletes who proved proficient in their sport. These patterns existed before as well as after training (Paxton, Triander, & Montgomery, 1983). Thus, the exact nature of the exercise-psychological well being connection remains undetermined. One purpose of this study is to contribute to the body of wellness research by examining psychological differences within a fit population resulting from changes in exercise patterns.

Effects of Aerobic Exercise on Anxiety

The term anxiety as used in this paper refers to a state of motor tension, autonomic hyperactivity, apprehensive expectation and hypervigilance. Persons exhibiting anxiety may be edgy, impatient or restless or may suffer sleep disturbances, sweats, increased respiration and pulse, muscle twitches or flushing (APA, 1980). Anxious persons often experience subjective fear or feelings of danger when either no cause for fear can be

identified or feelings of distress are disproportionate to the importance of the cause (Ledwidge, 1980). If the feared event may occur in the future, anxiety rather than depression most often results (Butler & Matthews, 1983). Given the prevalence of anxiety states in today's society, anecdotal claims for anxiety reduction through exercise have received considerable research attention.

Effects of acute exercise on anxiety. Whether measured electromyographically or psychometrically, vigorous acute physical activity has been demonstrated to produce a reduction in anxiety and tension (Morgan, 1981). Driscoll (1976) found physical exertion in combination with mental imagery to be comparable to a taped desensitization tape in the reduction of student text anxiety. Likewise, Fort (1986) reported that following 30 minutes of treadmill exercise, males and females significantly reduced state anxiety. In studies concerning the effect of running on anxiety, consistent reductions in state anxiety have been reported after 20 to 30 minutes of vigorous physical exercise for individuals scoring at all levels of standard anxiety scales. Effects of acute exercise appear to be more pronounced in persons with clinical anxiety elevations. Anxiety has been shown to return to pre-exercise levels within four to six hours post-treatment (Bahrke & Morgan, 1978; Blumenthal, Williams, Needels et al., 1982; Buffone, 1984; Folkins, 1976; Folkins & Sime,

1981; Morgan, 1973; Morgan, 1985; Sachs, 1982; Seeman, 1978; Taylor et al., 1985; Wilson, Berger, & Bird, 1981). It appears that the effects of acute exercise are transitory and contingent on the intensity and duration of the exercise bout. This finding suggests that a major benefit of regular aerobic exercise may lie in the prevention of chronic anxiety by reducing the anxiety on a daily basis (Morgan, 1981). Physiological studies have consistently found relaxation effects associated with aerobic activity (Taylor et al., 1985). Comparative studies, however, have found quiet rest sessions, meditation, hypnosis, progressive relaxation, biofeedback and even eating lunch to elicit similar reductions, a fact supporting the argument that the anxiety-relieving properties of exercise are due to the diversionary aspects of physical activity (Bahrke & Morgan, 1978; Morgan, 1981; Wilson et al., 1981). It also may be that particular components of anxiety are differentially affected by various treatments. Schwartz, Davidson, and Goleman (1978), for example, in a comparison study of practicing meditators and aerobic exercisers, found that exercisers reported more cognitive and less somatic anxiety while the meditators reported the obverse.

It has been hypothesized that acute physical activity can produce anxious behavior and symptomology in persons suffering from anxiety neurosis and in normals under

certain conditions (Ledwidge, 1980). A convincing study of 20 anxiety neurotics confirmed that in all cases where there was exercise intolerance it was attributable solely to mitral valve prolapse, a particular physiological complaint (Crowe et al., 1979). In another clinical population, a National Exercise and Heart Disease Project study found that, among 784 men who had suffered myocardial infarction within the previous three years, anxiety scores rose after a six week low-level exercise program (Stern & Cleary, 1981). The authors speculated that some patients experienced negative psychological effects from exercise, particularly fear of heart attack. In addition, Abood (1984) found that a single 5-minute episode of bench-stepping failed to reduce state anxiety in high-anxious women and actually increased it in low-anxious women. This finding provided evidence that attitudes toward exercise may affect any psychological changes that occur with physical activity.

Ledwidge (1980) has suggested that anxiety neurotics and others who have an intolerance for somatic conditions associated with exercise may associate rapid breathing, increased heart rate, and physical tiring with anxiety symptoms, most commonly breathlessness, heart palpitations and fatigue. He recommended "graded exposure to the distress of exercise" (p. 130) to desensitive the anxious to their somatic symptoms by the process of cognitive

relabeling. "Whereas the anxiety neurotic, under normal conditions, is frightened by the physical manifestations of his or her own anxiety, which in turn increases the level of anxiety and, in vicious circle fashion, leads to panic, the same individual, experiencing the same symptoms while exercising, correctly attributes them to the activity and is not alarmed by the discomfort" (p. 131).

In the pilot study performed as part of this research project, the researcher found that reducing daily anxiety and stress was the most frequently given reason for exercising. Subjects spoke at length during their interviews about the joys of releasing tension accumulated at work on an incremental basis either at lunch or immediately after work and often both. It appears that for the population of chronic exercisers, the anxiety-reducing properties of single bouts of physical activity are important inducements to exercise frequently.

Effects of chronic exercise on anxiety. As with acute exercise, a number of studies have provided evidence that participation in cardiovascular conditioning programs can produce anxiety reductions beyond those demonstrated in control groups (Gillespie, Schork, Klein, & Zyzanski, 1982; Goldwater & Collis, 1985; Lobitz et al., 1983; Neddo, 1984). In a study of psychosocial stress, 15 aerobically trained and 15 untrained subjects were exposed to a series

of stressors (Sinyor et al., 1983). At the conclusion of the session, the trained subjects showed lower state anxiety levels as measured by the Spielberger State/Trait Anxiety Inventories (STAI). Trait anxiety did not differ between groups. In a National Exercise and Heart Disease Project study (Stern and Cleary, 1982) 651 myocardial infarction (infarct) patients participated in either low-level (below 72 percent of maximum heart rate) exercise or control groups for two years. No differences on anxiety measures were found between groups at any testing period. The authors proposed that in order to achieve a significant effect, exercise of greater intensity and duration might be required. In the only study to demonstrate a positive effect of exercise on trait anxiety, 16 healthy middle-aged adults significantly lowered both state and trait anxiety scores after 10 weeks of a walk-jog program while controls did not (Blumenthal, Williams, Needels et al., 1982).

Effects of Aerobic Exercise on Depression

Depression is a complex pathological condition characterized by loss of interest in usual activities, appetite disturbance, change in weight and sleep patterns, motor agitation or retardation, decreased energy, loss of concentration and feelings of worthlessness and guilt (APA, 1980). Since depression is often accompanied by psychomotor incapacitation, it is not surprising that

vigorous physical exercise has often been prescribed and researched as a means of alleviating feelings of helplessness and low self-esteem in mild or moderately depressed persons (Morgan, Roberts, Brand, & Feinerman, 1970; Silva & Schultz, 1984). Major depressions of long standing are best treated with drug therapy (Eischens & Greist, 1984). It is likely, however, that exercise may be of secondary benefit to severely depressed patients (Hinkle, 1988). Although antidepressant effects of exercise are widely accepted, Hughes (1984) found in his review of the literature that these are not unequivocally substantiated.

Effects of Exercise on Depression in Clinical Samples. Several studies have dealt with exercise effects in clinically depressed samples. An early study by Griest and colleagues compared running with psychotherapy in mild to moderately depressed patients (Griest, Klein, Eischens, Faris, Gurman, & Morgan, 1979). Although Griest et al. concluded that exercise was at least as effective as psychotherapy in treating depression, the absence of a true control group confounded the results. It is possible that the patients might have improved with the passage of time without intervention of any type. On the other hand, Stern and Cleary (1982) in a study of 651 post-infarct patients found no difference in depression scores between controls and exercisers at six months, one-year, or two-year

testing. In another post-infarct study, however, Stern and Cleary (1981) found that while exercise decreased depression scores for the majority of patients, the depressed subjects experienced no greater change than the nondepressed. In considering reports of exercise-related reductions of depression it may be that findings for this clinical population cannot generalize to healthy persons. It has been substantiated that "myocardial infarction patients differ psychologically both from normal subjects and from coronary-prone persons before a cardiac episode" (Berger 1984).

In other clinical samples McCann and Holmes (1984) studied the effects of vigorous exercise on 43 depressed college women. Using random assignment, the researchers placed subjects in either a 2-hour-per-week aerobic program, a relaxation training group, or a no-treatment group. Subjects did not evince differences in expectancies for treatment. At the end of 5 weeks all groups had reduced depression; however, the exercise group demonstrated reliably greater decreases than the other groups. A second 5 weeks did not add appreciably to the treatment effect. In a similar study on a population of students who had experienced a large number of stressful life events during the preceding year, Roth and Holmes (1987) found that depression scores for the exercise group were significantly lower after 5 weeks of training than scores for either

the relaxation or control groups. Again, the second 5 weeks added little to the anti-depressant effect. Although not conclusive, there appears to be some evidence that aerobic exercise may be a healthful adjunct in the treatment of clinical depression.

Effects of Exercise in Non-Clinical Samples. Of more interest in this study are the anti-depressant effects of exercise in non-clinical samples. In a study of a non-clinical middle-aged population at Duke University (Blumenthal, Williams, Needels et al., 1982), 16 volunteers who participated in a 10-week run-jog program were compared to matched controls. Using the Profile of Mood States, researchers observed a small but nonsignificant reduction in depression scores for the treatment group and a significant increase for the controls. Taking into consideration other positive mood changes occurring in the treatment group, the authors concluded that fundamentaly healthy, well-adjusted individuals can enhance their sense of well-being through exercise. An alternative explanation could be that participants had greater expectation for improvement. Using the Zung Self-Rating Depression Scale (Zung, 1965) Morgan and colleagues (1970) investigated the anti-depressant effects of aerobic exercise in 101 adult males engaged in a six weeks training program. Analysis uncovered significant reductions only among the 11 subjects

who were depressed at the onset of the study. Failure to observe decrements in depression in subjects of normal range may in part be due to the insensitivity of the instruments to the necessarily smaller changes (Berger, 1984).

Folkins (1976) studied the effects of physical training on mood in 36 high coronary risk middle-aged men. Although subjects scored within the normal range on anxiety and depression initially, after a 12-week fitness program the exercise group significantly reduced both scores while controls reduced only slightly. In a study of the anti-depressant effects of jogging on a college population, Brown, Ramierz, and Taub (1978) divided 561 subjects into four unequal groups: clinically depressed joggers (n=91), depressed non-exercising controls (n=10); nondepressed joggers (n=406), and nondepressed controls (n=54). Subjects were offered a choice of not participating in exercise or exercising three or five times per week for 10 weeks. All groups significantly reduced their depression scores (as measured by the Zung Depression Scale); however, the joggers who exercised five days per week evidenced the greatest decreases.

To date, little is known about optimal levels of exercise for psychological enhancement. There have been some reports of over-exercised endurance athletes presenting a depressive psychological profile (Dishman, 1985), which

suggest a point beyond which exercise benefits become detriments. Participants in this researcher's pilot study, who regularly exercised aerobically between 6 and 16 hours per week, initially presented generally low depression scores on the Profile of Mood States. Study participants were assigned to one of four groups: control, attention-control, relaxation or exercise reduction. At the end of 10 weeks there was a nonsignificant trend toward even lower depression scores in the group that reduced its exercise to 5 hours a week or less. Although these results are highly speculative, perhaps exercise of this magnitude exacerbates common depressive symptoms. One purpose of the proposed dissertation study is to help define the level at which exercise is optimally effective in ameliorating depression.

Hypotheses to Explain the Effects of Exercise on Anxiety and Depression

"The effects of exercise on anxiety and depression have been attributed to diversion, social reinforcement, experience of mastery, and improved response to stress through reduced muscle tension, heart rate, skin conductance, and catecholamine, glucocorticoid, or lactate production" (Taylor et al, 1985). It has been proposed that "distraction from stressful stimuli rather than exercise per se is responsible for the improved affect associated with exercise" (Morgan, 1984, p. 96). Various

studies have compared the effects of an acute bout of aerobic exercise and relaxation, meditation, biofeedback and rest on negative mood states (Berger, 1986; Berger & Owen, 1983). Research has centered around anger/hostility, dejection/depression, tension/anxiety, vigor and fatigue as measured by the Profile of Mood States or state anxiety measured by the Spielberger State-Trait Anxiety Inventory. In theory, the simple act of focusing one's attention on some thought or activity distracts one from focusing on negative feelings about self (Folkins & Sime, 1981). Findings generally have indicated that exercise is at least as effective as the more passive therapies in ameliorating negative mood and increasing feelings of vigor (Bahrke & Morgan, 1978; Ewing et al., 1984; Griest et al., 1979, Hilyer et al., 1982, Morgan et al., 1970). The question of the relative duration of these effects is as yet unanswered; however, there is some evidence that tension reduction through exercise is more long lasting than through the other modes (Morgan, 1984). Laboratory evidence of faster recovery from acute psychosocial stressors in aerobically trained, as opposed to untrained, athletes may reflect on adaptive emotional coping response (Sinyor et al., 1983).

Mastery Hypothesis. Aerobic activity, by giving an individual a sense of being in charge of bodily processes such as heart rate, breathing and muscle action, is

thought to automatically produce a feeling of mastery (Soloman & Bumpus, 1978). Some behavioral therapies, hypnotherapy and biofeedback employ similar maneuvers in the course of treatment. By provoking positive mental images and linking otherwise anxiety-producing situations to general muscle relaxation, the individual experiences a systematic desensitization to the event, in this case the pounding heart, rapid breathing and strenuous muscle work once associated with flight or fear. An altered state of consciousness thus results from the repeated association of increased physical reactivity with intrinsic rewards: accomplishment of a strenuous physical task, a streamlined body and control of personal action and environment (Ravizza, 1984).

Relaxation Hypothesis. Morgan (1981) has suggested that explanations of the mechanisms through which exercise influences affect will be best found at the physiological level. For example, anxious and depressed persons tend to experience more muscle tension than do normals. Exercise, however, produces a natural relaxation of the muscles post exercise, a condition antithetical to the somatically tensed state of the clinically anxious (Ledwidge, 1980; Morgan, 1981).

Lactate Hypothesis. A second physiological basis for decreased symptomology is based on biochemical research demonstrating an association between excessive blood

lactate levels and anxiety (Ledwidge, 1980). A rise in lactate, a by-product of anaerobic metabolism, is a normal result of exercise. It is known that anxiety neurotics chronically overproduce adrenaline. It may be that increased adrenaline production leads to a concommitant increase in lactate which acts on cell enzymes to fulfill what the body perceives as a demand for energy. Two established benefits of aerobic training are diminished lactate production at a given workload and faster elimination of lactic acid from the bloodstream during vigorous exercise. By extension, it may be that fitness training may decrease anxiety symptoms by reducing lactic production.

Deep Sleep Hypothesis. Third, exercise has been shown to promote healthful sleeping patterns, particularly the stage 3 and 4 sleep necessary to feel fully rested upon wakening (Folkins & Sime, 1981; Ledwidge, 1980). Anxious and depressed persons often complain of fatigue and have been shown to experience a lack of deep sleep. A month's deprivation of regular exercise in college students produced "a change in sleep patterns suggesting increased anxiety" (Baekeland, 1970, p. 368). Thus, relief of depressive symptoms through aerobic exercise may also be partially explained through changes in sleeping patterns.

Catacholamine Hypothesis. A fourth hypothesis regarding the anti-depressant effect of exercise concerns

biochemical alterations occurring during aerobic activity (Morgan, 1984). The catacholamine hypothesis of affective disorders posits that lower production of norepinephrine in the brain is related to chronic depression and bi-polar disease. Animal research has demonstrated a greater presence of norepinephrine in exercised as compared to sedentary animals and improved emotionality in rats after chronic exercise. Depressed and manic patients are known to have lesser concentrations of brain norepinephrine in their urine than normals. Moreover, amphetamines, used in the treatment of depression enhance norepinephrine concentrations as measured in the urine. Likewise, with aerobic exercise of 30 minutes duration, norepinephrine excretion through the urine rises to 4.5 times that of pre-exercise levels (Ledwidge, 1980).

Endorphin Hypothesis. A final hypothesis common in popular exercise literature attributes positive mood changes associated with aerobic exercise to increased opiod activity in the brain (Markoff, Ryan, & Young, 1982). In theory, the endorphins reduce the sense of pain and produce a state of euphoria similar to that brought about by cocaine. Research has confirmed that plasma endorphins (endogenuous peptides with morphine-like effects) do increase with vigorous physical activity. The connection between the acute mood changes associated with exercise and endorphin activity, however, has not been confirmed.

Double-blind studies with runners have demonstrated that after exercise subjects were unable to discriminate between injections of a placebo and naloxone, an opiate antagonist. Since the dosage of naloxone was 0.8 mg, twice the dosage sufficient to reverse opiate-induced coma, it was proposed that if endorphins were indeed responsible for mood alteration post-exercise, any positive effects would be counteracted by the naxolone injection. The researchers found, however, that, regardless of treatment condition, subjects completing at least one naloxone and one placebo trial significantly reduced scores on the anger/hostility, depression/dejection scales of the POMS immediately post-exercise. The key to the puzzle may lie in determining appropriate dosage. Studies using injections of less than 10 mg. have produced no effects. The single study using a dosage of 10 mg. produced complete blockage of the analgesia present under normal conditions (Morgan, 1985). To date, however, the role of endorphins in the enhancement of mood with exercise has not been established (Dishman, 1985).

It is apparent from the previous discussion that the physiological and psychological mechanisms involved in exercise and its effects on anxiety and depression are complex and interrelated. Although investigation of the physiology of depression is beyond the scope of this study, the existence of a mind-body connection (that is, the

effects of exercise and the resultant bodily changes on the mind and emotions) is central to the argument for this research. For most persons, vigorous physical exercise performed 3 or 4 times weekly appears to produce an anti-depressant effect born of a combination of muscle relation, feelings of self mastery and sound sleep partially determined by resultant biochemical changes in the body. The question of the presence and degree of this effect in persons who exercise double or triple this amount has not been determined and is a major component of this study.

Physical Risks of Aerobic Exercise

Although much research has been devoted to endurance training and its effect on the body, primarily the cardiovascular system, little investigation has involved the question of exercise abuse and other hazards of exercise. The long-term effects of regular exercise on the musculoskeletal system have not been studied. What research does exist deals with acute injury and suffers from a lack of definitions, poor characterization of sub-groups within each exercise mode, lack of controls, selection bias and disregard of time intervals. When risks are not evaluated, the operational assumption is that exercise is, without qualification, a healthful activity (Koplan, Siscovik, & Goldbaum, 1985). As a result, many questions arise, to wit: What are the hazards associated

with aerobic exercise? At what point do exercise risks outweigh the benefits? What role do personality and mood factors play in weighing the risks and benefits?

Musculoskeletal Injury

For the purposes of this study, the term injury refers to musculoskeletal damage incurred as a result of exercise. Chance of injury varies with gender, body build, fitness level, age and mode, frequency, intensity and duration of exercise (Wells, 1985). Over a 4.5 year period, data from a sports medicine clinic in New York disclosed that the most frequently injured body parts were the knee (45.5 percent), the ankle (9.8 percent, and the shoulder (7.7 percent). Thirty-five percent of all injuries were derived from running. Males comprised 69 percent of the patients, females, 31 percent.

Injuries tended to be specific to particular sport acitivites. Runners, not surprisingly, tended to suffer hip, knee and foot injuries at significantly greater rates than nonrunners (Goodyear & Blair, 1984). Runners had a 1 in 3 chance of being injured and a 1 in 10 chance of seeking medical attention for a running-related injury in any given year. Almost a third of cyclists had a biking accident within a 3-year period with 13 percent having occurred in any given year. Sixty-two percent of these riders were injured, and of those injured, 32 percent sought medical attention. The primary hazard associated

with swimming was death by drowning; however, swimmer's ear, conjunctivitis, dental enamel erosion, and shoulder injuries (described in up to 50 percent of competitive swmmers) occurred frequently. In aerobic dance classes, 36 percent of injuries occurred below the knee; 76 percent of these were stress fractures or tibial stress syndrome (Koplan et al., 1985). Knee injuries comprised another 35 percent of the total.

In runners, injuries, particularly of the hip, knee, and foot, consistently have been found to increase with increasing mileage and intensity of workouts (Diekhoff, 1984; Valliant et al., 1981). Women averaging over 40 running miles per week have been found to experience higher incidence of stress fractures, hematuria, hip and back problems, sore feet, achilles tendonitis and heel pain than those running between 25 and 40 miles (Rudy & Estok, 1983). Reduced flexibility of the extensor muscles of the hip, leg and ankle caused by repeated muscle contraction can lead to poor posture, fatigue and injury (Pollock et al., 1984). In a second study, Estok and Rudy (1986) found that among a sample of 95 female runners, marathoners reported a significnatly higher incidence of heel pain and stress fractures than did non-marathoners. Both groups reported a high incidence of knee injury.

Sudden Death

The death of running czar Jim Fixx during a training run has led some to question the risk of dying from

exercise. The occurrence of sudden death during or immediately following vigorous exercise is generally caused by cardiac arrhythmia secondary to underlying CHD. A Rhode Island study of sudden death during jogging found an incidence rate of one death per 7,620 joggers, a rate seven times lower than the estimated death rate during sedentary activities (Leon, 1985).

Quantity of Exercise

How much exercise is too much? For many adults, running programs of moderate to high intensity (80 to 90 percent of maximum heart rate reserve) may not be suitable or enjoyable (Pollock et al., 1977). Musculoskeletal injuries to the foot, leg, and knee increased from 24 to 54 percent when beginners jogged (even with some walking interspersed) 45 minutes per day compared with 30 minutes. Regarding duration, it has been estimated that more than 95 percent of the improvement in aerobic capacity can be attained in a 4 to 5 day per week aerobic training program; additional days of training are, therefore, probably unnecessary. Furthermore, orthopedic injuries increase exponentially with exercise frequency. Beginners who trained 30 minutes daily for 1, 3, or 5 days per week suffered 0.0, 12.0, and 38.9 percent injury rates respectively. As a general rule, frequency and duration can be increased at the rate of 10 percent per week (Pollock et al., 1984). Conditioning every other day is

most frequently recommended when an endurance program is initiated. Daily, vigorous activity does not allow enough time for the muscoloskeletal system to adapt properly. The point in time when an individual can progress to a daily regimen is dependent upon age, initial level of fitness, intensity of training and freedom from excessive soreness and injury. Generally persons who are overweight, older and lower in fitness are more prone to exercise-related difficulties.

Amenorrhia

Recently much attention has been given to the amenorrheic female athlete. Twenty-five to 40 percent of female endurance athletes report a condition of secondary amenorrhia, cessation of menstruation after menarache for between 3 and 6 months (Wells, 1985). In a well-controlled study of amenorrheic and eumenorrheic (normally menstruating) women, Drinkwater et al. (1984) discovered that among the women reporting less than 3 menses a year, vertebral (but not radial) mineral density was significantly lower than in subjects with normal menstrual cycles. Although the average age of the subjects was 25 years, the amenorrheic group's average bone mineral density was equivalent to that of women 51 years old. In addition, the amenorrheic women had significantly lower female hormone levels. Although subjects did not differ on age, height, weight, lean body mass, age at menarche, exercise

history or frequency and duration of training, amenorrheic women did average 41.8 running miles compared to the 24.9 for the normals. The data suggest an interaction between estrogen and exercise resulting in an artificial menopausal (osteoporetic) effect on vertebral bone density. Oddly, vertebral bone density in male runners has been found to be approximately 20 percent higher than in male nonrunners, and physical activity has been shown to reverse bone loss in postmenopausal women.

Psychosocial Risks of Aerobic Exercise

Little is known about the etiology, diagnosis, treatment, prevalence or incidence of negative effects of aerobic exercise. Aerobic exercise by and large appears to be a healthful activity with many benefits for leading a long, happy and disease-free life. For chronic exercisers, however, the risks may outweigh the benefits and indeed produce a mild pathological effect. If exercise is used as the priamry means of fashioning the self-image or of coping with stressors, the result may be great fatigue, inability to concentrate, neglect of family and friends, poor eating habits, tension, depression and anxiety. Excessive running is characteristic of many patients suffering from anorexia nervosa, but it may well be that exercise is a result rather than a cause of the syndrome (Taylor et al., 1985; Yates, Leehey, & Shisslak, 1983). Individuals

consumed with the drive to exercise may ignore body signals and continue exercising when they are sick, injured or fatigued, thus exacerbating the chance of serious injury (DeFries, 1981; Rudy & Estok, 1983).

Running Addiction

The phenomenon of running addiction has been explained in numerous ways ranging from positive addition (Glasser, 1976) to enactment of masturbatory fantasies (Cooper, 1981). Sachs (1984) defined exercise addition as "dependence, of a psychological and/or physiological nature, upon a regular regimen of exercise, characterized by withdrawal symptoms after 24-36 hours without exercise" (p. 437). Withdrawal symptoms such as anxiety, tension, guilt, nervousness, twitching muscles and feeling bloated are key determinants of the existence of exercise addiction (Harris, 1981; Summers et al., 1982). Missing even one daily run has been shown to increase depression and increase galvanic skin response in habitual runners (Thaxton, 1982).

Withdrawal symptoms may be explained in several ways. It may be that expectations, promulgated by such publications as Runner's World, lead athletes to expect to feel symptoms if they miss a run. Second, when an exercise session is missed, the individual may experience insufficient stress reduction. Likewise, persons who rely on exercise for a sense of mastery may suffer a concommitant decrease in self esteem with each missed

exercise bout. Last, persons who use exercise to modify pervasive negative mood states may misinterpret return to dysphoric mood as physiological withdrawal (Sachs & Pargman, 1984).

One of the benefits of exercise discussed earlier is the sense of control or mastery of environment achieved through vigorous activity. This is the concept of "positive addiction" coined by Glasser (1976). Until recently it was commonly assumed that exercise dependence was in most ways a positive and healthful phenomenon. A few spokespeople in the exercise arena have now come forward to identify the negative aspects of obligatory exercise. They posit that chronic excessive exercise reverses the usual sense of mastery so that exercise controls the individual and eliminates other choices in life. The term addiction implies that exercise has turned from a healthful habit to a controlling and harmful activity. Exercise addiction has also been referred to as exercise dependence, compulsion, commitment and abuse (Dishman, 1985), terms that will be used interchangeably in this paper.

Measurement of exercise addiction is currently in its infancy. Of the three or four checklists purporting to measure commitment to running, runner's withdrawal symptoms or running addiction, none has reliability or validity data available. The Sachs and Pargman scale

(Sachs & Pargman, 1979) and the Carmack and Martens scale (Carmack & Martens, 1979) both focus solely on the positive aspects of addiction. Moreover, questions do not address the frequency or severity of reported behaviors, important features of addiction and withdrawal (Hailey & Bailey, 1982; Sachs & Pargman, 1984). Measurement of exercise dependence in sports other than running has not been attempted.

One has only to open a magazine to find examples of societal values contributing to the phenomenon of obligatory running. Aside from the common belief that "more is better," the current fashion of exquisite slimness and lean, muscular body type undoubtedly contribute to exercise abuse. Surveys describing runners' motivations to begin and continue execise generally rank body image factors (weight control, being able to eat more, body shape) as equal in importance to physical health and mastery (Johnsgard, 1985a; Johnsgard, 1985b; Roth, 1974; Sachs & Pargman, 1979).

An article in the New England Journal of Medicine (Yates et al., 1983) compared obligatory runners to anorexics in terms of their extraordinarily high personal expectations, tolerance for physical discomfort, denial of potentially serious injury and tendency toward depression and anger. Interviewing 60 long distance runners, the authors noted that "the typical obligatory runner is a

diet-conscious man, whereas the typical anorexic is an exercise-conscious woman. Both are balancing input and output on a scale of indescribable delicacy" (p. 255). They found both groups exercised in spite of illness, performed elaborate rituals, strictly monitored their diets and responded to an unaccustomed dietary departure by increasing running mileage.

Gathering data about exercise addiction has been an uneven proceeding. Kagan and Squires (1985) found positive correlations between various exercise parameters (time spent exercising, number of miles run per week, number of months of regular exercise) and addictive tendencies as measured by a standard addiction scale. For women these parameters were also significantly associated with Type A behavior. Folkins and Wieselberg-Bell (1981) studied MMPI scores for 46 ultramarathon (100 mile race) entrants. Although all scale means were within the clinically normal range, mean psychopathic deviate and schizophrenia scores were elevated one standard deviation above the mean. Also, the 26 runners who finished the race scored significantly higher than nonfinishers on hypochondriasis, depression, hysteria, psychopathic deviate and schizophrenia scales. A similar investigation (Colt, Dunner, Hall, & Fieve, 1981) administered the Schedule for Affective Disorders and Schizophrenia-L form (SADS-L) to 61 runners (average mileage 37.9 per week). Using orthopedic surgery

candidates as controls, the researchers discovered that 7 of 22 female and 6 of 39 male runners were diagnosed as having a primary affective disorder compared to only 3 of 23 controls.

Several studies have attempted to distinguish injured from uninjured athletes on the basis of personality factors. Crossman (1985) in her review found little evidence to support a psychosocial basis for injury. Estok and Rudy (1986) examined addictive behavior and various injuries in female runners but found no significant associations. On the other hand, a study of 68 runners who had exercised regularly for over 2 years demonstrated a positive association between number of injuries and Type A behavior, commitment to running, and addiction to running (Diekhoff, 1984).

One difficulty in conducting research on exercise dependence is the reluctance of exercisers to abstain from their sport. Baekeland (1970), in recruiting subjects for a study on the effects of exercise deprivation on sleep, discovered that many would-be participants refused to abstain from exercise even for a fee. Bahrke et al. (1986), in the only study of its type, compared 7 males who ceased aerobic activity for 6 weeks with 6 controls. (Subjects were allowed to participate in anaerobic activities). All participants had exercised aerobically at least 3 times per week for 2 or more years. Initially both

groups displayed Morgan's iceberg profile (Morgan, 1980). At the end of 6 weeks the exercise cessation group had increased total mood disturbance (as measured by the POMS) 171 percent compared to a decrease of 79 percent for controls. Not only does this study lend weight to the argument that exercise deprivation results in mood disturbance; it also appears that even after 6 weeks participants had not adjusted psychologically to being deprived of aerobic exercise.

A much different but not unrelated investigation of 72 male neurotics referred to a British clinic found that many of the patients fit into one of two extreme categories (Little, 1981). Thirty-nine percent overvalued health and fitness to the exclusion of other interests; 42 percent, on the other hand, had been purely sedentary all their lives. Among the 44 athletic subjects, a direct threat to their own physical wellbeing, often a slight illness or injury, had precipitated the breakdown in 32 cases. Among the nonathletic patients, the figure was 3 of 28.

These findings have implications for this study. It may be that persons who overvalue physical exercise may be more likely to experience negative psychological effects, even neurotic breakdowns, when their physical wellbeing is threatened, as is likely to occur at some time in their lives. Having greatly relied on exercise as a coping mechanism, these individuals may experience precipitous

increases in anxiety and depression when injury or circumstance renders them unable to exercise once or twice daily.

Motivation to Exercise

Despite the demonstrated and presumed benefits of aerobic exercise, at least two-thirds of Americans do not exercise regularly and only 15 to 20 percent exercise at levels recommended for cardiovascular fitness (Martin & Dubbert, 1982). It has been a matter of some research concern, therefore, to determine who enters and who adheres to exercise program. The definition of adherence to exercise varies depending on the exercise program involved, but for the purposes of this paper, adherence is defined as participation in the program at some minimal frequency ensuring physiological and/or psychosocial benefit. Most empirical investigations in this vein have taken the form of retrospective analyses of variables characterizing the exercise beginner in planned programs for either healthy or cardiac rehabilitation populations. Little is known about long-term adherence or the personal, situational or historical factors influencing chronic exercisers.

Determinants of adherence can be categorized to include personal characteristics (e.g., past participation patterns, Type A behavior, personal expectancy, perceived health), environmental characteristics (spousal support, cost, medical screening, climate) and activity

characteristics (perceived discomfort, activity intensity) (Dishman, Sallis, & Orenstein, 1985). Drop-outs tend to be older, overweight, sedentary, cigarette smokers and blue collar workers (Massie & Shephard, 1971; Oldridge, 1979; Oldridge, 1982). Drop-outs in cardiac rehabilitation programs have been found to be more depressed, anxious and hypochondriacal than compliers (Blumenthal, Williams, Wallace, Williams, & Needles, 1982). Most withdrawals occur within 3 to 6 months of beginning an exercise regimen (Martin & Dubbert, 1982).

Neither understanding the healthful effects of exercise nor feeling at risk for illness appear to be powerful motivators to exercise (Lindsay-Reid & Osborn, 1980); however, McCready and Long (1985) found that persons with an internal locus of control tended to adhere more faithfully to an aerobic fitness program than did subjects with an external locus of control. Furthermore, in two studies, self-motivation, the inherent quality of persisting in tasks once begun, proved to be the greatest discriminator between who did and did not remain in exercise programs (Dishman & Ickes, 1981; Dishman, Ickes & Morgan, 1980). Examination of individuals who have successfully incorporated exercise into their lifestyles have consisted primarily of surveys of race participants (Johnsgard, 1985a; Johnsgard, 1985b; Roth, 1974). In general, these surveys have identified physical wellbeing,

tension reduction, weight control and mastery of a difficult task to be the principle reasons runners continue to exercise. Opportunity for social interaction and a feeling of centeredness also have been cited as important motivational concommitants of running. For example, in the pilot study performed by this researcher, subjects exercising more than 6 hours per week were asked to list the 3 factors that most motivated them to exercise. None of the 24 participants listed a reason other than the 6 given above. Obviously, the tension control factor has particular application to the hypotheses of this proposal.

Relaxation

The basis of modern relaxation techniques, most notably progressive relaxation, autogenic training and guided imagery, lies in the meditative heritage of the Eastern religions (Lichstein, 1988). Most 20th century inventions are adaptations of time-honored meditative approaches. Hinduism, yoga and Buddhism have encouraged the practice of meditation to achieve wisdom through contemplation, altered consciousness and relaxation.

Edmund Jacobson (1888-1983) is credited with the development of the progressive relaxation technique, whereby one alternately tenses and relaxes muscle groups to achieve a greater awareness of the difference between body tension and muscular relaxation (Jacobson, 1929; Lichstein, 1988). The Jacobsonian method originally used between 50

and 140 distinct treatment sessions over a period of as much as 6 months. Wolpe, however, developed an abbreviated format using between 5 and 7 sessions. Jacobson himself endorsed a format using 1 or 2 sessions, although his emphasis lay in a much greater number of sessions.

In the 1960's and 70's variations of relaxation, such as transcendental meditation (TM) and systematic desensitization, came into wide use (Lichstein, 1988). It was with the advent of biofeedback, however, that the medical profession was won over to the ranks of those prescribing relaxation in the treatment of pain management, hypertension and heart disease. With the advent of behavioral medicine in the 70's, self control methods were developed that extended relaxation into the individual's personal environment. Cue-controlled conditioning, coping relaxation and applied relaxation used deep breathing and cognitive prompts in combination with cognitive restructuring approaches to combat tension and anxiety outside the professional's office. Numerous protocols, including stress innoculation, anxiety management training and self controlled desensitization, combined under the rubric of stress management.

In examining the research of relaxation-based treatments, comparisons are difficult because of the lack of consistency and procedural variation found therein (Lichstein, 1988). Experiential and biological changes

resulting from relaxation have been found to be large but also highly variable among individuals with respect to their magnitude and longevity as well as the amount of practice needed to sustain them. Moreover, these effects are in part dependent on the individual's receptivity to the particular treatment. In addition, little is known about long term effects of relaxation as most research has focused on state effects. Because of the great variation in protocol and format, relaxation treatment method by and large has been at the discretion of the therapist.

Stress management programs for the alleviation of chronic anxiety have tended to use progressive relaxation (Hamilton & Bornstein, 1977; Jannoun, Oppenheimer, & Gelder, 1982; Sarason, Johnson, Beberich, & Siegel, 1979), self-control relaxation (Barlow et al., 1984; Forman, 1982) or meditation (Lester, Leitner, & Posner, 1984). Often more than one relaxation method has been employed (Lichstein, 1988). Hoelscher, Lichstein and Rosenthal (1984) found 4 progressive relaxation sessions coupled with home practice to be effective in reducing state anxiety. In another study (Fairbank, DeGood, & Jenkins, 1981), three sessions of progressive relaxation were sufficient to reduce anxiety in a woman suffering from post-traumatic stress disorder. Using cue-controlled relaxation with anxious college students, Spoth and Meade (1981) found reductions in state anxiety after 6 hour-long sessions.

In addition, after 4 taped relaxation sessions in combination with biofeedback 20 anxious outpatients reduced both state and trait anxiety (Mathew, Hoe, Kralik, Weinman, & Claghorn, 1981).

Although little research has examined the efficacy of relaxation in the treatment of depression, available results have been positive (Lichstein, 1988). Although depression is characterized by decreased activity and energy, relaxing treatments have proved useful in neutralizing distressing thoughts and reducing the tension that accompany mild or moderate depression.

Relaxation techniques have also been applied to Type A subjects in an effort to reduce coronary-prone behaviors. Intervention has been most effective in ameliorating the hard-driving, competitive and impatient aspects of TABP (Suinn, 1982). In subjects with initially high levels of Type A behavior, Jenni and Wollershein (1979) found both cognitive therapy and stress management training effective in reducing self-perceptions of these behaviors. Benson, Alexander and Feldman (1975) found reductions in premature ventricular contractions in 8 of 11 heart disease patients after 4 weekly sessions of meditation. Hazaleus and Deffenbacher (1986) found an eclectic mixture of relaxation techniques effective in reducing manifestations of anger (an important component of the TABP) in college students. At 4-week follow-up

reductions remained significant. It is thought that "development of a relaxed attitude as a product of relaxation practice may claim particular salience in this domain" (Benson et al., 1975).

Although research is scarce, it may be that the adoption of relaxation techniques may have long-term implications for life enhancement. Sherman and Plummer (1973), in an investigation of well-adjusted, undergraduate students, found that 2 years after a 6-session self-control relaxation program participants were still practicing relaxation and maintaining its psychological benefits. In the current study, one item of interest is the possibility of improved mood and decreased TABP among normals who have heretofore chosen exercise as their primary coping mechanism. It is proposed that training in relaxation may result in short-term positive psychological changes and, by extension, long-term lifestyle benefits.

Type A (Coronary Prone) Behavior Pattern

Coronary Heart Disease: Incidence and Etiology

Coronary heart disease (CHD) is a potentially fatal disease characterized by an insufficient oxygen supply (ischemia) to the heart due to a gradual accumulation of plaque in the arterial walls (Shekelle, Gale, Ostfeld, & Paul, 1983; Schocken et al., 1987). Over a period of some 20 to 40 years, the arteries gradually narrow until severe chest pain (angina) and/or myocardial infarction (heart

attack) occur. When a coronary artery is 75 percent occluded, the diagnosis is coronary artery disease (CAD); a diagnosis of coronary atherosclerosis refers to the disease process throughout the arterial system. CHD is the single cause of death before the age of 65 in the United States today; approximately 500,000 persons succumb to CHD each year. Middle-aged men are at greatest risk for premature coronary heart disease (Roskies, 1987).

A number of risk factors have been associated with the premature onset of heart disease. The most potent, or primary, risk factors are in order of importance: family history of heart disease, gender, hypertension (elevated blood pressure), high levels of blood cholesterol (hyperlipidemia) and cigarette smoking. Secondary risk factors include obesity, diabetes mellitus and lack of exercise (Lamb, 1984; Martin & Dubbert, 1982; Matthews, 1982; Troxler & Schwertner, 1985). In combination, risk factors geometrically increase the probability of developing CHD. Even so, less than 50 percent of CHD is explained by standard risk factors. In an effort to explain the remaining 50 percent, researchers have directed their attention toward behavioral and psychological factors in the form of what has come to be called the Type A (coronary-prone) behavior pattern (Roskies, 1987).

The Type A Behavior Pattern

The construct of the Type A (coronary-prone) behavior pattern was developed through the work of two

cardiologists, Ray Rosenman and Meyer Friedman, who studied the role of the central nervous system and behavior in the development of coronary disease. They defined the pattern as "a characteristic action-emotion complex which is exhibited by those individuals who are engaged in a relatively chronic struggle to obtain an unlimited number of poorly defined things from their environment in the shortest period of time, and, if necessary, against the opposing efforts of other things or persons in their same environment" (Friedman & Rosenman, 1969, p. 67). Their primary achievement lay in the development of a reliable method of diagnosing TABP in seemingly healthy persons and using it to predict CHD (Roskies, 1987).

Persons exhibiting the Type A pattern are hyperresponsive to challenge, expend more effort, are more self-involved and are more hostile than their more easy-going Type B counterparts (Barefoot, Dahlstrom, & Williams, 1983; Scherwitz, Graham, Grandits, Buehler, & Billings, 1986; Schwartz et al., 1986). Type As tend to communicate rapidly and explosively, incorporating many self-references in their speech patterns, exhibit impatience, competitiveness and aggression and hold very high performance standards (Barefoot et al., 1983; Dembroski et al. 1978; Ivancevich & Matteson, 1984; Margolis, McLeroy, Runyan, & Kaplan, 1982; Scherwitz et al., 1983). On measures of psychological distress, such

as anxiety, depression, somatization and neuroticism, no differences have been found between Type A and B subjects. It also appears that Type As have significantly less motivation than Type Bs to seek counseling intervention (Chesney et al., 1981).

Type As have been described as feeling a sense of urgency regarding time. Studies have demonstrated that Type A persons underestimate while Type Bs overestimate the passage of time (Bortner & Rosenman, 1967; Glass, 1977). In addition, Type A adults are more likely to be found in managerial positions than in blue-collar occupations (Burke, 1983), and Type A students are more likely to spend time studying, have higher career aspirations and belong to a fraternity or sorority than are Type Bs (Ditto, 1982). At least one study has indicated that Type A men have an alcohol intake approximately twice that of Type B men (Camargo, Vranizan, Thoresen, & Wood, 1986). Research has confirmed TABP as an independent risk factor in the pathogenesis of coronary heart disease (CHD); it is considered a set of overt behaviors characterizing future cardiac patients (Matthews, 1982).

The Role of the Type A Behavior Pattern in Coronary Heart Disease

In recent years a large number of prospective and retrospective studies have confirmed that men exhibiting the Type A pattern are more than twice as likely to develop

premature CHD and atherosclerosis than are their more relaxed counterparts (Brand, Rosenman, & Sholtz, 1976; Friedman & Rosenman, 1959; Jenkins, 1976; Rosenman, Friedman, Straus, Wurm et al., 1964; Roskies et al., 1978; Stevens et al., 1984). The foundation of this research dates back to two large scale prospective projects, the Western Collaborative Group Study (WCGS) and the Framingham Heart Study (Haynes et al., 1980; Heckler, Chesney, Black & Frautschi, 1988; McGee, 1973). The cohort for the WCGS was 1,384 apparently healthy male executives between the ages of 39 and 59. All were classified at intake as exhibiting either Type A or Type B behavior. After 4.5, 6.5 and 8.5 years, subjects identified as Type A were found to develop heart disease at rates between 1.7 and 4.5 times that of men judged as Type B. Moreover, Type A behavior was found to be independently associated with incidence of CHD and to be a stronger predictor for younger men. Subjects scoring in the highest third of the Type A distribution suffered a 1.7 times greater incidence of CHD than those in the bottom third. Among men who had evidence of CHD at the onset of the study, Type A behavior was associated with a higher rate of recurring heart attack (Jenkins, 1976).

Follow-up research in the WCGS yielded similar results. After 8.5 years, 257 of the original 3,154 subjects had developed CHD. One hundred seventy-eight of

the 257 had previously been judged to be Type A. Each CHD subject was matched for age, occupation and date of intake with two controls from the subject pool. In order to assess the behavioral components of CHD, the Structured Interview was administered to test Type A behavior and 12 of its operationally defined components. Using univariate analysis, the researchers found a significant relationship between incidence of CHD and hostility, competitiveness, rapid response to questioning and Type A content. When all 12 components were included in the regression model, only hostility remained a significant risk factor for development of heart disease (Hecker et al., 1988; Jenkins, Zyzanski, & Rosenman, 1978; Rosenman, Brand, & Jenkins, 1975; Roskies, 1987).

In an attempt to confirm the findings of the WCGS using the extensive extant data base from the Framingham Heart Study, researchers developed the Framingham Type A Scale from a 300-item psychosocial questionnaire (Haynes et al., 1980). Using 10 items from the instrument administered earlier to 1,674 disease-free males and females (ages 45-64) between 1965 and 1967, the researchers found they could indeed predict CHD. At follow-up 8.5 years later it was found that white-collar male workers who exhibited Type A behavior, suffered work overload, received frequent promotions and suppressed anger (anger-in) had developed twice the angina, coronary heart disease and

myocardial infarction of those classified as Type B. The association held only for men holding white-collar employment. Type A women developed twice as much CHD and three times as much angina as Type B women. Those who developed CHD also scored significantly higher on the anger-in, anxiety and tension scales.

Since the initial flurry of excitement regarding the predictive powers of the Type A pattern, results have been contradictory. In a study of men displaying at least two of three primary risk factors (hypertension, smoking, and high cholesterol), the Multiple Risk Factor Intervention Trial (MRFIT) found TABP to be unrelated to CHD incidence (Scherwitz et al., 1983). Studies comparing the extent of coronary atherosclerosis in Type A/B patients undergoing diagnostic angiography showed positive and negative results in nearly equal numbers (Blumenthal, Williams, Kong, Schanberg, & Thompson, 1978; Roskies, 1987; Zyzanski, Jenkins, Ryan, Flessas, & Everist, 1976). The most recent breakthrough in the understanding of the relationship of TABP to CHD occurred with the publication of an article based on data collected on 2,289 angiography patients at Duke University (Williams et al., 1988). After controlling for age, sex, high cholesterol, smoking and blood pressure, the researchers found an age-dependent association between Type A behavior and arterial occlusion. Among patients aged 45 and younger, Type As, as assessed by

the Structured Interview, manifested more coronary artery disease. The reverse held true for patients over 45.

Explanation of these findings involved the medical concept of survival effects:

> That is, some individuals may have biological vulnerabilities that make them particularly susceptible to the deleterious effects of the risk factor. If such persons are removed by death early in life, the older persons in the population at risk would be hardier, or less susceptible to the adverse effects of the risk factor. Biologically vulnerable Type As develop disease at relatively young ages, resulting in a positive association between Type A behavior and CAD severity in the younger patients. Surviving older Type A patients may be biologically hardier than their Type B counterparts, resulting in the observed reversal of the effect among the older patients. (p. 149)

Negative findings in other angiographic studies may be explained by the failure to evaluate the age by Type A interaction; that is, any positive relationship present for the younger patients might be cancelled out by the lack of relationship in the older group. The Duke study also confirmed earlier findings that the Type A factor held secondary status in comparison to smoking and high cholesterol. Negative statistical findings in earlier studies might be explained by the use of small sample sizes (150 of less) and the consequent yielding of insufficient statistical power. With samples of this size, the Type A effect might not have been detected even with sole use of subjects aged 45 or younger.

The Role of Autonomic Arousal in the Type A Behavior Pattern

Type A subjects have been consistently shown to exhibit greater sympathetic autonomic nervous system (ANS) arousal under conditions of challenge than have Type B subjects (Corse et al., 1982; Dembroski et al., 1978; Roskies, 1987). Using either the JAS or the SI, Type A subjects have been found to display greater heart rate variability, systolic blood pressure (SBP), skin conductance and vasoconstriction and greater elevations in coritsol, epinephrine and norepinephrine under challenge. Under normal conditions, differences in ANS arousal have been discovered in some studies but not in others (Dembroski et al., 1978; Lawler, Rixse, & Allen, 1983; Lovallo & Pishkin, 1980; Scherwitz et al., 1978). Type As nevertheless tend to react strongly under mental, physical and emotional conditions requiring even low-level autonomic response. Interestingly, under these conditions Type As report no more arousal or change in mood than do the unaroused Type Bs and are highly resistant to behavior change (Burke, 1983; Schwartz et al., 1986). This lack of awareness and resistance to change may be due in part to the individual's longstanding custom of hyperreactivity. Bergman and Magnusson (1986) in a longitudinal study of 233 Swedish school children, identified Type A characteristics at age 13 that remained stable at age 27. In theory, the

autonomic arousal that has been associated with both CHD and TABP may be that the mechanism by which Type A behavior translates to CHD. If this is the case, the hyperresponsiveness to perceived threat or challenge, of which Type As seem largely unaware, may prove a particularly difficult pattern to change. To date, however, a lack of empirical evidence renders the hypothesis of exaggerated autonomic reactivity a plausible and intriguing possibility (Roskies, 1987; Scherwitz et al., 1978).

Active coping with a stressor is known to increase sympathetic nervous system response and the release of catecholemines, such as norepinephrine, into the bloodstream. Elevated levels of catecholamines raise blood pressure, accelerate collection of blood platelets and arterial degeneration, speed lipid mobilization, produce myocardial lesions and induce fatal cardiac arrhythmias. Thus, the Type A individual's efforts to control uncontrollable events in the environment may contribute to the explanation of the coronary-prone, as well as the behavioral, aspects of the pattern (Matthews, 1982; Roskies, 1987).

Anger and Hostility

Of the more than 40 components defining Type A behavior in the JAS and the SI, hostility, anger, irritation and loud, abrupt speech appear to be most predictive of CHD (Matthews et al., 1977). A reanalysis

of the WCGS data indicated that one major factor, Anger-Hostility, accounted for 65 percent of the variance in predicting CHD (Roskies, 1987). Several recent studies have demonstrated a significant positive association of the potential for hostility and anger-in with extent of CHD (Barefoot et al., 1983; Dembroski et al., 1985; Shekelle et al., 1983; Williams et al., 1980). Within this context hostility is defined as "a durable predisposition to evaluate people or events negatively, often in a suspicious, distrustful, cynical or even paranoid fashion. Anger represents an emotional state incorporating feelings ranging from irritation and aggravation to rage and fury" (Roskies, 1987, p. 17).

In order to better understand the role of hostility in hypertension and cardiovascular disease, Schwartz and colleagues (1981) examined cardiovascular reactivity to various mood states induced through mental imagery during exercise and at rest. Anger produced significantly greater increases in diastolic blood pressure (DBP), pulse rate and slower recovery from exercise than fear, sadness, happiness or relaxation. Fear produced a larger number of intermittent muscle contractions while anger produced a higher, more generalized muscle tension. In short, the investigators found that certain physiological reactions (vasoconstriction and increased DBP) were associated with vigilance, increased muscle strength and protection

against hemorrhage necessary in a physical fight. Over time, the sustained muscle tension of a chronic angry "fight" response may have severe cardiovascular consequences. The intermittent contractions associated with fear, on the other hand, rally the speed and endurance needed to flee but may not couple with the cardiovascular system to produce chronic symptomology.

Williams and colleagues (1980) demonstrated that among 424 angiography patients, those with hostility scores less than or equal to 10 (as measured by the Cook-Medley scale of the Minnesota Multiphasic Personality Inventory) had 48 percent incidence of coronary occlusion compared to 70 percent for those with scores above 10. Although both Type A behavior pattern and hostility were independently associated with the presence of atherosclerosis, the hostility score carried the stronger relationship. These findings were confirmed in the Western Electric Study (Shekelle et al., 1983) where 1,877 male workers were examined annually for evidence of CHD from 1957 through 1978. Adjusting for age, blood lipid level, cigarette smoking, blood pressure and alcohol intake, researchers discovered that the difference between means of the first and fifth quintiles was associated with a 42 percent increase in mortality from all causes. Subjects who had scores in the lowest quintile (Scores less than or equal to 10) at first examination had lower prevalence of CHD at the

10 and 20 year marks. The association between hostility and CHD was not found to be linear as the middle quintiles experienced the most cardiac incidents. The researchers hypothesized that the absence of increased cardiac risk at higher levels of hostility represented sampling error. Over a 25-year period, Barefoot and his colleagues (1983) found CHD incidence to be nearly 6 times greater among physicians scoring above the median hostility score (as assessed by the MMPI) than those scoring below. This predictive relationship was independent of hypertension, family history of hypertension, cigarette smoking and age. Finally, persons scoring high on hostility were found to have elevated levels of low-density lipoproteins in a five-year dietary study aimed at reducing plasma lipids and blood pressure (Weidner, Sexton, McLellarn, Conner, & Matarazzo, 1987). The results were replicated at follow-up one year later.

It has long been proposed that persons manifesting TABP choose competitive rather than cooperative performance situations, actively perceive environmental threat, and respond to threat in a hostile manner (Jenkins et al., 1979; Margolis et al., 1979). These behavioral characteristics were graphically demonstrated in a social interaction life-simulation study conducted by Van Egeren in 1979. Sixty male and female subjects were classified as either Type A or B and were instructed to interact with a

partner by pressing buttons to transmit messages through a television screen. While heart rate and finger blood volume pulse were electronically monitored, the partners sent messages signalling cooperation, competition, punishment, reward or withdrawal during any interaction. Between interactions they could send 1 of 55 messages communicating requests, intentions or feelings. Over 20 trials, both male and female Type As exhibited more aggression, competition, and more than twice the vasomotor response of Type Bs. In fact, the Type A-Type A dyads competed twice as often and punished three times as often as the B-B dyads. They cooperated less frequently, gave less reward, expressed more anger, sent more threatening messages and attempted to dominate more often than did the Type Bs. Seeming to find competition stimulating, Type As sent the message, "When you compete I feel pleased" 17 times compared to twice in the Type B dyads. Moreover, they refused their partners' messages 15 times more than did the Type B dyads. In mixed Type A-B dyads, these differences disappeared; however, some Type A subjects reported a sense of frustration at their inability to compete and punish when their Type B partners were friendly and cooperative.

In sum, the Type A behavior pattern is a coping response used to gain control of one's environment. For the Type A individual this may mean enhanced self-esteem

and sense of mastery when successful. When unsuccessful it may mean a sense of pervasive threat or danger to self and a subsequent autonomic arousal implicated in the development of coronary heart disease. Upon possible loss of control, Type As initially increase their efforts, heighten competitiveness and increase aggression, hostility and anger. Type As tend to ignore evidence that control is not attainable and continue their exertions until recognition of failure is inescapable (Roskies, 1987).

Reported Stress, Tension, and Health

It has been hypothesized that Type A individuals, having a greater need for stress in their lives, seek out stress in their environments. Kelly and Houston (1985) studied 91 employed female workers to determine differences in self-reports of stress, tension and number of leisure activities. Findings indicated that while Type A and Type B women did not differ in the amount of time spent in recreational activities, Type A women spent a greater percentage of recreational time in physically active and competitive activities. In a sample of 355 life insurance agents, Matteson, Ivancevich, and Smith (1984) found Type As reported 50 percent more health complaints than did Type Bs. Likewise, Type As reported significantly greater stress in their lives than did Type Bs.

The question of the accuracy of self-report among Type As is complex. A series of investigations by Glass (1977) reported that Type As, assessed by the JAS, worked quickly, strove hard to succeed and suppressed subjective states (such as fatigue and negative affect) that might interfere with performance. These findings have led others to the conclusion that Type As tend to deny health problems, particularly CHD symptomology. For example, in the study cited in the preceding paragraph, Matteson et al. (1984) stated that the 50 percent greater report of health problems by Type As was likely understated. Although there is some evidence pointing to suppression and/or denial of unpleasant conditions in the Type A, it is also possible that these individuals either are unaware of the negative aspects of these situations or do not experience them in the same way as others do.

Since TABP has been conceptualized as a set of coping mechanisms in response to perceived loss of control, moderately uncontrollable events may be more threatening to Type As than either completely controlled or uncontrollable ones. Pittner and Houston (1980) examined psychophysiological reactivity among 84 Type A/B male college students. Subjects were randomly assigned in equal numbers to three experimental conditions: threat of shock, threat to self-esteem and low stress control. All subjects were asked to perform the Digits Forward segment

of the Wechsler Adult Intelligence Scale. The threat of shock group was told that incorrect responses might result in an electrical shock. The threat to self esteem group was told that they were not doing as well as others and needed to try harder. The low-stress group was told they were doing fine. Physiological reactivity was measured by SBP, DBP, heart rate and finger pulse volume, while psychological reactivity was measured on four occasions by four different forms of the Multiple Affect Adjective Checklist (MAACL).

Both Type A and Type B subjects experienced more arousal and reported more anxiety and hostility in the threat to self-esteem condition. Type A subjects, however, experienced significantly more arousal than Type Bs but reported less anxiety and hostility. Through item analysis, the researchers concluded that Type As tended to cope with stressful situations differently from Type Bs. In both stressful conditions Type As tended to make conscious efforts not to think about the aversive aspects of the experience (suppression); in the threat to self-esteem trial they tended to cope by denying unpleasant affective responses. Moreover, use of suppression was associated with greater negative affect, use of denial with less negative affect.

> These results suggest that when subjectively distressed, Type A individuals are more likely to

> consciously try to cope with the situation-that is, consciously try to suppress thinking about the aversive aspects of the situation. Further, the results suggest that in a situation that is particularly threatening to Type As (e.g., the threat to self-esteem condition), Type As tend to employ more denial in the situation and experience less subjective distress, although manifest more psychophysiological arousal, than Type Bs." (p. 155-156)

It may be that Type As endure stress at higher levels and/or for longer periods of time than do others. Likewise, it may be that this greater exposure to stress produces greater autonomic arousal and, consequently, more rapid cardiovascular degeneration. Moreover, the tendency to deny threatening circumstances may generalize to the recognition of symptoms requiring medical attention so that the Type A may postpone seeking care when early CHD warning signs arise. Furthermore, there is a growing body of evidence supporting the hypothesis that persons who did not attend to their psychological and somatic reactions to stressful events are more susceptible to illness (Suls & Fletcher, 1985).

In keeping with the definition of the Type A behavior pattern as one elicited by "appropriately challenging circumstances," underreporting of fatigue, physiological or psychological symptoms are expected to occur only under conditions of perceived challenge (Carver, Coleman, & Glass, 1976; Schlegel et al., 1980). For example, Rhodewalt, Hays, Chemers, and Wysocki (1984) categorized 51

university administrators as Type A/B using the JAS. They found that only those Type As who perceived their jobs as stressful or experienced many undesirable and moderately uncontrollable life changes reported angina, hypertension, and psychological distress. Type As reporting low stress and Type Bs in either category had fewer cardiovascular complaints. The study's results give credence to the hypothesis that it is the Type A's perception and subsequent response to events, rather than the events themselves, that exacerbate physiological distress. Likewise, two experiments by Goldband (1980) demonstrated that under conditions involving time pressure, potential loss of control and competition (tasks considered relevant to the Type A pattern), Type As exhibited greater physiological reactivity than Type Bs; but when performing tasks not theoretically relevant, no reactive differences emerged.

In the same vein, Schwartz and his colleagues (1986) studied task performance among Type As and Type Bs in three conditions: universal failure, personal failure and no failure. Using random assignment in equal numbers, the researchers examined responses to tasks in which subjects were a) told that no one achieved a passing mark, b) told that they performed poorly in relation to the others, and c) were given no feedback. In the second phase of the experiment similar problems were again administered. The

MAACL was administered at the beginning of the experiment, after phase 1, and after phase 2. All subjects, regardless of A/B type, scored higher on anxiety and depression after personal failure than universal failure. However, Type A, but not Type B, subjects performed better in phase 2 following personal failure. In the personal failure condition, where there was some chance of regaining control, the Type As continued to strive for success. It may be that Type A individuals were regulating their self-esteem by continual striving for control (Matthews, 1982). Lack of measured affective differences between Types A and B may have represented the Type A tendency to underreport negative feelings.

Matthews (1982) reviewed the literature regarding the relative general task performance of Types A and B. Type As tended to outperform Type Bs in challenging situations that called for endurance or persistence, worked more quickly when no time limit was given, and set higher performance standards. Type Bs outperformed As on tasks requiring slow, careful attention and a broad focus of attention while Type As tended to work harder and perform better than Type Bs following brief, salient task failure. One common theme present in the previous discussion concerns the manner in which Type A individuals struggle to control aspects of their environments which pose a danger to them physically or psychologically. The Type A appears

to be engaged in a chronic struggle to raise self-esteem and to ward off threats in the environment through hypervigilence and chronic autonomic arousal. There is currently, however, no evidence that suggests that either type is more or less successful across employment categories (Matteson, Ivancevich, & Smith, 1984). However, the greater number of cardiovascular incidents and associated absenteeism or shortened work life ultimately may make the Type A a less efficient worker than the Type B employee. In addition, personal characteristics such as aggression, hostility, irritability and depression may be counterproductive in personal and job-related relationships.

Modifying Type A Behavior Pattern

Persons exhibiting the Type A behavior pattern in time literally wear out their bodies under the duress of excessive perception of threat and the subsequent intensity and duration of physiological reactivity to that threat (Roskies, 1987). The difficulty is compounded by a common insensitivity among Type As to bodily warnings such as fatigue or illness, a blaming of difficulties on the environment and a reluctance to seek treatment. Consequently, modification of the Type A behavior pattern, although not widespread, has taken behavioral forms. Appealing to the Type A's insistence on accomplishing more and more in less and less time, many strategies attack from an efficiency angle by promising the individual increased

control through awareness of environmental perceptions, relaxation techniques and more effective thought patterns. These models avoid the association of TABP with illness or psychiatric disorders. Rather than attempting to cure poor coping skills, they seek to improve existing ones. Currently the literature addresses 3 primary questions regarding TABP modificaiton:

1. Does psychological intervention reduce TABP?
2. Which particular treatment modalities have met with the greatest success in reducing TABP?
3. Which, if any, of these modalities improves the prognosis for CHD morbidity and mortality?

The literature is further divided into work dealing with clinical and nonclinical populations.

Counseling to reduce Type A behavior pattern. Studies with myocardial infarction patients have demonstrated the efficacy of counseling in reducing Type A behavior. After two years of either cardiac counseling (counseling geared toward dealing with CHD), cardiac/Type A counseling (cardiac counseling with a component aimed at modifying TABP) or no treatment, patients receiving cardiac/Type A counseling demonstrated significantly greater reductions in TABP than the other groups (Powell et al., 1984). Both treatment groups had lower infarct recurrence rates than the control. There were no differences between groups in total cholesterol levels or blood pressure.

Brief group psychotherapy and behavioral therapy were compared in an exploratory study of 27 healthy Type A men (Roskies et al., 1978). Participants were asked to make no lifestyle changes during the 5 month, 14 session period of the study. A male and a female co-therapist led the psychotherapy group, which involved psychological testing, interpretation of early family dynamics and explication of current behavior as a replaying of outdated family scripts. In the behavioral therapy group, participants kept a diary detailing the advent of situational tension and were taught a variety of relaxation techniques, including Jacobsonian muscular relaxation and deep breathing. Both treatments resulted in significant changes in serum cholesterol, systolic blood pressure, number of psychological symptoms, general satisfaction and sense of time pressure with no concommitant changes in smoking, eating or exercise habits. In a similar study using behavior therapy, a support group and a control group (Levenkron, Cohen, Mueller, & Fisher, 1983), researchers found that after 8 weeks subjects in the treatment groups significantly decreased their JAS-determined Type A scores and anger and hostility scores. Surprisingly, however, total cholesterol rose significantly with treatment, an aberrant finding for which the researchers could find no explanation.

Relaxation therapies to reduce Type A behavior pattern. In a typical study examining reduction in Type A behavior,

Suinn and Bloom (1977) placed 14 Type As in either a control or an Anxiety Management Training (AMT) group. AMT involves use of imagery to precipitate stress, identify muscular stress onset and reduce stress through relaxation. After 3 weeks of bi-weekly training sessions, subjects in the treatment group scored significantly lower only on the Hard-driving scale of the JAS. No changes in triglycerides, cholesterol or blood pressure were observed. It is likely that the 3 week period was of insufficient length to produce significant physiological behavioral changes.

Jenni and Wollersheim (1979) compared the effectiveness of Stress Management Training (SMT), cognitive therapy and no treatment in reducing Type A behavior. Individuals under severe stress were referred by physicians and recruited through newspaper advertisement. Sixteen of the 42 subjects were judged to be high Type As by SI interviewers. Subjects were matched for gender and Type A status and randomly assigned to treatment groups meeting once a week for 6 weeks. The SMT group were taught to visualize an anxiety-producing scene, a relaxing scene and a success-experience scene; subsequently they were trained to substitute either the relaxation or success scene for the anxiety-producing one. AMT audiotapes were also used to help subjects cue in on tension and rehearse adaptive responses through imagery. Cognitive therapy

subjects were taught cognitive restructuring according to Ellis' A-B-C model. Six weeks post-treatment, the treatment group subjects evaluated themselves using the Bortner Type A Scale. Although both treatment groups were more effective than no-treatment, cognitive therapy was more effective in reducing self-reported TABP among high Type As than was Stress Management Training. A difficulty with the research was that the initial measure of Type A classification, the SI, was not the same instrument used to measure Type A change (Bortner Scale).

Psychological intervention, then, in the form of either counseling or relaxation therapy has met with some success in modifying TABP. In addition, counseling has been shown to result in positive physiological changes and a lower infarct recurrence rate.

Type A Behavior Pattern and Aerobic Exercise. Regular aerobic exercise has been consistently demonstrated to be an effective intervention in the reduction of TABP among healthy Type As (Blumenthal et al., 1980; Gillespie et al., 1982; Jasnoski, 1983; Lobitz et al., 1983; Neddo, 1984). Most recently, Blumenthal et al. (1988) randomly assigned 36 healthy Type A males to either an aerobic exercise training group or a strength and flexibility training group. After 12 weeks the aerobic exercise group, but not the strength group, manifested significant decreases in TABP and in physiologic indices of CHD risk factors.

Among the post-infarct contingent, those judged as Type A at the onset of a rehabilitative exercise program tended to drop out of the program within the first year (Dishman, 1985; Oldridge, 1981; Oldridge, 1979). However, other research has demonstrated that although slow to recognize the necessity for remediation, Type As tend to be more responsive to exercise than Type Bs once they commit to treatment (Matthews, Siegel, Kuller, Thompson, & Varat, 1983). Rejeski and associates (1984) found that in a cardiac rehabilitation study with 57 patients at Wake Forest University, there was both a negative correlation of JAS score with attendance and a positive correlation with percentage of cardiac work and MET gain. This suggests that once Type As recognize their symptomatic condition, they respond energetically to treatment.

Although many Type As do not engage in regular exercise, greater exercise intensity and duration have been associated with the TABP (Folsom et al., 1985; Jasnoski, 1983). It has been determined that the optimal Type A work environment is one that is controllable, fast-paced and extremely challenging (Ivancevich & Matteson, 1984), characteristics that can certainly apply to a vigorous aerobic exercise regimen. It may be that the hard-driving, competitive nature of the Type A, when applied to exercise, leads to excessive or overly intense workouts that are ultimately more harmful than beneficial. Currently, "it is

unclear whether the coronary artery disease prophylactic potential of exercise for hyperlipidemia, hypertension, weight control, and other factors of reduced tension, anxiety, and elevated mood outweigh the goal obsession that exercise might promote for some individuals. It is equally unclear that positive psychological outcomes will reliably generalize to Type As or whether alternative cognitive-behavioral or somatic therapies are more appropriate" (Dishman, 1985, p. 127).

Neither is it known what proportion of chronic exercisers can be classified as Type A. The prior study for this project revealed that of the 24 subjects, 17 (70 percent) were categorized as Type A by the Jenkins Activity Survey. If, as this researcher suspects, the large majority of chronic exercisers exhibit Type A behavior, it may be that these behaviors to some extent counteract the cardiovascular benefit derived from exercise. Indeed, the Type A chronic exerciser may simply be substituting one form of physiological reactivity for another. Instead of feeling aroused and threatened by, for example, self-imposed pressure at work, the Type A exerciser may feel threatened by the possibility of gaining weight, growing old and reaching the limit of his or her ability to run faster or longer. In an endless race with time, the exercising Type A can self-impose impossible goals and unattainable performance standards and at the same time be

rewarded for it by the admiration of society and the accomplishment of sub-goals and "personal bests." It will be for medical researchers to determine if, ultimately, the Type A who runs 150 miles a week risks wearing out the body in a manner comparable to the sedentary Type A.

Of greater importance to the current study, however, is the critical factor of hostility. If by definition the Type A demonstrates hostile tendencies, chronic exercise may serve as a release valve for Type A exercisers. It may be that one explanation for the extreme frequency and duration of exercise in this population is the need to eliminate angry, hostile feelings in a socially acceptable manner. If this is the case, the question arises whether teaching alternative means of dealing with anger, such as relaxation techniques, might relieve the perceived need to exercise this intensely, a question heretofore unexamined in the literature.

Summary

Scientific research investigating the interrelationships among Type A (coronary prone) behavior, dysphoric mood, relaxation and aerobic exercise is in its infancy. The psychological underpinnings of the coronary prone pattern are not well understood, but evidence supports the presence of anxiety, hostility and depression as part of the underlying construct. Aerobic exercise in general appears to have positive physical and psychological

benefits including protection against coronary heart disease and reduction of anxiety, depression, hostility and TABP. At some point, however, the practice of exercise becomes physically and psychologicaly hazardous. This point varies among individuals; however, the American College of Sports Medicine recommends exercising no more than 1 hour per day, 5 days per week, at an intensity between 60 and 90 percent of maximum. Persons exercising at levels above these guidelines are at risk for musculoskeletal injury, fatigue, amenorrhia, premature osteoporosis (in females only), deficient personal relationships, irritability, compulsivity and poor eating habits. Upon forced withdrawal from exercise for even one day, the chronic aerobic exerciser often experiences withdrawal symptoms, characteristically anxiety, guilt, tension and depression. In addition, one study (Little, 1981) has linked neurotic breakdowns to physical injury in men preoccupied with physical fitness.

Given permission to relax their exercise regimens, it may be that chronic exercisers experience positive changes in Type A behavior and dysphoric mood. On the other hand, being deprived of the accustomed dose of exercise, which may serve as a primary coping mechanism, could actually increase tendencies toward hostility, anxiety and depression. Empirical support for either view is currently lacking. Both excessive exercise and exercise cessation

have been associated with dysphoric mood, but no research has examined exercise reduction in the population of chronic exercisers. In addition, although little research has investigated the presence or absence of the TABP in chronic exercisers, the opportunity for exceedingly high performance standards, competition, aggression and time urgency in the exercise world provides an ideal psychological environment for Type A individuals.

Relaxation in forms such as progressive muscle relaxation and imagery has been demonstrated to reduce dysphoric mood and, in some instances, Type A behavior. Teaching alternative methods of coping with daily stressors could, in fact, bolster the psychological resources of the chronic exerciser, reducing the perceived need to exercise and providing significant coping mechanisms for use when exercise is not possible or desirable.

These threads will be drawn together in the following chapter, which details the purpose, subject selection, instrumentation and procedures of the proposed study as well as the results of its preliminary pilot project.

CHAPTER III

Methodology

Purpose of the Study

The purpose of this study was to investigate the comparative effects of exercise reduction and relaxation training on dysphoric mood states and Type A behavior in persons who exercise beyond American College of Sports Medicine (ASCM) guidelines. Currently there is little research dealing with the psychosocial behavior of persons who have not only incorporated aerobic exercise into their lifestyles, but have demonstrated a devotion to it that extends beyond what is considered necessary for cardiovascular fitness. Physically, a point is reached where, with increases in frequency, intensity and duration of exercise, additional benefits of aerobic exercise diminish and chance of injury increases. The question arises whether the psychological benefits of aerobic exercise also reach a point of diminishing returns as exercise frequency, intensity and duration increase. In addition, no research to date has examined the effect of relaxation training on the coronary prone behavior pattern or negative mood states in chronic exercisers.

Samples Size and Subjects

In order to achieve a power of .90 for differences between experimental and control-population means of one

standard deviation (assuming an alpha level of .05), 66 subjects were necessary. After matching for amount of exercise, gender, and age, subjects were randomly assigned to a control group or one of two experimental groups. The sample-size-to-statistical-power relationship just cited applies to a single experimental vs. control-population contrast and assumes uniform allocation of sample subjects. For this study, 68 volunteers between the ages of 23 and 56 who claimed to have exercised aerobically 6 or more hours per week on a regular basis for at least a year were recruited through local health clubs, a triathalon club and newspaper advertisement.

Instruments

During an initial interview with each subject (Appendix A) the researcher orally administered a Demographic Information Form (Appendix B) and an Exercise History Form (Appendix C). Once informed consent (Appendix D) was obtained, the subject completed two psychological instruments, a measure of aerobic fitness and a measure of perceived exertion. The Jenkins Activity Survey (JAS) (Jenkins et al., 1979) and the Profile of Mood States (POMS) (McNair, Lorr, & Dropplemen, 1971) were administered to each subject pre- and post-treatment. In addition, each subject completed the Harvard Step Test (Appendix G) (Kirkendall, Gruber, & Johnson, 1987) to determine initial fitness level. All subjects completed 10

exercise diaries (Appendix E), one for each of the 10 weeks of the study, detailing the frequency, duration and intensity of each workout. Intensity of exercise was measured by the Rating of Perceived Exertion Scale (Pollock et al., 1984) and exercise heart rate (Appendix F).

Jenkins Activity Survey (JAS)

The Type A behavior pattern [TABP] has most commonly been measured using either the Structured Interview (SI) (Rosenman et al., 1964) or the Jenkins Activity Survey (JAS). The Framingham Scale (Haynes, Levine, Scotch, Feinlab, & Kannel, 1978) is a third valid and reliable, but little used, instrument. Although all three measures have successfully predicted the development of coronary disease, Matthews (1982) has demonstrated that they measure distinctly different features of Type A behavior pattern (TABP) with very little overlap. Pointing to the lack of understanding of the psychological dimensions underlying TABP, Matthews concluded that the failure to comprehensively measure the construct has prevented systematic investigation of its psychological components. For example, Abbott, Peters and Vogel (1988) demonstrated that the JAS failed to assess the hostility component of the TABP. Nevertheless, the JAS is the most widely used measure of Type A, or coronary prone, behavior, primarily because of its ease of administration and predictive validity (Matthews, 1982). The definition which has guided research into the TABP describes it as

> an overt behavioral syndrome or style of living characterized by extremes of competitiveness, striving for achievement, aggressiveness (sometimes stringently repressed), haste, impatience, restlessness, hyperalertness, explosiveness of speech, tenseness of facial muscles and feelings of being under the pressure of time and under the challenge of responsibility. Persons having this pattern are often so deeply committed to their vocation or profession that other aspects of their lives are relatively neglected. Not all aspects of this syndrome or pattern need be present for a person to be classified as possessing it. The pattern is neither a personality trait nor a standard reaction to a challenging situation, but rather the reaction of a characterologically predisposed person to a situation that challenges him or her. Different kinds of situations evoke maximal reactions from different persons. (Jenkins et al., 1979, p. 3)

In addition, research points to the Type A's high degree of self-involvement and reference to self in everyday conversation (Scherwitz et al., 1986; Lovallo & Pishkin, 1980; Scherwitz, Berton, Leventhal, 1978), free-floating hostility and anger (Dembroski et al., 1985; Dimsdale, Hackett, Block, & Hutter, 1978) and resistance to change.

Persons who do not display the Type A behavior pattern are designated Type Bs. The Type B individual is one who lives a more relaxed, unhurried and satisfied lifestyle and behaves differently--not merely less intensely--than the Type A (Matthews, 1982). It is common practice to categorize any individual as either Type A or Type B; however, in many studies a true Type A is considered to be one who falls in the top third of the distribution of scores and a true Type B one who falls in the bottom third of the JAS (Bergman & Magnusson, 1986; Jenkins et al.,

1979). The description of TABP does not address the development of the pattern, what purpose it serves or which specific elements contribute to pathology.

To fully understand TABP one must examine many areas of human experience including work, cultural values and beliefs and interpersonal dealings. Type As tend to have very high and ill-defined performance standards which they are in a continual race to attain. It has been suggested that because Type As overestimate the role of internal factors (effort) as opposed to external factors (chance) in determining the probability of outcome, they tend to become engaged in a chronic struggle to control what is likely to harm them physically or psychologically. Furthermore, Type As tend to have high expectations of significant others and to give them unclear, negative or inadequate feedback on performance. In addition, Type As tend to have wider social circles characterized by less intense and less intimate relationships than do Type Bs (Margolis et al., 1983; Matthews, 1982).

The Type A behavior pattern, as determined by the JAS or the SI, has been determined to be an independent risk factor of the same magnitude as smoking, hypertension and serum cholesterol level for coronary heart disease and atherosclerosis (Abbott et al., 1988). [Some studies, such as Williams, et al. (1988), have found no relationship between coronary disease severity and JAS-assessed Type A behavior.]

Essentially, TABP is a collection of behaviors thought to characterize future cardiac patients. However, the importance of TABP as an independent risk factor diminishes with age, a phenonomenon known as survival effect. Biologically speaking, some persons possess vulnerabilities which make them particularly susceptible to the deleterious effects of a risk factor. If these persons succumb to the adverse effects of a risk factor early in life, the remaining older people in the population are, as a consequence, hardier or less susceptible to development of the disease. Thus, surviving Type As may be biologically hardier than their Type B counterparts, resulting in a reversal effect for coronary heart disease (CHD) in older persons (Williams et al., 1988). However, at an early age, perhaps in childhood but at least as early as age 20, Type As develop increased autonomic arousal in response to environmental stimuli. This increased reactivity to stressors may account for the doubled risk of CHD among Type As (Lawler, 1983/1984; Matthews et al., 1977; Dembroski, MacDougall, Shields, Petitto, & Lushene, 1978).

To date, no single measure of Type A behavior pattern has been devised that can completely assess this complex construct. The SI and the JAS measure independent aspects of the pattern and may be particularly suited to different research uses. The following comparison of the two instruments will clarify the choice of the JAS for this

study. The SI, because it includes measurement of voice and attitude inaccessible through a paper and pencil test, provides the more accurate indication of heightened sympathetic response (Dembroski et al., 1978; Matthews & Saal, 1978) and may be better suited to use with clinical populations. The JAS, on the other hand, is used to assess competitive achievement striving and may be better suited to research regarding emotional correlates of CHD (Matthews, 1982).

The Structured Interview can be administered and interpreted properly only with extensive specialized training (Jenkins et al., 1979). In addition, it must be administered individually, making it an expensive and time consuming instrument suitable primarily for use by well-funded teaching or research organizations or persons willing to pay a substantial fee. The JAS has in its favor convenience and reliability, having consistently provided more reliable scores for both men and women than has the SI. It is the most widely used and well known of TABP measures (Abbott et al., 1988).

Both the JAS and the SI are significantly correlated with the prevalence of coronary disease (Jenkins, 1976). Moreover, the JAS yields an additional global score and three factor-analytically-derived scores which capture the style of the behavior (Speed and Impatience: Factor S), the type of occupational setting that is conducive to

Type A display (Job involvement: Factor J) and the characteristic traits and values associated with TABP (Hard driving: Factor H) (Burke, 1983; Jenkins et al., 1979). None of these factors is independently related to incidence of CHD or correlated with the SI (Chesney et al., 1981). The advantage of these factors lies in assessing both their behavioral contribution to CHD risk and the intensity of a general domain of behavior styles encompassing such characteristics as time urgency, achievement striving, irritability, competitive urge, impatience and involvement in heavy responsibility (Jenkins et al., 1979).

Form C of the Jenkins Activity Survey, the form used for this study, is a 52-item multiple-choice questionnaire, designed for use by the scientific community in measuring the Type A behavior pattern. Four previous versions were used solely by the authors and their colleagues for purposes of validation. The instrument was standardized on 2,588 male participants in a longitudinal heart disease project, the Western Collaborative Group Study (WCGS). However,

> Score distributions and factor analysis results for the large sample of working women who completed the JAS in the Chicago Heart Association Detection Project in Industry suggest that the items have roughly the same meaning to employed women as to employed men. (Jenkins et al., 1979, p. 9)

The JAS is most appropriate for middle and upper-middle class employed persons between the ages of 25 and 65 and may be administered in unsupervised settings.

As previously mentioned, the JAS renders a global Type A score and three subscale scores: Speed and impatience (Factor S), Job involvement (Factor J) and Hard driving (Factor H). The mean standard score (zero) of each scale corresponds to the respective mean score in the WCGS population. A score of zero does not indicate a lack of Type A behavior; rather, persons scoring close to zero are difficult to categorize as either Type A or Type B. The instrument is not self-interpreting and, since scoring is complicated, scores are best interpreted to the individual in terms of percentiles. Normative data were based on a sample of 2,588 mid-to-upper-level male managers ranging in age from 48 to 65 years. Raw scores of these men at the time of their participation in the WCGS formed an approximately normal distribution. The mean score was transformed to zero with a standard deviation for all scales of 10 points. Differences of 5 or more points either among the different scales for the same individual or among scores for different individuals represent meaningful differences (Jenkins et al., 1979).

Reliability. Two types of reliability, internal consistency and test-retest, have been computed for the JAS. Internal consistency reflects the degree to which items within a scale measure a uniform concept. Test-retest reliability measures the stability of individual test scores over time. The Type A scale, the

overall measure of TABP, has been correlated with the S, J and H subscales at values of .67, .42 and .58 respectively. Subscales correlated with one another with values between .19 and .27 (Jenkins et al., 1979). Using two different computational methods, internal consistency reliability coefficients for the Type A scale were .83 and .85 (Jenkins et al., 1979; Blumenthal, 1985). Test-retest reliability estimation has been confounded by the fact that the JAS has undergone multiple revisions; thus some coefficients reflect differences in form as well as change over time. However, correlations ranging between .60 and .71 over periods of one to four years indicate that characteristics measured by the JAS are somewhat stable for at least that length of time (Jenkins et al., 1979; Johnston & Shaper, 1983). Abbott and his associates (1988) found the JAS to provide more reliable scores than did the SI for both males and females.

Validity. The JAS was originally developed to conform to distinctions between Type A and Type B behavior as determined by the SI. Overall correspondence between Type A ratings on the two instruments has been found to range between .70 and .77 (Dembroski et al., 1978). The JAS has been found in numerous studies to be significantly related to the prevalence of CHD after other risk factors (e.g., age, cholesterol, cigarette smoking, diastolic blood pressure) were controlled. Evidence of predictive validity

established in the prospective findings of the WCGS, where men scoring in the top third of the JAS overall incurred 1.7 times the incidence of CHD over a four-year period than did those in the bottom third. Type A score, as determined by the JAS, has also been found to discriminate between men surviving a single coronary event and those experiencing a recurrence, even after other primary risk factors were controlled (Jenkins et al., 1979).

JAS-determined Type A scores repeatedly have been shown to have a positive association with occupational prestige and educational level. Type A scores for men and women do not differ when adjusted for socioeconomic status. Except in studies featuring a broad age spectrum, age does not appear to be a biasing factor (Jenkins et al., 1979).

Finally, correlations of the four scales with most standard psychological instruments have proved to be low, most likely because the Type A construct was conceptualized on a medical rather than a psychological model. The California Psychological Inventory (CPI), Cattell's 16-Personality Factor Inventory (16-PF) and the Minnesota Multiphasic Personality Inventory (MMPI) scores have not been found to be correlated with Type A behavior, probably because they assess an attitudinal and motivational dimension not measured by the JAS (Jenkins et al, 1979; Matthews & Saal, 1978). In a study of 100 college students, Nielson and Dobson (1980) established

discriminant validity between the JAS (Form T) and several measures of trait anxiety: the State-Trait Anxiety Inventory (-.026); the Multiple Affect Adjective Check List (-.043); and the four scales of the Inventory of General Trait Anxiousness (-.078, .092, .072 and .040). Smith (1984) used 50 cardiac patients to calculate Pearson correlation coefficients between the JAS and the Spielberger State-Trait Anger Scale (.42) and the neuroticism scale of the Eysenck Personality Inventory (.37). Except for these few studies, the affective characteristics of Type As, particularly those implicated in CHD (anxiety and hostility), have been neglected by researchers (Matthews, 1982).

Profile of Mood States (POMS)

The Profile of Mood States (McNair et al., 1981) is a factor-analytically-derived inventory developed for the assessment of 6 transient, fluctuating affective states: Tension-Anxiety (Factor T), Depression-Dejection (Factor D), Anger-Hostility (Factor A), Vigor-Activity (Factor V), Fatigue-Interia (Factor F) and Confusion-Bewilderment (Factor C). Factor T describes somatic or musculoskeletal tension which may or may not be directly observable. Factor D represents a depressed mood characterized by feelings of worthlessness, futility, guilt or emotional isolation. The A Factor defines feelings of anger, resentment, hostility and antipathy toward others.

Vitality, energy and ebullience are defined by Factor V while low energy level, weariness and exhaustion are represented by Factor F. Factor C is characterized by a state of cognitive inefficiency, forgetfulness and uncertainty.

The POMS consists of sixty-five 5-point rating scales for which the subject answers the question, "How have you been feeling during the past week including today?" The one-week period is designed to encompass a sufficient time period for depiction of the individual's "typical and persistent" moods while retaining sensitivity to acute treatment effects. The POMS is easy to comprehend, requires little time to complete and is readily accepted by the average individual (Eichman, 1978). Persons having at least a seventh-grade education generally have no difficulty completing the inventory, which is virtually self-administering and can be completed in 3 to 5 minutes (McNair et al., 1981).

The POMS has been normed on both psychiatric outpatients and college students and is best used in treatment evaluation (Eichman, 1978). It is recommended as a method of assessing mood changes in such patients or, on a research basis, in normal subjects over the age of 18 who have had at least some college education. When using the college form, male and female norms are combined because

very little variance has been found to be associated with gender (McNair et al, 1981). The college form was used in the current study.

Reliability. In producing the current version of the POMS, 6 independent factor-analytic studies of the 6 mood factors were performed. Factors are considered identifiable, reliable and replicable. Internal consistency reliabilities for the factor scales ranged from .84 to .95 in two separate studies. Stability coefficients on 100 psychiatric outpatients ranged from .65 to .70 from intake to pretherapy (an average of 20 days). In the same sample the stability coefficients from intake to the time following of 6 weeks of therapy ranged from .43 to .51. The transient nature of a state of mood, whether or not treatment has occurred, precludes high test-retest coefficients, which, if present, might point to lack of construct validity (McNair et al., 1981). These findings were confirmed in two partial replications by Norcross, Guadagnoli, and Prochaska (1984).

Correlations among the POMS factor scores appear to be fairly comparable for both normal and psychiatric samples, except in the case of Tension/Anxiety where the difference between that factor and other moods is more distinct. Tension/Anxiety correlations with Depression/Dejection range from .56 in normals to .77 and .76 in male and female psychiatric patients, respectively. Correlations between

the Tension and Anger factors lie in the .54 to .58 range, while those between the Anger and Depression scales range from .62 to .70. The fact that the scales are inter-correlated inhibits clear differentiation among clinical groups (Weckowitz, 1978). The suggestion that the various mood states might be accounted for by fewer than six factors (Norcross et al., 1984; Reddon, Marceau, & Holden, 1985), however, has been contraindicated by the performance of principal components analysis, which reinforced the desirability of retaining all 6 (McNair et al., 1981; Eichman, 1978).

Scoring for the POMS is performed by summing the responses obtained for the adjectives defining each factor. By adding these 6 factor scores, a single global estimate of mood disturbance (Total Mood Disturbance or TMD score) may be obtained. This score may be considered to be highly reliable because factors are moderatley to highly intercorrelated. No separate norms or validity data are available for the TMD score (McNair et al., 1981).

Validity. The POMS has considerable "face validity," apparent from examination of the various items contributing to the factor scales. Several studies have shown one or more individual factors to be sensitive to change after both short-term drug treatment and psychotherapy. Different patterns of results in these studies argue against a response set or change as a function of repeated

testing. A series of studies assessing mood at several points before and after an emotion-inducing event has provided further evidence of predictive validity (McNair et al., 1981).

Evidence of concurrent validity derives from the high correlation of factor scales with those of the Hopkins Symptom Distress Scales (Somatization, Anxiety, and Depression) and the Taylor Manifest Anxiety Scale. Other correlations have been computed only for the outpatient population, but it appears, for the population studied, that the POMS factors have little correlation with the standard demographic variables of age, gender and race. Among males, for example, Tension, Depression and Anger correlations with age were -.07, -.11 and -.15 respectively. Correlations of the same three scales with education were .10, .08 and .08 and with race .24, -.20 and -.18. Correlations for females fell in a similar range (McNair et al., 1981).

Rating of Perceived Exertion (RPE) Scale

The Rating of Perceived Exertion Scale (Hughes, et al., 1984) is a 15-point scale ranging from 6 to 20 with an exertion descriptor at each odd number (e.g. very light, hard, very hard). Subjects are asked to estimate how difficult they perceive the workload to be; that is, to rate the total amount of exertion and physical fatigue. RPE is linearly related to heart rate (HR); to work

intensity across a variety of exercise conditions and modalities; and to oxygen uptake (VO2), lactate levels and ventilation (multiple correlation of .85 for physiological factors). The RPE has been shown to be reliable across tests. Observing RPE/HR correlations within subjects at baseline, one year and three years, Hughes et al. (1984) found coefficients of .88, .89 and .89 respectively.

Although the RPE was developed as a measure of exertion, the similarity of the correlation of heart rate and RPE during exercise, recovery and rest indicates that it actually measures fatigue within individuals (Noble, 1979; Hughes et al., 1984). Since heart rate during exercise is an index of exercise intensity, the correlation of RPE with exercise-induced heart rate is used as a test of RPE scale validity. The magnitudes of within-subjects correlations are quite large (.88, .89), supporting use of the scale as a valid estimate of individual fatigue. The scale is not valid for comparisons across individuals, however, because of large person-to-person variations in perception of the intensity of equivalent workloads. For example, what might be considered a light workload for an elite athlete might be perceived as a very heavy load for an unconditioned individual.

RPE is particularly useful in studies where physiological factors are not directly measured since it provides an objective indicator of relative fatigue from

test to test (Pollock et al., 1984). Thus, if exercise performance changed between tests while the endpoint RPE remained constant, the tests could be interpreted to represent a true change in cardiorespiratory fitness. That is, the greater performance would be due to an enhanced capacity for work rather than increased effort.

Inactivity and smoking are both associated with higher levels of fatigue as expressed by RPE self-ratings. Age, TABP, cholesterol level, body mass index and blood pressure have not been found to be significantly associated with the scale. The low RPE of active persons may be in part due to the habituating effects of exercise to the aversive properties of fatigue. Likewise, inactive individuals may be more attuned to or fearful of these properties (Hughes et al., 1984; Borg & Noble, 1974; Gutmann, Squires, Pollock, Foster, & Anholm, 1981).

Although each point on the scale was originally conceived as corresponding to a heart rate value at a particular work intensity (i.e., point 8 represents a heart rate of approximately 80; point 18 represents a heart rate of 180), this use of the scale has been shown to be invalid. The scale is valid when heart rate is expressed as a relative percentage of maximum (Pollock et al., 1984).

As intensity is added to workload, progression through the numerical points of the RPE is not linear. At point 10 the progression becomes curvilinear with only small amounts

of additional intensity needed to increase ratings above the level of 15. Few individuals use the maximum score of 20; most use 17, 18, or 19. Many subjects do not discriminate well at the lower end of the scale, and about 10 percent are unable to use the scale accurately. Proper directions, both written and verbal, are essential to accurate use of the RPE (Pollock et al., 1984).

Exercise Heart Rate (EHR)

Estimating exercise heart rate is accomplished by counting the heart palpitations with two fingers at either the radial or the carotid artery (Pollock et al., 1984). Applying too much pressure at the carotid artery can cause HR to slow by reflex action. Likewise, a few individuals are particularly sensitive to pressure on the baroreceptors located in the artery, and for them this location is not recommended. A third alternative is to place the heel of the hand over the apex of the heart on the left side of the chest. Deceleration of heart rate begins immediately post-exercise; therefore, an accurate count will begin within 2 to 4 seconds. Using a wristwatch, or preferably a stopwatch, one begins counting on a full beat with the first count being zero and continues counting for 10 seconds. If the count does not end on an even beat, then one-half beat is added to the last full count. In this study EHR and RPE are used as cross-check measures of exercise intensity; in general, as exercise heart rate increases, so does fatigue.

Harvard Step-Up Test

The Harvard Step-Up Test (Brouha, 1943; Johnson & Nelson, 1979; Safrit, 1981) is a measure of maximal aerobic work capacity. The subject steps up and down on a 20-inch bench to the beat of a metronome at the rate of 30 complete steps per minute for up to 5 minutes. At the end of 5 minutes or when the subject ceases exercise, heart rate is taken 1 to 1½ minutes after exercise. A step is defined as one total ascent to the platform and one total descent to starting position. Step tests are in general inexpensive, convenient and noiseless. Because they involve no noisy equipment, electrodes or complicated directions, they are considered non-threatening to the subject, have greater test-retest reliability than bicycle ergometers or treadmills and prevent having to perform multiple tests to obtain a baseline (Hellerstein, Hirsch, Ader, Greenblot, & Siegel, 1973). Utilization of results requires uniformity of protocol, environment and test preparation for subjects. In addition, subjects may be physically intolerant of stepping because of knee or hip injuries. In forming conclusions concerning any changes in aerobic work capacity over time, it should be noted that conditioned responses may be affected by learning the procedures or reducing test anxiety over time (Hellerstein et al., 1973).

In maximal exercise testing, the end point of the test is defined by the individual's tolerance for exertion.

When the subject has reached the limit of his/her tolerance (i.e., stops exercising), measures of intensity (heart rate) and duration of exercise are observed and recorded to define the individual's limits. In general, such measures are somewhat higher in using a treadmill than either a bicycle ergometer or the step test (Bruce, 1973).

Procedures

Prospective study participants were asked to attend an initial interview with the researcher (Appendix A) during which time demographic data (Appendix B) and exercise histories (Appendix C) were taken and individuals were screened for the presence of recent dramatic life events that might bias the study's results. At this point, persons willing to participate in the study were asked to sign informed consent forms (Appendix D) and completed the JAS, POMS and Harvard Step-Up Test. Directions for completion of the exercise diary (Appendices E and F) were explained and questions answered. Subjects were provided with preaddressed, stamped envelopes in which to mail their completed diaries on a weekly basis to the researcher. In addition, subjects were given copies of the JAS and POMS and asked to complete them on the last day of the study and to return them with their final diary sheet. Subjects were instructed to maintain their usual exercise regimen until scoring was completed for all subjects and they were notified to begin keeping their diaries.

Upon pre-test scoring, subjects were randomly divided into three groups matched on the basis of gender, age, and usual amount of weekly exercise as determined by the interview. The groups were defined as follows:

1. Group 1 was a control group. Members were asked to maintain their current exercise regimen and keep an exercise diary for a period of 10 weeks. [The ACSM suggests that 10 to 20 weeks are necessary for psychological and physiological training adaptations to occur (Dishman, 1984)].

2. Group 2 was a treatment group. Members were requested to reduce their exercise regimen to include no more than 5 hours of aerobic activity per week. They were also asked to keep an exercise diary for 10 weeks.

3. Group 3 was also a treatment group. Members were asked to maintain their current exercise regimen, keep the exercise diary and attend 5 meetings with the researcher for the purpose of learning relaxation techniques. (The format for the relaxation training group is provided in Appendix H.) Subjects chose to attend one of 3 identical-content meetings held for each relaxation session. Subjects were required to attend 4 of the 5 meetings in order to have their data included in the analysis.

Once all participants were screened, the researcher contacted them by telephone. Members of all groups were

advised to begin keeping the exercise diaries on January 1, 1990. The terms of the study were re-explained and questions answered. In addition, the relaxation training group was polled in order to determine days and times most convenient for meetings. A letter detailing the meeting schedule was then sent to all relaxation group members. Meetings occurred during weeks 2, 3, 5, 7 and 9 of the study. Upon analysis of the data, an explanation of the results of the study was mailed to all participants.

Data Analysis

The data were analyzed to investigate the magnitude and statistical significance of mean differences among groups. In a case such as the present study where there are several dependent variables, the use of multivariate analysis of covariance (MANCOVA) is recommended (Tabachnick & Fidell, 1983). After adjusting for pre-existing differences on the dependent variables (Type A behavior, anxiety, depression, anger), the MANCOVA procedure allows investigation of significant differences among groups in the best vector of dependent-variable means post-treatment.

The advantage of MANCOVA over a series of ANCOVAs, one for each dependent variable, is reduction of the likelihood of Type I error (Tabachnick & Fidell, 1983). To the extent that the dependent variables are uncorrelated, the use of MANCOVA optimizes the discovery of behaviors that may be affected by the independent variable(s). To the extent

that the dependent variables are correlated, the various dependent variables will measure similar facets of behavior in somewhat different ways.

In using MANCOVA, data are carefully analyzed to investigate their consistency with the assumptions of the procedure. These assumptions include multivariate normality, lack of outliers, homogeneity of variance-covariance matrices, linearity of the relationships among dependent variables and covariates within each cell, homogeneity of regression, reliability of covariates and lack of multicollinearity (singularity). These assumptions will be discussed in detail in Chapter 4. Data are screened for outliers and discrepancies before analysis. In the event that significant differences between groups are found, tests of specific comparisons, such as a stepdown analysis or a test of multivariate strength of association, are performed. In this way, information concerning the nature of specific group differences, such as which groups differ significantly and which dependent variables are responsible for those differences, is obtained.

Pilot Study

Purpose

As part of this research, a pilot project using identical hypotheses to those outlined in Chapter 1 was conducted by the researcher in the summer of 1989.

Subjects (n=24) were recuited at triathalons and Greensboro and Winston-Salem Running Club meetings. All participants were interviewed and administered the JAS, POMS and Harvard Step-Up Test. Subjects were matched by amount of exercise, gender and Type A behavior and randomly assigned to one of four groups. Group 1 was a conventional control group. Group 2 was also a control group but differed from Group 1 in that the members attended 5 meetings for the purpose of receiving information on exercise technique and training. The second control group was added in order to investigate the attention effect of the meetings and to test the supposition that participants might not adhere to the requisites of the study without attention from the researcher equivalent to that of the other groups. Group 3 was asked to reduce their exercise to no more than 5 hours per week and attended 5 meetings identical in content to those of Group 2. Although the interest of the researcher was the effect of exercise reduction, group meetings were added to the treatment in order to ensure subject compliance with the terms of the study. Group 4 also attended 5 meetings, the subject of which was changing behavior through mental imagery and progressive relaxation. Persons missing three or more meetings were dropped from consideration. All groups kept exercise diaries for 10 weeks. At the end of the 10-week period, subjects self-administered the JAS and POMS and mailed the tests to the researcher.

Results

Three subjects were dropped from the study, which left 21 participants. One refused to reduce his exercise level; one missed three of the five meetings; and one did not receive the message to begin the study. Subjects (11 males, 10 females) ranged in age from 24 to 60 years ($\bar{X}$=35.28). Subjects were primarily college educated and were either self employed or employed in managerial positions. Exercise performed during the week before the interview was used as a baseline. During that week participants participated in between 4 and 14 distinct exercise sessions ($\bar{X}$=8.04) for between 30 and 100 minutes per session ($\bar{X}$=57.2). Participants rated their perceived exertion during exercise at between 11 and 19 on a 20 point scale ($\bar{X}$=14.8) and refrained from exercise (on average) one day during the week. These individuals had been exercising regularly (3 or more times per week) for periods ranging between 2 and 29 years ($\bar{X}$=12.6).

A multivariate analysis of covariance (MANCOVA) was performed in order to test the null hypothesis that after adjusting for pre-test scores, no differences existed among group means on the dependent variables (Type A behavior pattern, Tension/Anxiety, Depression/Dejection, Anger/Hostility). No significant differences were found. This was not an unexpected finding since the sample of 21 was extremely small and afforded very low statistical power.

Another anomaly caused by the small sample size arose through violation of several assumptions of MANCOVA. The Barlett Box Test, for example, demonstrated heterogeneity of variance for Depression/Dejection both pre- and post-test. A single outlying score could, in this instance, account for the discrepancy. Likewise, some departure from normality occurred for most tests. Finally, an F-test on Wilks' Λ revealed heterogeneity of regression for Type A Behavior Pattern and Depression/Dejection. Violations of the magnitude found in the pilot study could be attributed largely to insufficient sample size and were not expected to pose difficulties in the main study.

The sample as a whole showed a trend toward increasing Type A behavior, with the attention control group evidencing the greatest gain. Interestingly, among individuals there were wide fluctuations in pre- and post-test scores, with subjects increasing or decreasing as much as 50 points (on a 300-point scale) within the same treatment group. Somewhat unexpectedly, the relaxation training group also evidenced an increase in TABP. This result can probably be attributed to one extreme score increase in a subject who changed from a low-to a high-pressure job during the course of the study, an event that could dramatically alter responses on the Jenkins Activity Survey.

Regarding mood, post-test scores for all groups fell in the low-normal range. Large standard deviations were found for Depression/Dejection pre-test and post-test in the attention control group and for Tension/Anxiety pretest in the first control group, indicating the presence of extreme scores in these test groupings. Pretest scores on Tension/Anxiety, Depression/Dejection, Anger/Hostility and posttest Anger/Hostility scores were virtually identical for all groups. The exercise reduction group exhibited lowered scores on two variables, Depression/Dejection and Anger/Hostility and increased Tension/Anxiety scores, although not significantly. In the relaxation group the only trend was toward reduction in Tension/Anxiety.

Implications

The decision to have two control groups in the pilot study was based on concern that members of a control group that did not receive the attention provided by the researcher in the form of meetings might neglect to maintain their exercise diaries. This was not found to be the case; in fact, Group 1 was the most faithful in terms of follow-through. In addition, the large TABP fluctuations within groups were of concern to the researcher. These may be explained by the nature of the group meetings which consisted primarily of imparting information concerning exercise training and technique. During the course of treatment, group members responded

enthusiastically to the information in different ways, some becoming highly motivated to reach new fitness heights and others relaxing their attitudes. These changes in attitudes and motivation undoubtedly confounded the results. With this experience in mind, it was decided to use only one control group in the present study and to eliminate regular meetings for both the control group and the exercise reduction group. In order to ensure compliance in the current study, the researcher made telephone calls to the participants when difficulties arose.

A further concern was the generally low, flat profile of pretest mood scores. Given the low-normal range of scores, it appeared unlikely that post-test scores would reveal a declining trend. Of interest, then, was the decrease in Depression/Dejection and Anger/Hostility scores for the exercise reduction group and Tension/Anxiety for the relaxation group, findings that lent some support to the tenability of the second and sixth research hypotheses.

CHAPTER 4

RESULTS

The contents of this chapter include a description of the subjects and data analysis, including discussion of the degree to which the assumptions of MANCOVA have been satisfied.

Subjects

Fifty-eight of the 68 persons who agreed to enter the study completed its requirements. Four left the study because of time commitments; 5 did not return their diaries but offered no explanation in response to the researcher's telephone calls; and 1 completed the diaries but left the country without completing the post-tests. A final subject, who completed all requirements, was dropped from the study because of circumstances which rendered her post-test scores invalid, leaving a total of 57. Subjects (18 males and 39 females) ranged in age from 23 to 56 years of age ($\underline{\bar{X}}$ = 37). The large majority were college educated and either self employed or employed in administrative positions. Fifty-five participants were Caucasian; 2 were Hispanic; 1 was Afro-American. Using the subjects' recall of the week's exercise prior to the interview as a baseline, it was determined that participants ranged between 1 and 18 ($\underline{\bar{X}}$ = 7) distinct exercise sessions during that week of

between 15 and 150 ($\underline{X}$ = 62) minutes duration for a total mean of 432 minutes (7.2 hours) of aerobic activity per week. Subjects' perceptions of the intensity of that exercise ranged from 9 to 20 ($\overline{\underline{X}}$ = 15) on the Borg Scale. In addition to their aerobic activity, subjects averaged 112 minutes of anaerobic exercise during the week in question. They rested 2 days on average.

Study participants reported having engaged in regular aerobic exercise (3 times per week or more) for between 1 and 35 years ($\overline{\underline{X}}$ = 12.245). Since the onset of their aerobic programs, subjects had undergone between 0 and 5 interruptions of 3 months or more ($\overline{\underline{X}}$ = 0.709) when they did not exercise. When asked to list their 3 primary reasons for continuing to exercise regularly, participants overwhelmingly pronounced weight control the single most motivating factor, followed by general health, increased energy and enjoyment (See Table 1). Results of the Harvard Step Test, a general measure of fitness level, were surprising in view of the fact that subjects spent a minimum of 6 hours per week engaging in vigorous physical activity. Nine participants (16%) refused to take the test because of knee or ankle injuries. Of those remaining, 12 (21%) ranked in the low fit category, 8 (14%) in the average, and 28 (49%) in the high fit.

Subjects were assigned randomly to groups after matching for amount of exercise, age and gender. The

Table 1

Reported Reasons for Maintaining Current Exercise Levels

Reason	Number of Responses	Percentage
Weight control/can eat more	44	.26
General health	21	.13
Enjoyment	17	.10
Increased energy/feels good	16	.10
Stress reduction	15	.09
General fitness	13	.08
Appearance/body image	11	.07
Mental well-being/mood control	11	.07
Social network	6	.04
Competition	6	.04
Habit	4	.02
Feeling of mastery	3	.02

control group (n = 18) had a baseline mean of 411 minutes of aerobic activity per week, averaged 40 years of age, and contained 7 men and 11 women. Group 2, the exercise reduction group (n = 19), averaged 404 minutes of exercise per week, had a mean age of 36 and held 6 males and 13 females. The relaxation group (n = 20) averaged 478 minutes of aerobic exercise per week, averaged 37 years of age and contained 5 men and 15 women.

Participants were diligent in completing the requirements of the study. All but 4 of the relaxation group members attended all 5 treatment sessions. The remaining 4 missed the final meeting. In the exercise reduction group subjects reduced their aerobic activity to an average of 3.5 hours ($\overline{X}$ = 213 minutes) per week, a reduction of nearly 53 percent (See Table 2). Pre-test step-up scores were not reported in the table because the high percentage of subjects refusing to take the test or failing to finish it because of knee pain rendered the test results invalid.

Table 2

Group Comparisons of Mean Exercise and RPE Levels

	Control	Reduction	Relaxation	Total Sample
Mins. of Exercise (Baseline)	411	404	478	432
Mins. of Exercise (10-week mean)	397	213	501	372
RPE (Baseline)	14.9	15.2	15.1	15.1
RPE (10-week mean)	14.4	14.6	15.3	14.7

Assumptions

As noted in Chapter 3, the principal data analytic method used was multivariate analysis of covariance.

The validity of this statistical procedure depends on satisfaction of the following assumptions: within-group dispersion matrices are assumed to be homogeneous; the dependent variables and covariates are assumed to follow a multivariate normal distribution in each population; samples are assumed to be chosen independently from each population, using simple random sampling; and the covariates are assumed to be correlated with the dependent variables. To the extent that available data permit examination of these assumptions, they will be examined in order.

The assumption of homogeneity of dispersion matrices was investigated by applying the Bartlett-Box test to the sample variance-covariance matrices. These matrices were found to differ significantly ($p < .012$) in violation of the homogeneity assumption. Follow-up tests using the univariate Bartlett-Box procedure supported null hypotheses of homoscedasticity for all dependent variables except Depression/Dejection ($p < .001$). According to Tatsuoka (1988), multivariate analysis of covariance is robust with respect to departures from homogeneity of dispersion matrices when sample sizes are equal, as is essentially the case in this study (sample sizes were 18 for the control group, 19 for the exercise reduction group, and 20 for the relaxation group).

The assumption of multivariate normality was examined through visual inspection of the frequency distributions of each dependent variable and each covariate. No significant departures from normality were observed.

Since subjects volunteered to participate in this study in response to written requests and advertisements, it cannot be assumed that the sample is randomly representative of a population of chronic exercisers. However, subjects were selected independently and were assigned to control and treatment groups using a stratified random sampling procedure. Within-sample and between-sample independence was thus assured.

Bartlett's test of sphericity was conducted to examine the possibility that the dependent variables were uncorrelated with the covariates. The null hypothesis of sphericity was rejected ($p < .001$), indicating satisfaction of the assumption that the covariates predicted the dependent variables with non-zero slopes.

Findings

Statistical analysis using the MANCOVA procedure revealed no statistically significant differences among group means for the vector of dependent variables (Type A behavior pattern, Tension/Anxiety, Depression/Dejection, Anger/Hostility) after controlling for pre-test scores on all variables. The Wilks omnibus F test showed no significant treatment effects ($F_{8,94} = .602$). Nor did

univariate F-tests indicate significant between-group differences. F values were .862 (p = .429) for Type A behavior, .340 (p = .713) for Tension/Anxiety, 1.730 (p = .188) for Depression/Dejection, and .099 (p = .906) for Anger/Hostility. Pre- and post-test means and standard deviations are reported in Tables 3 and 4, and adjusted post-test means are shown in Table 5. All indices suggest very small, statistically insignificant treatment effects.

A table containing estimated effect sizes (Table 6) presents a comparison of the adjusted means of the treatment groups with those of the control group. In general the effect sizes were small (0.02 to 0.40 in absolute value). Exceptions were the Type A mean for the exercise reduction group, which was approximately one-quarter of a standard deviation greater than the control mean and the Tension/Anxiety and Depression/ Dejection means of the relaxation group, which were one-quarter and two-fifths of a standard deviation, respectively, below corresponding control-group means. Although these mean differences were not statistically reliable, i.e., the null hypothesis of no differences between population means was retained, in these three cases the effect sizes were substantively different. Exercise reduction appeared to have made some difference in terms of increased scores on Type A behavior. Likewise, relaxation

training appeared to have had a non-significant but substantively important effect in terms of reducing anxiety and depression scores.

In sum, none of the research hypotheses were supported. Neither Type A behavior, anxiety, depression nor hostility were affected significantly in either direction by reduction of aerobic activity to recommended levels. Likewise, a 5-session course of relaxation training produced no significant reductions in these variables. In the following chapter the implications of these findings are discussed.

Table 3

Pre-test Means and Standard Deviations

	Control (n = 18)	Reduction (n = 19)	Relaxation (n = 20)	Total Sample (n = 57)
Type A	268.3 (SD=58.5)	251.7 (SD=54.1)	221.8 (SD=70.8)	246.4 (SD=63.7)
Anxiety	43.9 (SD=6.6)	43.7 (SD=6.5)	43.2 (SD=9.2)	43.6 (SD=7.5)
Depression	41.0 (SD=5.8)	42.1 (SD=4.6)	43.8 (SD=7.3)	42.4 (SD=6.0)
Hostility	42.4 (SD=5.4)	46.4 (SD=8.5)	46.1 (SD=7.5)	45.0 (SD=7.4)

Table 4

Post-Test Means and Standard Deviations

	Control (n = 18)	Reduction (n = 19)	Relaxation (n = 20)	Total Sample (n = 57)
Type A	267.7 (SD=61.5)	268.1 (SD=70.8)	230.1 (SD=72.4)	254.6 (SD=69.8)
Anxiety	43.6 (SD=7.1)	43.5 (SD=7.6)	40.9 (SD=7.2)	42.6 (SD=7.3)
Depression	41.4 (SD=5.4)	42.8 (SD=6.9)	41.0 (SD=2.8)	41.8 (SD=5.2)
Hostility	43.6 (SD=4.5)	44.9 (SD=7.7)	43.9 (SD=5.4)	44.1 (SD=5.9)

Table 5

Adjusted Post-Test Means

	Control (n = 18)	Reduction (n = 19)	Relaxation (n = 20)	Standard Deviation of Control (Post-test)
Type A	246.7	263.4	255.8	61.5
Anxiety	43.5	42.9	41.7	7.07
Depression	42.4	42.6	40.2	5.37
Hostility	43.9	44.6	43.9	4.53

Table 6

Estimated Effect Sizes

	Reduction	Relaxation
Type A	0.27	0.15
Anxiety	-0.08	-0.26
Depression	0.05	-0.40
Hostility	0.18	0.01

CHAPTER 5

DISCUSSION

Implications

The purpose of this research was to examine the differential effects of exercise reduction and relaxation training on Type A behavior pattern, anxiety, depression and hostility in chronic aerobic exercisers. Although no statistically significant findings resulted from the present study, there are several important implications for this research. Initially, the researcher suspected that a majority of chronic exercisers fell into the Type A category. Time urgency, hard-driving tendencies, high performance standards, competition, achievement striving and aggression--all characteristics of the Type A individual--well can be said to describe the realm of vigorous physical activity. It would not be surprising, then, to find persons ardently devoted to aerobic exercise exhibiting high Type A scores. This suspicion was confirmed in the pilot study (n=21) performed as part of this project wherein 70 percent of subjects were categorized as Type A by the Jenkins Activity Survey (JAS). In the current larger sample, however, Type A scores were normally distributed with the sample pre-test ($\bar{X}$ = 246) and post-test ($\bar{X}$ = 254) means falling in the 60th percentile in

the range of scores. While somewhat above average, scores in the 60th percentile are not considered to be high; rather they indicate a moderate degree of both Type A and Type B behaviors. Overall, 54 percent of the subjects scored above the 50th percentile on TABP. This finding confounds reports by Folsom et al. (1985) and Jasnoski (1983) that greater exercise intensity and duration are associated with the Type A behavior pattern (TABP) but may well support Hinkle, Lyons and Burke's (1988) finding of no significant differences (except on "running when not motivated") on hard-driving variables between Type A/B roadrace runners. In essence, the prevalence of TABP among chronic exercisers is as yet undetermined.

In observing the present distribution of scores, however, one might surmise that the exercise itself served as an outlet for the hurried and competitive drives of Type As, thus producing an artificial lowering of scores. Upon reduction of exercise (in this case by 53 percent) one might reasonably expect an increase in Type A scores as the opportunity to strive athletically diminished. This proved not to be the case. Judging from the present sample, it appeared that not only did the Type A/B scores of chronic exercisers fall in a distribution similar to published norms, they also were unaffected by the reduction of exercise to generally accepted levels. The question becomes, if TABP can be modified through exercise, at what

point do the ameliorative effects of exercise subside? The results of the present study indicate that if Type A behavior is reduced through exercise, after 3 to 5 hours of weekly exercise little further reduction is obtained. Since reduction of exercise to 5 hours or less produced no negative effects in regard to TABP, it appears that in prescribing exercise for modification of the pattern, the American College of Sports Medicine guidelines are sufficient.

In the current study anxiety, depression and hostility, in addition to TABP, were unaffected by reductions in exercise levels. This finding initially appears to confound the literature which states that aerobic exercise reduces dysphoric mood. Previous research, however, has concentrated on populations for which initiating an exercise program was the prescribed treatment. By and large, it has not examined the effects of exercise beyond 5 sessions per week. Again, it may be that more than 5 hours of activity per week (or possibly as little as 3 hours) adds little to the positive mood effects of exercise. The course of the study (10 weeks) was on the lower end of the time spectrum considered sufficient to allow psychological changes to occur as a result of exercise manipulation (10 to 20 weeks). Therefore, it is also possible that the treatment period was of insufficient length to allow statistically detectable adaptions to occur.

In this study, reducing exercise to an average of 3.5 hours per week had no effect in either direction. Since the pre-test scores of the sample on anxiety, depression and hostility were uniformly low, it might have been expected that with exercise reduction, dysphoric mood would increase. Several studies have pointed to the short-term (1 or 2-day) negative effects of exercise deprivation on mood, including increased anxiety, nervousness and depression (Harris, 1981; Summers et al., 1982; Thaxton, 1982). Despite this expectation, after 10 weeks exercisers who had cut their former activity approximately in half appeared to have suffered no ill effects in terms of anxiety, depression or hostility. One possible explanation for this finding may be that participants suffered withdrawal symptoms during the early part of the study but gradually adapted to their reduced exercise levels. Another possibility is that 3 to 5 hours of vigorous aerobic activity is enough to maintain a positive mood profile. Once more, in regard to maintaining low levels of anxiety, depression and hostility, ASCM recommendations for amount and quality of exercise appear to be sufficient.

Perhaps the most important implication of this study lies in determining appropriate exercise levels for healthy individuals. Because the likelihood of injury increases with additional frequency, intensity and duration of exercise, it is important that optimal activity levels,

not only for cardiovascular conditioning but also for personality enhancement and mood control, be determined and publicized. The American College of Sports Medicine (ASCM) has determined limits within which aerobic activity improves and maintains cardiovascular fitness. This study supports these same limits in regard to one personality construct (TABP) and three mood variables (anxiety, depression and hostility). No detriments in either TABP or mood occurred when exercise was reduced to amounts within ASCM guidelines and, in regard to exercise, more was not better beyond that point. While it appeared that no damage was done in terms of TABP or mood, neither was further benefit added. In terms of emotional health for this population, there appears to be no need to exercise more than 3 to 5 hours per week; in terms of physical health, there are serious concerns about increasing exercise beyond those levels.

In Chapter 1 the rationale presented to support non-directionality of the first four research hypotheses was that, given exercise reduction, subjects could conceivably respond in one of two ways. Upon experiencing a reduction in a primary coping mechanism (aerobic exercise), subjects might exhibit increases in impatient, aggressive behaviors and affective symptomology. On the other hand, upon reducing exercise to a more moderate level, subjects might experience less pain and fatigue and

have more opportunity to develop other, neglected coping strategies. In order to examine the possibility that both events were operating in the current study, thus neutralizing the statistical effects of either event, individual scores in the control and exercise reduction groups were examined for differences of .5 standard deviation or more. In terms of Type A scores, 8 of 19 subjects in the exercise reduction group, compared to 7 of 18 in the control group, differed .5 standard deviation or more pre-test to post-test. In the reduction group, however, 7 of the 8 increased Type A score compared to 4 of the 7 for the control group. One may tentatively speculate that for a significant proportion of chronic exercisers (in this instance, 40 percent of the exercise reduction group), exercise reduction may result in rather large elevations of TABP as measured by the Jenkins Activity Survey. For others, however, exercise reduction seems to make little difference in terms of Type A behavior.

Using the same criteria, examination of individual anxiety scores yielded no differences between groups. In both groups test score changes were evenly distributed in positive and negative directions; however, more subjects in the exercise reduction group experienced these changes (12 of 19 in the reduction group, 8 of 18 in the control group). In terms of depression scores there were also more reduction group changes of .5 standard deviation or more (7

in the reduction group, 3 in the control group). Of these changes, 5 of the 7 reduction group scores represented increases in Depression/Dejection as opposed to only 1 of 3 for the control group, a finding which may indicate a slight differential treatment effect in operation for some participants.

Last, in terms of hostility, 12 of the 19 exercise reduction group members, compared to 7 of 18 control group members, differed more than .5 standard deviation pre-test to post-test. Of these, 8 reduction group members, compared to 3 control group members, decreased Anger/Hostility scores. One may tentatively speculate that for a portion of chronic aerobic exercisers (in this case, approximately one-third of the reduction group), exercise reduction to moderate levels may result in a substantial hostility-reduction effect. This comparison is particularly significant (although not statistically so) in view of the very low pre-test scores on all mood variables for the total sample. That further large decreases in hostility were present for one-third of the exercise reduction group may have implications for further research regarding hostility as a factor in premature coronary heart disease and the role of exercise in reducing CHD.

Regarding the relaxation hypotheses, the lack of statistical findings regarding mood variables was not surprising given the uniformly low mood profiles

demonstrated in the sample. Since dysphoric mood states were already extremely low, there was little room for further decreases. However, adjusted mean anxiety and depression scores for the relaxation group were .26 and .40 standard deviations, respectively, below the mean of the control group. While mean differences were not statistically significant, given the initially low mood profiles for the total sample, differences of this magnitude are substantively of value, lending credence to the body of research that credits the practice of relaxation techniques with decreases in anxiety and depression. While the subjects in this study reported using exercise as a method of stress reduction, common sense dictates that knowledge of other coping mechanisms, such as relaxation, enhances general well being and provides alternative skills to be used when exercise is inappropriate or impossible.

The learning of relaxation techniques, however, had no effect on TABP or hostility, a component of TABP. Although few studies have examined the effect of relaxation on TABP, one study (Jenni & Wollersheim, 1979) produced decreases in TABP as a result of 6 sessions of relaxation training substantively similar to that of the present study. In Jenni and Wollersheim, however, all participants were initially identified as high Type As. Upon informal examination of relaxation group subjects with high pre-test

Type A scores, it appeared that the sessions made little difference in their post-test scores. Thus, this study did not confirm the efficacy of relaxation training in reducing Type A behavior. It may be, however, that a more intensive program consisting of a greater number of practice sessions would prove effective.

Implications for Counseling

Folkins and Sime (1981) have reviewed some theoretical perspectives regarding what is known today as the mind-body connection. They posited that simply hypothesizing that the body and mind influence one another does not address the complexities and mechanisms of the interactions; i.e., what happens and how it happens. In addition, they pointed to the fact that most research in the area has been largely atheoretical with speculation regarding the underlying mechanisms taking either a physiological or a psychological viewpoint.

Lazarus (1975) has offered a cognitively based theory of adaptation and emotion that can be applied to physical fitness training. He has proposed that physiologic changes associated with training are similar to adaptations born of response to emotional stressors. Affective changes thought to follow endurance training may be influenced by cognitive reappraisals of those effects in a particular psychosocial context. Thus physical exercise may be a coping mechanism by which individuals adapt to their environments. Physical

training, then, is one of many processes by which a person can reduce somatic discomfort brought about by environmental stressors.

If exercise training is useful in self-regulation of response to environmental stressors, it is important for helping professionals to understand and appropriately encourage the practice of exercise among their clientele. Browman (1981) offered the following comment:

> If exercise is to be a viable primary or adjunct treatment for psychopathology, researchers need to identify patients for whom activity is an efficacious therapy, quantify the relative amount and session duration of the exercise regimen, specify the type of activity and when it should be conducted, identify variables which interact with the exercise program (e.g., inclusion in a group activity and physiological changes), and evaluate other relevant parameters. The aim of nonexercise psychotherapy is to effect permanent psychological changes with the patient ultimately independent of the therapist. Presumably an exercise regimen could be a form of self-management. (p. 195)

Although Browman's comment was made in regard to clinical populations, this study, performed with a normal sample, offers some direction in understanding several of Browman's specific parameters, particularly the amount, duration, type and efficacy of exercise. Judging from the results of this research, 3 to 5 hours of aerobic activity per week, performed at 60 to 90 percent of maximum heart rate and lasting 15 to 90 minutes per session, is sufficient to maintain positive mood states in normals. In addition,

further increases in exercise may provide no further benefit, if benefit exists, in reducing Type A behavior pattern or negative mood. In prescribing exercise as an adjunct to counseling, professionals would be wise to familiarize themselves with the literature regarding not only the healthful physical and psychological effects of aerobic versus anaerobic activity, but also the deleterious physical effects of over-exercise. It has been well established that with increased frequency, duration and, particularly, intensity of exercise, the likelihood of injury rises. Now, in light of the current research, exercise in excess of 5 hours per week cannot be recommended on the grounds that further psychological benefits accrue.

Limitations

Because no research to date has examined the effects of exercise reduction on either mood or Type A behavior, the current research is best considered exploratory. As such, there are several limitations to be considered. First, the study used a relatively small number of volunteer subjects from a normal, but elite population. The impossibility of random sampling in this instance renders the results more tenuous than if a master list of chronic aerobic exercisers were available. However, subjects participated in a broad range of aerobic activities and were solicited through many means.

Second, it may be that the results do not generalize to other populations, particularly in regard to the relaxation findings. It may be, for example, that chronic exercisers are either more or less resistant to learning relaxation techniques than others. Likewise, another program of relaxation training using different methods, other instructors or a greater number of sessions might have produced different results. Moreover, the current sample was primarily college educated, white, middle class and members of organizations devoted to exercise. While survey research shows these characteristics to be typical of lifestyle exercisers in general, there may be variables for which the sample differs from the target poulation. The current sample, for example, was largely female, and all subjects resided within a hundred-mile radius of Greensboro, North Carolina.

In addition, there may have been variables other than those for which the groups were matched (amount of exercise, gender and age) on which the groups differed. It may have been, for example, that members of a particular group formerly had been exposed to relaxation techniques or were in an off-season training lull.

One potential limitation was a possible differential loss due to subjects having left the study. Upon performance of Hotelling's T-squared test, the null hypothesis that in terms of pre-test variables there were

no significant differences between subjects who completed the study and those who did not was retained ($F_{4,63}$ = .294; $p > .10$). Thus, there was no evidence that subject mortality presented a source of bias (See Table 7).

Table 7

Comparison of Pre-test Means and Standard Deviations for Subjects Completing and Not Completing the Study

	Type A	Anxiety	Depression	Hostility
Completing	246.4 (SD=63.7)	43.6 (SD=7.5)	42.4 (SD=6.0)	45.0 (SD=7.4)
Non-completing	244.8 (SD=72.7)	42.1 (SD=4.1)	41.4 (SD=2.9)	42.5 (SD=3.8)

Because anaerobic activity was not considered in the study, the possible presence of this form of exercise also may be considered a limitation. Although anaerobic activity has not been shown to have positive mood effects, the fact that the exercise reduction group was allowed to continue anaerobic training may have contributed to the lack of statistical findings.

Another limitation concerns instrumentation. Although the Jenkins Activity Survey and the Profile of Mood States are the preferred instruments for measuring Type A behavior and mood in a study of this type, it is not entirely clear that change measured by any questionnaire

represents true change. In general, questionnaires are limited in their sensitivity because they rely on subjective perceptions rather than behavioral observations. Given the current state of the research, however, the only alternative measure of Type A behavior, the Structured Interview, while a better predictor of CHD, has not been used to evaluate change, primarily because its categorical classification system (A or B; A1, A2, X, B) does not lend itself to the detection of the subtle changes expected from an intervention. In the case of mood evaluation, the individual is the most reliable source for reporting internal change. However, when behavioral self-report measures, such as the exercise diaries, are used, there is an increased likelihood of reporting inaccuracies. Subjects may have recorded more or fewer exercise sessions than they actually performed. However, given the importance of aerobic exercise in the lives of these individuals, their devotion to fitness, and their self-images as athletes, underreporting of exercise activity in the study was high unlikely.

Finally, even had post-treatment differences in Type A behavior or mood been discovered, they would not demonstrate that coronary heart disease risk had been reduced nor would they demonstrate a decrease in physiological reactivity. At this point it is unclear if chronic exercisers are more likely to be classified Type A than regularly active

exercisers, if TABP change can be sustained, or if behavior change in the proper direction would lower CHD risk. While questions of physiological reactivity and risk of CHD are best left to medical researchers, the present study provides some support for the psychological efficacy of current ASCM guidelines for exercise.

Recommendations

The results of the present study provide some information concerning aerobic exercise as a psychologically healthful activity. Future research using larger samples is needed to confirm or deny these results. In addition, more research is needed to describe the population of chronic exercisers in regard to the presence of the TABP; the effects, if any, of exercise in its amelioration; and the physiological and psychological concommitants of that change. Finally, further research using proper controls is needed to investigate aerobic exercise and aerobic exercise as an adjunct to counseling in the treatment of anxiety and depression.

Conclusion

In conclusion, this study is the only known study to investigate the effects of exercise reduction on TABP and dysphoric mood. In addition, only one controlled study has examined the mood effects of exercise cessation among habitual exercisers (Bahrke et al., 1986). Experimental research dealing with the population of those who exceed

these standards has in large part concerned biomechanics and nutrition. Personality and mood variables have been investigated primarily through survey rather than experimental methods. Further, few studies have dealt with possible reductions in TABP through relaxation training.

The understanding of the interactions of mood and TABP with self-management techniques such as relaxation and exercise is essential to the helping professions. In a society plagued by rising health costs and astounding rates of depression and coronary heart disease, training individuals to develop healthful lifestyles is prudent, necessary and economical. This research was performed in order to achieve a better understanding of the relationships among these variables. In some measure, it is hoped that these findings will help counseling and medical professionals to delimit their recommendations regarding the use of relaxation and exercise as forms of self-therapy.

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Appendix A

Script: Initial Interview

Hello, I'm Susan DeVaney. I want to thank you for your time and cooperation in coming here today. As you no doubt know I am in the process of selecting particular individuals to participate in a study concerning personality characteristics and exercise. For the next 30 minutes to an hour I will be gathering information about you. We will start with some basic demographic information and a few general questions about the amount of stress you are currently experiencing. Then, if we both agree to your participation in the study, you will complete two self-report questionnaires and take a 5-minute test of physical endurance. If it seems as though I am being overly formal in this interview it is because for research purposes all the interviews must be as much alike as possible. Do you have any questions before we begin? ANSWER QUESTIONS HERE.

Let's begin. COMPLETE DEMOGRAPHIC INFORMATION FORM.

Good. Now, I am going to ask you a few questions about the presence of major stressful events in your life. In the past six months have you undergone a major stressful event in your life, such as marital separation, divorce, death in the immediate family, or significant legal or financial difficulty?

IF NO, SKIP TO "IF INDIVIDUAL IS NOT UNDERGOING A MAJOR STRESSOR."

IF YES, RESPOND Do you believe that this event has had an impact on your exercise behavior? WAIT FOR RESPONSE.

Can you explain that a little more for me? WAIT FOR RESPONSE.

Okay. Thank you. That helps me to understand.

IF THE INDIVIDUAL IS UNDERGOING A MAJOR STRESSOR THAT IS INFLUENCING EXERCISE BEHAVIOR, RESPOND In an experimental study such as the one I'm beginning, it is very important to make certain that the results that are obtained are due to the interventions built into the study and not to any extraneous factors. Because I am studying personality I have to be careful that any changes I observe are not due to feeling better or getting over a stressful event such as you have experienced. As much as I hate to lose you, I think that because of your current stress level now would not be a good time to participate in this study.

I certainly appreciate your cooperation today. Thank you very much for coming by. It was a pleasure talking to you.

IF THE INDIVIDUAL IS NOT UNDERGOING A MAJOR STRESSOR, RESPOND Good. Now I am going to ask you a few questions about your exercise program. ADMINISTER EXERCISE QUESTIONNAIRE AT THIS TIME.

Good. Now let me explain generally what will be required of you if you agree to participate. First you will fill out two self-report questionnaires and take a short test of physical endurance. That should take about 25 minutes altogether. We'll do that part today.

Then, as soon as I have interviewed all the prospective participants, I will randomly divide all the participants into one of three groups. Everyone, no matter what group he/she is in, will be asked to keep an exercise diary daily for 10 weeks. SHOW EXERCISE DIARY. HAVE PARTICIPANT FOLLOW ALONG AS YOU EXPLAIN HOW TO COMPLETE THE DIARY. Note that everything I have told you about completing the diary is found on the back of each sheet. If you have a question about completing the diary you have only to read the instructions. At the end of each week you should mail a diary to me in one of the stamped addressed envelopes I have provided for you. On the last day of the tenth week all participants will complete the same two tests I'll be giving you in a moment and mail those back to me along with the final exercise diary sheet.

Group 1 is a control group. Members of this group merely maintain their current exercise pattern, keep the diary, and complete the tests. Members of the second group do the same thing and, in addition, attend 5 meetings with me over the course of the 10 weeks for the purpose of learning relaxation techniques. Each of the 5 meetings

will be held 3 times in order to allow people options for attendance. Group 3 will keep the diary, take the tests, and limit their aerobic activity to no more than 5 hours per week.

About a month after the study is over I will be sending you a report telling you exactly what I was looking for in the study, why I chose to study these variables, and what I found. I will also include your individual results so you can compare them to the findings in the different groups.

Do you have any questions? ANSWER QUESTIONS HERE.

IF PERSON DOES NOT WISH TO PARTICIPATE RESPOND, Well, I'm sorry I can't interest you in participating. Thank you very much for your time and cooperation today. It was a pleasure talking to you.

IF PERSON DOES WISH TO PARTICIPATE, HAVE HIM/HER SIGN CONSENT FORM.

The Jenkins Activity Survey asks questions about aspects of behavior that have been found helpful in medical diagnosis. Each person is different, so there are no right or wrong answers. For each question, choose the answer that is true for you and fill in the space in front of that answer. Do you have any questions?

ADMINISTER JENKINS ACTIVITY SURVEY.

On this sheet is a list of words that describe feelings people have. Please read each one carefully.

Then fill in one circle under the answer to the right which best describes how you have been feeling during the past week including today. Do you have any questions?

ADMINISTER PROFILE OF MOOD STATES.

Good. Now, do you need a break before we begin the exercise test?

This test consists of stepping up and down on this bench in rhythm with this metronome. Continue stepping as long as you can. I will tell you to stop if you are still stepping after 5 minutes. As soon as you stop stepping I want you to have a seat in this chair and give me your arm so I can take your pulse. Any questions?

BEGIN HARVARD STEP TEST.

Okay, are there are any questions you would like to ask me before we call it a day? ANSWER ANY QUESTIONS.

Well, then we're all done. Thank you so much for your cooperation. I will be in touch with you by phone as soon as I've identified all the participants and we'll work out the necessary details. Be talking to you soon.

Appendix B

Demographic Data Form

Name_____

Address_____City_____Zip_____

Telephone (H)_____(W)_____

Birthdate_____Age____ Gender (Circle one) Male Female

CIRCLE ONE ANSWER FOR EACH QUESTION

1. What is your current marital status?
    a. single (never married)
    b. married
    c. separated or divorced
    d. widowed.
2. Which of the following racial/ethnic groups best describes your origins?
    a. American Indian or Alaska Native
    b. Asian or Pacific Islander
    c. Black or African-American
    d. White, not of Hispanic origin
    e. Hispanic origin
3. Which of the following best describes the highest educational level you have attained?
    a. elementary or less
    b. some high school
    c. high school graduate
    d. some college
    e. college or university graduate
    f. some graduate school or hold post-graduate degree

4. What is your current employment status?

    a. Not employed

    b. Employed less than 25 hours per week

    c. Employed more than 25 hours per week

5. Which of the following best describes your employment?

    a. Not employed

    b. Clerical

    c. Blue collar, laborer

    d. Managerial, administrative

    e. Self employed

    f. Technical worker

    g. Other

Appendix C

Exercise History Form

Recall the aerobic exercise activities you participated in over the last 7 days; that would be beginning at this time last _____, and answer the following questions.

1. On how many separate occasions during the last week did you exercise aerobically?_____
2. Look at this scale. **Show Borg Rating of Perceived Exertion Scale.** On average over the last week, how would you rate the intensity of your aerobic exercise?

   _____
3. How many days of rest (no aerobic activity) did you experience during the last 7 days?_____
4. On each of the separate occasions on which you exercised, how many minutes (on average) did you spend in aerobic exercise?_____
5. Recall your exercise sessions of the past week. What was the least number of minutes you spent exercising aerobically on any one occasion?_____
6. Again recall your exercise sessions of the past week. What was the greatest number of minutes you spent exercising aerobically on any one occasion?_____
7. On the occasions when you exercised did you perform preliminary static stretching?_____

8. During the past week on how many separate occasions did you perform warm up stretching exercise?_____

9. On the occasions when you did warm up, how many minutes on average did you devote to it?_____

10. During the past week did you perform cool down static stretching?_____

11. During the past week on how many separate occasions did you perform cool down stretching?_____

12. On the occasions when you did perform cool down stretching, how many minutes on average did you devote to it?_____

Use the chart below to log the answers to questions 13 through 16.

13. During the past week what types of aerobic activity did you perform?

14. During the past week on how many separate occasions did you perform each of these activities?

15. On average how many minutes did you spend on each occasion when you performed each of these particular aerobic activities?

16. On average at what level of intensity did you perform each of these aerobic activities? **Show Rating of Perceived Exertion Scale.**

Activity_____

Frequency_____

Minutes_____

RPE_____

Use the chart below to log the answers to questions 17 through 20.

17. During the past week what exercise activities did you perform that were not aerobic?

18. During the past week on how many separate occasions did you perform each of these activities?

19. On the occasions when you performed these activities how many minutes (on average) did you spend on these particular activities?

20. On average at what intensity did you perform each of these activities? **Show Rating of Perceived Exertion Scale.**

Activity_____

Frequency_____

Minutes_____

RPE_____

21. Was this a typical exercise week for you?_____

If not, how was it atypical?_____

_____

_____

The following questions concern your exercise history.

22. In what year did you first begin a program of regular (3 times or more per week) aerobic exercise?_____

23. Has your program of aerobic exercise undergone significant (3 months or more) interruptions since you first began it?_____ How many times?_____

When was the last period of interruption?_____

24. To what do you attribute this (these) interruptions? Describe._____

_____

_____

_____

25. People are motivated to exercise for many reasons. In order, what would you say are your 3 chief reasons for exercising?

a._____

b._____

c._____

The following questions concern persons who offer support for your current exercise regimen.

How would you characterize the amount of support you receive for your current exercise regimen from the following people?

	none/minimal	moderate	whole-hearted
26. Spouse/ significant other			
27. Other family members			
28. Friends			
29. Colleagues/ fellow workers			
30. Other (Specify)_____			

Appendix D

University of North Carolina Greensboro
Department of Counseling and Specialized Education
Informed Consent Form

I understand that the purpose of this project is to study the effects of exercise and relaxation training on personality and mood in persons who exercise at a level above that recommended by the American College of Sports Medicine.

I confirm that my participation is entirely voluntary. No coercion of any kind has been used to obtain my cooperation.

I understand that I may withdraw my consent and terminate my participation at any time during the project.

I have been informed of the procedures that will be used in the project and understand what will be required of me as a subject.

I understand that a test of maximum cardiovascular endurance will be used in the study. I certify that I am physically healthy and willing to participate in this test.

I understand that all my responses, written/oral/task, will remain completely anonymous.

I understand that a summary of my data results from the project will be made available to me at the completion of the study if I so request.

I wish to give my voluntary cooperation as a participant.

Signature_____Date_____

Address_____

_____Zip_____

Witness_____Date_____

Appendix E

Weekly Activity Diary

Name______________________________ Participant Number______________

Week Number______________

Date	Begin TX	End TX	PreHR	EndHR	Activity	Perceived Exertion
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
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						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
						6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Completing Your Exercise Log

This single sheet of paper is your record of exercise sessions for an entire week. Begin recording tomorrow, which is _____ and continue until _____. At the end of the week, place the log in one of the addressed stamped envelopes I have given you and mail it.

1. Place your name on the line at the top left side of the sheet.

2. Place the number of the week of the study on the line to the right.

3. Place the numbers for the month and date of each workout in the first column (example: 5/23).

4. Write the time in hours and minutes when you begin each workout (example: 6:09) in the column headed **Begin TX.**

5. Write the time in hours and minutes when you end each workout in the column headed **End TX.**

6. Write the number of heart beats counted in 10 seconds immediately before you begin exercise in column headed **Pre HR.** To take your pulse place the tips of the first two fingers lightly on the carotid artery or the radial artery and count the pulsations. You may also place the heel of the hand over the left side of the chest and count. Remember that applying excessive pressure to the carotid artery can cause the pulse rate to slow. <u>If the count does not end on an even beat, add one-half beat to the last full count (example 10.5)</u>.

7. Write the number of heart beats counted in 10 seconds immediately post-exercise in the column headed **End HR.** Heart rate begins deceleration within 15 seconds after cessation of exercise so count must be made immediately to be accurate. Take 2 to 4 seconds to position the hand and begin the 10 second count. You can complete the count within the recommended 15 second period.

8. Write the type of physical activity performed. Example: running.

9. To use the Rating of Perceived Exertion Scale estimate how difficult you feel your exercise workload is; that is, rate the degree of perceived exertion you feel. Perceived exertion is the total amount of exertion and physical fatigue, the total, inner feeling of exertion. Do not concern yourself with any one factor such as leg pain, shortness of breath, or work grade. Be as honest and objective as possible. Try not to underestimate or overestimate. Be as accurate as possible. Mark the number that best approximates your perception of the intensity of your workout with 6 being the lowest intensity and 20 being the highest. Notice the descriptors of the scale numbers on the back of the page.

Please be as accurate as possible in completing this log. Make the notations on the log at the time of your workout. It is easy to say you will write the measurements down later and then forget the number.

Appendix F

Table: Conversion Table for Upper Limit/Target Heart Rate

beats/10 seconds		beats/ minutes	beats/10 seconds		beats/ minutes	beats/10 seconds		beats/ minutes
9	=	54	18	=	108	27	=	162
10	=	60	19	=	114	28	=	168
11	=	66	20	=	120	29	=	174
12	=	72	21	=	126	30	=	180
13	=	78	22	=	132	31	=	186
14	=	84	23	=	138	32	=	192
15	=	90	24	=	144	33	=	198
16	=	96	25	=	150	34	=	204
17	=	102	26	=	156			

Rating of Perceived Exertion Scale

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

Appendix G

Instructions for the Harvard Step-Up Test

This test consists in measuring the endurance in stepping up and down on a bench 20 inches high and the pulse reaction to this exercise.

1. A subject steps up and down on a 20-inch bench at the rate of 30 complete steps per minute as long as he can, but not in excess of 5 minutes. Stepping up and down is done so that the lead foot may be alternated. The cadence of 120 counts per minute may be maintained by watching the swinging of a 39-inch-long pendulum.

2. Immediately after the test, the subject is seated and his pulse is taken.

The "rapid" form consists of taking the pulse count only once - from 1 minute to 1 minute and 30 seconds after the exercise. The score is obtained from the formula:

$$\text{Index of fitness} = \frac{\text{Time of stepping in seconds X100}}{5.5 \text{ pulse count}}$$

The interpretation of scores is as follows:

Below 50 = Poor

50 - 80 = Average

Above 80 = Good

Computations for the "rapid" form test may be avoided by the use of the following table.

Table 1. Scoring Table for Harvard Step-Up Test (Rapid Form)

Duration of Effort	Heart Beats From 1 Minute to 1½ Minutes										
	40/44	45/49	50/54	55/59	60/64	65/69	70/74	75/79	80/84	85/89	90+
0-29"	5	5	5	5	5	5	5	5	5	5	5
0'30"-0'59"	20	15	15	15	15	10	10	10	10	10	10
1'0"-1'29"	30	30	25	25	20	20	20	20	15	15	15
1'30"-1'59"	45	40	40	35	30	30	25	25	25	20	20
2'0"-2'29"	60	50	45	45	40	35	35	30	30	30	25
2'30"-2'59"	70	65	60	55	50	45	40	40	35	35	35
3'0"-3'29"	85	75	70	60	55	55	50	45	45	40	40
3'30"-3'59"	100	85	80	70	65	60	55	55	50	45	45
4'0"-4'29"	110	100	90	80	75	70	65	60	55	55	50
4'30"-4'59"	125	110	100	90	85	75	70	65	60	60	55
5'	130	115	105	95	90	80	75	70	65	65	60

Below 50 - Poor general physical fitness

50-80 = Average general physical fitness

Above 80 = Good general physical fitness

Adapted from M.J. Haskins. Evaluation in Education. Wm. C. Brown Co., Dubuque, Iowa. 1971. p. 15.

Appendix H

Relaxation Training Manual

Relaxation Group

Session 1

Objectives: 1. To introduce the concept of increased personal productivity through the medium of relaxation.

2. To teach and practice deep breathing.

Thank the group members for their participation; then have them introduce themselves by telling about their current exercise regimen and its relationship to stress in their lives. Discuss for a few minutes how exercise can serve as a stress reducer. Then relate the following information.

The goal of a good training program, a good plan of action at work, or a good relaxation regimen is efficient use of energy. Exercising 15 hours a week may not be the most efficient way to increase fitness or to train for a race. Rather, incorporating proper training technique in a less time-consuming regimen may minimize over-use injuries while achieving the same physical conditioning. Likewise, learning to relax may allow the mental and physical break needed to work and play more efficiently.

The main goal of these 5 weekly sessions is to learn a more effective use of energy by learning to relax physically and mentally. This entails 4 sub-goals:

1. Being more selective in choosing what stressor to respond to.

2. Modulating the degree of response to any stressor.

3. Minimizing the duration of that response.

4. Maximizing the benefits of recuperation.

These goals are achieved by

1. Being more aware of one's physical tension, thoughts, and behavior.

2. Controlling physical tension, thoughts, and behavior.

3. Practicing these newfound skills.

4. Using these skills in preparing for and meeting stressful situations.

5. Increasing stress resistance through balancing threat and challenge with pleasure and tension release breaks.

Before one can learn to control stress, one must first have a working definition and understanding of it. Stress is any stimulus that calls for a defensive response from an organism. Therefore, positive as well as negative events (stimuli) can be stressful. What elicits a strong stress response in one person may cause little response in another; the strength of the responses are in large part learned behavior and can be modified. For example, if Sara's mother-in-law offers to help Sara clean up the house, Sara may bristle, anger, and develop a headache ("There she goes again, letting me know she thinks I'm a terrible housekeeper.") But Sara may be delighted to pay a housekeeper to do the same work. Stressors comprise a constant environmental condition to which we must learn to adjust. Without some stress we could never learn and grow; by taxing our bodies we make them stronger; by taxing our brains we develop increased knowledge and expertise. But if we overtax our bodies we become injured; if we over-work we burn out.

Physical and mental stressors generate the same neurophysical responses in humans. Psychological stress is perceived by the organism as actual physical danger. If this stressful condition is prolonged, the body's ability to adapt and return to homeostasis is exceeded, and the stress response becomes destructive. (At this time ask the group to share how their stress responses manifest

themselves. Typical answers will be headaches, nightmares or sleep disturbances, muscle tension, and irritability.)

The body responds to stressors in predictable ways. Let's assume I am feeling stressed because I am concerned that the group turn out well tonight. Psychologically speaking, I would be experiencing anticipatory anxiety. But physiologically speaking, my entire endocrine system (hypothalmus, pituitary, pancrease, adrenals, gonads) is activated. My heart rate and oxygen consumption increases. Body temperature is up. Blood supply increases; blood sugar rises; immune and anti-inflamatory responses activate. These are the same responses that the body has developed to ensure the preservation of the species. The heart is pumping faster in anticipation of attack; the muscles are tense; and there is more adrenalin, cholesterol, tryglycerides, and sugars in the blood. One intuitively can see that remaining in this state of readiness for fight or flight eventually will damage the system. (Stop here for comments and questions.)

So how does one change the pattern of hypervigilant response to environmental stressors? There are three ways:

1. Accept the present level of stress, cope with it, and go on.

2. Alter beliefs about and perceptions of the threatening event.

3. Alter the environment. This may be an alteration of the stressor, a diffusion of the stressor through alteration of the surroundings, or your leaving the environment.

(Stop again and ask for examples from participants' own experience of these methods of dealing with stress.)

Explain to the group that they will be learning various methods of dealing with stress over the next 5 weeks. All the methods require practice in order to be effectively incorporated into one's life; otherwise, they will be something the individual "did once" that didn't work. Ask for a commitment to practice the deep breathing that will be taught during this session. Explain that it only takes 2 to 3 minutes and can be done anywhere, including a crowded office or a car.

Deep Breathing

Sit in a relaxed position with no body parts crossed. Eyes can be open or closed. Have the participants count their pulses for 10 seconds. Ask them to record their 10-second count. Ask the members to inhale deeply through the nose and mouth while you count slowly to 7. Have them exhale through their mouths as you count to 8. Explain that immediately after you have counted aloud for 2 minutes, you will ask them to take another pulse count. (Their pulse count in many instances will be lower on the second occasion.)

After the exercise ask the participants how they feel. Ask them to describe both mind and body sensations. Since many people are not used to being mentally alert while physically relaxed, this may be a new sensation for them. Explain that the average heart rate of a person in this country is 80 beats per minute; if one were to reduce heart rate from 80 to 60 beats per minute, one would save 30,000 beats per day. The savings over the course of a lifetime would be phenomenal, as would general wear and tear on the heart. As athletes, the participants are concerned about reducing their heart rates. Reiterate that one universal response to stress is a rise in heart rate which can be counteracted by the simple acts of recognizing the state of tension and responding with deep breathing. Ask participants to practice deep breathing at least once a day for the next 2 weeks and to take mental note of the occasions when they see need to use it.

Relaxation Group

Session 2

Objective: To teach and practice progressive relaxation.

Begin the session with a discussion of the success (or lack thereof) in identifying stress response during the last 2 weeks and in using deep breathing to counteract it. Reiterate as necessary any information from the last session.

Teach progressive relaxation. (See following pages.) Lead the group in both the long and short forms. Allow time for discussing the participant experience after each exercise. Some participants may have difficulty concentrating, may think the long form was too long, or may complain that they "drifted off." Assure them that extraneous thoughts and drifting are all perfectly normal and part of the relaxation process. In fact, losing touch with the spoken words and allowing the unconscious to take over often indicates a deeper level of relaxation than rigid adherence to the spoken directions.

Give each participant a tape which has a progressive relaxation exercise on one side and a guided visualization (see following pages) on the other. Ask participants to practice using the tapes on a daily basis. Process through group discussion fears or concerns about using the tapes.

PROGRESSIVE RELAXATION EXERCISE

Introduction. As the name implies, progressive relaxation involves the progressive tensing and relaxing of

various muscle groups. Although the exercise is a relaxation technique, we start with tension because most individuals find it easier to go from a tensed state to a relaxed state than to simply relax muscles. Progressing from a tensed state to relaxation also helps to develop the ability to recognize and differentiate the feelings of tension and relaxation in the muscles. The first session of progressive relaxation training might take 30 to 45 minutes. As training continues, however, the sessions become shorter; muscle groups can be combined and the tension phase can be omitted. The goal of progressive relaxation training is self-control. With practice an individual can learn to recognize subtle levels of muscle tension and immediately relax those muscles.

General Instructions. "As we proceed through this exercise, various muscle groups will be tensed for a short time and then relaxed on the following cues: NOW for tension and the word RELAX for relaxation. On the word NOW, you should tense the muscles and hold the tension until the word RELAX, and then you should let all the tension go at once, not gradually.

As we go through tension and relaxation, I will ask you to pay attention to the feelings of tension and relaxation. This is in part a concentration exercise; focus attention on the feelings in your muscles. Today try

to remain awake and pay attention to the feelings in your muscles. Later you can also use this exercise as a sleep aid.

Once a muscle group has been relaxed, try not to move it except to be comfortable; try to tense only the particular muscle group that we are working on.

Do not talk during the exercise; ignore distracting sounds and activities; and keep your attention on the feelings in your muscles.

We will go through each of 16 muscle groups twice. Each time I will remind you about the tension methods, give you the signal to tense (the word NOW), then the signal to RELAX. We will go through the tension and relaxation a second time, and then we will go on to the next muscle group.

The 16 muscle groups that we will go through and the general instruction for tensing those muscles include the following:

1. Dominant (right) hand and lower arm: Make a fist.

2. Dominant biceps and upper arm: push elbow down and pull back without moving the lower arm.

3. Nondominant (left) hand and lower arm: Same as 1.

4. Nondominant biceps and upper arm: Same as 2.

5. Forehead (upper face): Lift eyebrows as high as possible and wrinkle forehead.

6. Central face: Squint and wrinkle nose.

7. Lower face and jaw: Clench teeth and pull back corners of mouth.

8. Neck: Pull chin forward and neck back.

9. Chest, back, and shoulders: Pull shoulder blades together and take a deep breath; continue to take a deep breath while tensing and release with slow, easy breathing as you are relaxing.

10. Stomach/abdomen: Make stomach hard.

11. Dominant right upper leg: Counterpose top and bottom thigh muscles.

12. Dominant calf and lower leg: Pull toes toward head.

13. Dominant foot: Curl toes and foot inward (do not hold too long to avoid foot cramps).

14. Nondominant upper leg: Same as 11.

15. Nondominant calf and lower leg: Same as 12.

16. Nondominant foot: Same as 13.

For a shorter session, the muscle groups may be combined as follows:

1. Dominant hand and arm (hand, lower arm, upper arm).

2. Nondominant hand and arm.

3. Face (upper, central, and lower face muscles).

4. Neck.

5. Trunk area (chest, back, shoulders, stomach, abdomen).

6. Dominant leg and foot (upper leg, lower leg, foot).

7. Nondominant leg and foot."

Specific Instructions. "Make yourself comfortable; remove any constraining items that might get in your way such as watches, glasses, or shoes. Close your eyes and take 3 deep, relaxed breaths. Breathe in slowly and completely, and breathe out slowly and relaxed.

Focus your attention on the muscles of your dominant (right) lower arm and hand. When I give the signal, make a fist and tense the muscles of your dominant lower arm and hand. Ready...NOW."

Tension talk. "Feel the tension...Focus on the tension...Feel the muscles pull...Notice the tightness... Hold the tension...Put tension in the muscle...Hold it..." (5-7 seconds) "and - RELAX."

Relaxation talk. "Let all the tension go...Let the muscles get more and more relaxed...Let go...Notice how you feel as relaxation takes place...Notice the feelings of relaxation...Relax deeper and deeper...Just let the muscles go...more and more completely...Notice the pleasant feelings of relaxation...Continue letting the muscles relax...Keep relaxing...Let yourself relax...Feel the relaxation through the muscles...Continue letting go...Let the muscles keep relaxing...Nothing to do but let the muscles relax...Feel the relaxation come into the muscles...

Pay attention to the feelings of relaxation as the muscles relax more and more...more and more completely...deeply relaxed...Let the muscles loosen up and smooth out... Relax...Notice how you feel as the muscles relax...Let the tension go away...Feel calm, peaceful relaxation...Let the tension go as you breathe slow and easy...Feel calm, rested...With each breath the muscles relax more and more...Notice the difference between tension and relaxation...See if the muscles of the arm feel as relaxed as those of the hand...Just let the muscles continue to relax...Relax...Relax..." (30-40 seconds).

"We're going to repeat the tension/relaxation sequence again for the dominant hand and lower arm. All right, I'd like you to again make a fist and tense the muscles of the dominant hand and lower arm. Ready, NOW." (Repeat tension phase 5-7 seconds.) "And RELAX." (Repeat relaxation phase 45-60 seconds.)

"All right. Now I'd like you to shift your attention to the muscles of the upper arm and biceps of your dominant arm. Ignore the lower arm and focus only on the upper arm throughout the exercise." (Continue to go through each of the 16 muscle groups twice following the same tension and relaxation phases as for the dominant hand and lower arm.)

General Relaxation Talk. "Notice the relaxation in all the muscles...Complete and deep relaxation...Check the muscles in your dominant hand; let those muscles keep

relaxing...Check your other muscles...If you notice tension, just let the muscle keep relaxing...Let the tension go...Let the face muscles relax...Let your shoulders relax...Breathe slowly and easily...With each breath, the muscles relax more and more...Enjoy the feelings of relaxation..." (45-60 seconds).

"In a moment I will count backwards from 4 to 1. On the count of 4, you should move your legs and feet; on 3, move your arms and hands; on 2, move your head and neck; and on 1 you can open your eyes and get up slowly. All right. Four: move your legs and feet; stretch out. Three: move your hands and arms around when you're ready. Two: move your head and neck. One: open your eyes. You may feel a little dizzy, so move slowly as you become more alert."

RELAXATION EXERCISE

"Close your eyes and let your body relax. You don't work at it; you don't try. You simply let the sound of my voice relax you--the silence of the room relax you. You relax deeper with each downward count of my voice. You relax deeper 10, sinking deeper 9, drifting deeper 8, relaxing deeper 7, deeper 6, letting go deeper 5, deeper 4, relaxing deeper 3, deeper 2, deep, relaxed and at ease as I count 1. As you breathe, rhythmically and naturally, you may find yourself relaxing even more into the rhythm of your natural processes. Exhaling the tension. Blowing the tension away. And if you were to hear an extraneous noise--a door slam or a telephone ring--you may choose to let that sound serve as a cue to relax you even further. You may choose not to respond in your usual way to these sounds. Of course if an emergency were to arise, you would be able to respond to it immediately. But for the moment there is no emergency, only the opportunity to relax and get in touch with yourself as you relax deeper 10, deeper 9, drifting deeper 8, deeper 7, relaxing deeper 6, sinking deeper 5, deeper 4, deeper 3, letting go deeper 2, deep and relaxed as I count 1. You relax even more, letting go of the physical manifestations of these tensions as you relax each body part from the top of your head to your toes. You let the tension go from across your forehead now and around your eyes. From across the bridge of your nose and around

your mouth. You may feel your jaw slacken and drop open. You may feel your face sag--how good it feels to let the muscles vacation. You may feel that your head is heavy as the tension evaporates from your neck leaving it limp, loose and pleasantly relaxed. Your shoulders may loosen now. And all the while the tension flows from your shoulders through your arms: your upper arms--biceps and triceps--your elbows, your lower arms, your wrists, palms and fingers--tension draining, muscles melting, fatigue lifting. And now you may want to take a full deep breath--and blow it out, and with it goes all the tension stored in your chest and upper abdominals. You inhale again, and as you exhale you let your stomach relax--and your buttocks--your whole torso now weightless and free. Moving now to the thighs, the tension drains from your hips to the legs--down through the knees, the calves, the ankles, around the heels, through the arches and out the toes. Taking a moment now to enjoy the relaxation you are feeling in every body part from the top of your head to the tips of your toes. And now, when you're ready, you may imagine yourself in a warm quiet place, a place where you are all alone and safe from the cares of your everyday life. Experience the sights: the colors, textures, movements, objects in your safe place. Use your internal vision to see vividly this quiet, safe place. Experience the sounds. Let the sounds enlarge your sense of what it is like to be in this place.

You may want to become aware of the smells and tastes associated with this place--the taste of your mouth, the aroma of the air. And you may want to put into play your tactile sense--reaching out to touch an object or experiencing the sensations of your skin. Understand fully, using all your senses, what it means to be in this quiet, safe place, this place where you can give yourself the freedom to be happy and alone with yourself, to savor the quietude of your inward life, to envision your soul--the essence of what is you. It is pleasant here and the feelings of warmth, love and confidence pervade. Experience the freedom. Glorious, isn't it? The freedom to experience fully your human possibilities. What you want is this--this peaceful fullness--this vision of full possibility. Take your time and imagine yourself as you would like to be, as you can be: confident, fulfilled, healthy and vigorous. Take your time. Experience fully what it feels like to be the person you want to be. See yourself. Feel the feelings. It's so simple. All it takes is letting go. Relaxing. Letting go. This place is a reflection of you, your goodness and happiness and confidence. Revel in it. In the real you--in the possible you. It feels good. It feels right. It is all you always knew you could be. Feel the feelings. Allow the feelings associated with the possible you to grow and develop. Experience them fully, whatever they may be. It's as

natural as breathing to feel these feelings. What is it that you are feeling? Revitalized? Powerful? Confident? Secure? Whatever these feelings may be they are the pinnacle of your humanity, the possible and the real within you. And when you're ready to return to your waking state, you may choose to bring with you all the positive feelings that you have rediscovered in your being. You can take these feelings with you throughout your day or recapture them at any time. The choice is yours; these emotions are as close as a thought. You carry them within you at all times. They are yours to do with what you will. You can choose to feel wonderful, renewed--to understand the possible in your life whenever you like. In a moment, when you're ready, you may awaken your body, coming slowly and peacefully to alertness. On the count of 3 you may gradually resume full consciousness. Feeling the use of your limbs as I count 1. Feeling coming back into your torso as I count 2. Eyes open wide awake as I count 3. Ready? One--feeling coming back into your arms and legs. Two--feelings coming into your torso. And 3--eyes open, wide awake."

Relaxation Group

Session 3

Objective: To teach and practice the principles of relaxation through guided imagery.

Begin the session with a discussion of the use of the progressive relaxation tape over the previous 2 weeks. Identify blocks to using the tapes, successes, any changes perceived by the participants. Answer any questions about the techniques applied in the tapes.

The goal of this session is to help participants modify thought processes which hinder their performance. For most people, particularly Type A individuals, personal expectations and judgments contribute to the intensity and duration of stressful experiences. Ask participants to recall a recent stressful experience as though watching it on film. Then ask each participant to describe the experience by giving a running commentary of the thoughts that occurred at the time. Typical thoughts may include examples of perfectionistic thinking, fears of failure, or unrealistic objectives. Discuss the concept of internal dialogue with emphasis on the themes which emerge from the group's discussion.

Most self talk is automatic, born of years of repetition. For some people there is a lack of awareness that these messages exist. For others there is considerable resistance to giving up old messages as this

represents a threat to identity. Make the point that we seek to modify thinking not because these thoughts are incorrect but because they are limiting. If one's goal is to perform well on the job, berating oneself for being less than perfect leaves one with a sense of failure. Neither will telling oneself "I won't let this bother me" enable one to be effective. Instead of placing positive thoughts or realistic goals in place, such thinking merely suppresses negative emotions which will ultimately reemerge. Over time such thoughts as "I must pack one more thing into my day" or "I will not let this guy get to me" will create an internal atmosphere of constant autonomic arousal, time pressure, fear of failure and irritability--hardly a mental environment conducive to improving or even maintaining efficient work habits.

Have the participants discuss some of the unproductive thinking they use in their daily lives. Help them to turn these statements around to express realistic goals, conscious positive choices, and efficient actions. Emphasize dispelling self-imposed limitations. Teach and discuss the principles of relaxation and guided imagery training found on the following pages.

Lead the group in the guided meditation provided on the following pages. Spend some time afterward discussing how the participants experienced the exercise. Emphasize

the concept of the exercise as an example of productive thinking. Ask the group to practice imagery daily using the tape as a guide.

RELAXATION EXERCISE (Perfect Workout)

"Close your eyes and let your body relax. You don't work at it; you don't try. You simply let the sound of my voice relax you--the silence of the room relax you. You relax deeper with each downward count of my voice. You relax deeper 10, sinking deeper 9, drifting deeper 8, relaxing deeper 7, deeper 6, letting go deeper 5, deeper 4, relaxing deeper 3, deeper 2, deep, relaxed and at ease as I count 1. And as you breathe, rhythmically and naturally, you may find yourself relaxing even more into the rhythm of your natural processes. Exhaling the tension. Blowing the tension away. And if you were to hear an extraneous noise--a door slam or a telephone ring--you may choose to let that sound serve as a cue to relax you even further. You may choose not to respond in your usual way to these sounds. Of course if an emergency were to arise, you would be able to respond to it immediately. But for the moment there is no emergency, only the opportunity to relax and get in touch with yourself as you relax deeper 10, deeper 9, drifting deeper 8, deeper 7, relaxing deeper 6, sinking deeper 5, deeper 4, deeper 3, letting go deeper 2, deep and relaxed as I count 1. You relax even more, letting go of the physical manifestations of these tensions as you relax each body part from the top of your head to your toes. You let the tension go from across your forehead now and around your eyes. From across the bridge of your nose and around

your mouth. You may feel your jaw slacken and drop open. You may feel your face sag--how good it feels to let the muscles vacation. You may feel that your head is heavy as the tension evaporates from your neck leaving it limp, loose, and pleasantly relaxed. Your shoulders may loosen now. And all the while the tension flows from your shoulders through your arms: your upper arms--biceps and triceps--your elbows, your lower arms, your wrists, palms and fingers--tension draining, muscles melting, fatigue lifting. And now you may want to take a full deep breath--and blow it out, and with it goes all the tension stored in your chest and upper abdominals. You inhale again, and as you exhale you let your stomach relax--and your buttocks--your whole torso now weightless and free. Moving now to the thighs, the tension drains from your hips to the legs--down through the knees, the calves, the ankles, around the heels, through the arches and out the toes. Taking a moment now to enjoy the relaxation you are feeling in every body part from the top of your head to the tips of your toes. And when you're ready, you may decide that you want to begin to exercise. And I don't know what form of exercise you choose. But whatever you choose, it is an activity that you will enjoy and relish, one where you will succeed. You may imagine yourself preparing for exercise now--taking a few deep breaths and warming your muscles. You may become aware of the readiness of your muscles as you prepare

exercise--of the strength and power of your body and the appreciation you have for the good things exercise does for you. And as you begin you may become aware of the appearance of your body, its sleekness, the tight musculature, your clothing. You can feel the sensation of the material against your body. You feel the sensations of your skin as you move through space and time--as your body moves rhythmically and naturally through your workout. You sense the natural body movement, the synchronization of your muscle groups--everything as it should be. It is effortless to exercise in this relaxation state. You may note the tilt of your head, the relaxed sway of your shoulders, the perfect squared positioning of your hips and knees. You may begin to feel the rhythmic nature of your breathing, the sensation of perspiration on your skin. And all the while you are moving effortlessly and in perfect rhythm through your environment; you are in perfect harmony with yourself and your surroundings. You may note that every body part is in perfect harmony with yourself and your surroundings. You may note that every body part is in perfect alignment with the others. It is as though you were watching a film of a great athlete, and you may be amazed at how easy it is to exercise in this relaxed state. You may feel the strength and power of your body--the grace and poise. Every movement just like the last. You appear to have perfect control of your body, and it feels wonderful

to experience it. Listen to the sounds associated with your workout. Taste your mouth and lips. Smell the smells. It is the perfect workout. Just as you knew it could be. Perfect harmony. Perfect rhythm. Not too fast and not too slow, but just right for you. Whether it is racing or strolling, it is just right for you. Take another moment to experience the total experience of this perfect workout. You may want to remember that this workout can be yours whenever you want it. You can carry this feeling of relaxation, of effortless movement, into any workout at any time. You are in control of your mind and your body. It is up to you. And in a moment, when you are ready, you may want to slow your workout as you prepare to end it. Slowing your pace, stretching your muscles, readying yourself to complete this satisfying experience. Making yourself ready to return to your waking state where you can carry the positive ramifications of your exercise into all facets of your everyday life. And in a moment, when you're ready, you may awaken your body, coming slowly and peacefully to alertness. On the count of 3 you may gradually resume full consciousness. Feeling the use of your limbs as I count 1. Feeling coming back into your torso as I count 2. Eyes open wide awake as I count 3. Ready? One--feeling coming back into your arms and legs. Two--feelings coming into your torso. And 3--eyes open, wide awake."

Principles of Guided Imagery

RELAXATION

1. Learning to relax through meditative response is the first step and should be practiced at least once daily. It is best to practice at a time other than bedtime at first.
2. Use the tape recording as a method of practicing the process of relaxation. After a week of daily practice, use your own mental suggestions.
3. Make a note of any difficulty you have using the procedure. If you find that stray thoughts are entering your mind, take a moment to think about it and then make a conscious decision to return to relaxing. Another option is to tell yourself that stray thoughts, nose twitches, phone calls, etc. will not disrupt the relaxation process; in fact, if the phone rings, you will feel even more relaxed.
4. Practice relaxing deeper as you count down from 10 to 1. You may want to imagine yourself walking along a stair, feeling lighter and more relaxed with each step.
5. Mentally follow the pattern used in progressive relaxation (head to toe or toe to head) to induce muscular relaxation.
6. To become even more relaxed, repeat step 4.

7. It is VERY IMPORTANT to practice relaxing by this method at least once a day for a week or two before you add imagery.

IMAGERY

1. Use the relaxation method suggested above.
2. Imagine a quiet, safe, comfortable place of your choosing. Allow yourself to experience all the sensations associated with this place. Use all the senses: smell the smells, taste, touch, hear. Allow yourself to look all around, up and down.
3. Allow yourself to feel the feelings associated with this place. They may be many and varied feelings, but only good feelings are allowed.
4. Phrase any instructions you give to yourself positively. For example, say, "I feel joyous and energetic" rather than "I don't feel depressed."
5. Give yourself permission to go from one phase of the process to another. Avoid giving orders to yourself. For example, say "I can be relaxed and comfortable" rather than "I will be relaxed." You will meet with less resistance from yourself if you give yourself some operating room--a choice about what to do and when to do it.
6. Never say "try" in your instructions to yourself. Rather say "I can" or "When I'm ready I may."

7. Write your images or your instructions to yourself down in advance. Then read them into a tape recorder. (This step is optional.)
8. Once you have relaxed and have experienced the safe place, you can give yourself a suggestion. This suggestion should be phrased positively (take time to do this in advance) and should involve a visual image where possible.
9. Result imagery is usually more powerful and long-lasting than other types but generally takes longer to take effect. For example, one may imagine oneself playing volleyball on the beach; i.e., living a healthy lifestyle without beer and cigarettes or in a bikini without those excess pounds. Or one may imagine oneself observing others eating a favorite food while you happily say no, you prefer to only put moderate amounts of healthy foods into your body, not chocholate fudge swirl with whipped cream on top. For training purposes, one may visualize running effortlessly or flawlessly stroking the tennis ball.
10. Repeat the image 3 times. You may want to use slight variations or different situations.
11. Add emotion to your image. Feel, for example, the satisfaction being able to turn down the dessert, to not want the dessert. Feel the pleasure of feeling slim, the power and of not being tied to food, the

thrill of letting go of the worry associated with constantly dieting. Feel the thrill of calling on the energy reserve for the final kick in a race.

12. One effective image is to imagine yourself as the person you want to be. It is easy at that point to fill in the particulars, which may vary depending on what changes you are concerned with making.
13. There are many advanced techniques in visualization training. If you become practiced and want to learn more, consult a professional. Often these principles do not seem to work, but more often than not they have been misunderstood or not faithfully followed. Professional guidance may help you to master them fully.

Some additional thoughts:

1. Don't wait until things get out of hand to use relaxation and imagery. They are not cures, nor are they stopgap measures. For maximum effectiveness, prevention, and general holistic well-being the meditative process should be practiced daily - or several times daily.
2. Check your phrasing. Be sure to phrase your suggestions and visualize in the most positive manner possible. It is easy to let those nots and shoulds slip in to our suggestions.

3. Remember, you are always in control. You will not change behavior you do not really want to change (smoking, eating, drinking). If you want to improve your running form or race time, however, systematic visualization can help you do it.
4. Relaxation and imagery are not substitutes for counseling or professional assistance. They are adjuncts to it. Serious personal difficulties deserve professional treatment.
5. Remember that any tool can be used for good or evil. Those may seem like harsh terms; however, there have been instances where individuals used these techniques to deprive themselves of sleep on a consistent basis (in order to study or work more). While this was effective for a while, lack of sleep eventually put these individuals in severe physical distress.
6. It may help to keep a record of your practice experiences for awhile. Note when you use it, when it is most effective, what images you have tried and/or liked, what questions you have, what did not work well, and what you might like to do differently. This record keeping has the effect of reinforcing your practice and helping to make relaxation an habitual behavior.
7. Find ways to reinforce the incorporation of relaxation and imagery into your lifestyle. Many people learn

the principles, practice for a while, and when things "get better," gradually stop using it. Talk to a professional about ways to establish healthful habits such as visualization and to discourage their slipping by the wayside.

Relaxation Group

Session 4

Objective: To practice adding emotion to mental images during relaxation.

Begin the session with a discussion of the use of the guided imagery tape over the previous 2 weeks. Identify blocks to using the tape, successes, and any changes perceived by the participants. Answer any questions about techniques applied in the tapes.

The goal of this session is to help participants add emotion to thought processes in developing their own self talk or mental imaging. Ask participants to close their eyes and imagine a pleasant experience. Then ask them to intensify the pleasantness of the emotions they feel. After a moment, ask them to return their emotional intensity to its original state. Next, ask the group to make the experience less pleasant. After a moment, ask them to intensify the unpleasantness of the experience. Then ask them to experience the original emotional intensity they identified. Finally, have them open their eyes. The point of the exercise is to aid in the realization that humans are in control of their emotions. Within the space of a minute or two, participants have experienced an event in a variety of ways and felt a variety of emotions, both neutral and strong. Share with the group a time in your life when your thinking about an

otherwise neutral event colored your feelings about it. Ask the group to share examples from their lives. Possible examples might include a job interview where one may leave feeling good about the performance and later begin to worry about having appeared silly or ill-informed, an altercation with a co-worker where one felt angry and threatened but later felt pleased about clearing the air, or an exam where one experienced anxiety early on but grew confident as work progressed. Explain that in using relaxation to modify behavior, thought is ineffective without emotion. Telling oneself that one will only eat good, nutritious foods will not be as effective in changing eating behaviors as adding to it the feelings of accomplishment, joy and satisfaction of being a healthy and fit individual.

Lead the group in the guided meditation found in the second session. Allow some time to discuss the experience with the group.

Relaxation Group

Session 5

Objective: To review and synthesize the material from the previous sessions.

Spend this session reviewing the previous material and relating it to situations of concern to the participants. In particular, ask for situations where participants have used or might use deep breathing techniques, progressive relaxation, guided meditation and imagery. Relate each of these to exercise uses such as relaxing before a race, using muscle relaxation during a workout or imagining a perfect workout. Lead the group in the guided meditation provided in Session 3.

Thank the group members for their participation and answer any questions they may have regarding the study.