

THE EFFECTS OF LEVELS OF EXERCISE AND GENDER
ON DEPRESSION AND ANXIETY

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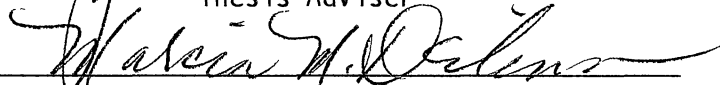
This study is dedicated to the memory
of my uncle, Dr. William Mottola


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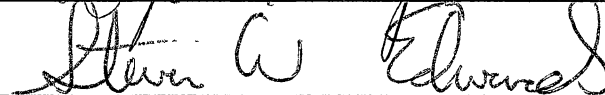
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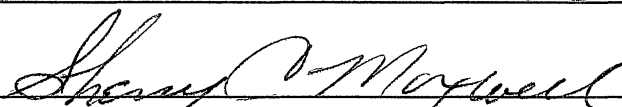



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CHAPTER I

INTRODUCTION

In matters of health and disease and virtue and vice, no symmetry is more basic than that between soul and body. . . . To get proper symmetry of body and soul one must exercise both. The bookish student must do gymnastics, and the man used to physical exertion must cultivate "music" and philosophy (Plato, 1946/388 B.C.).

Several centuries ago, Socrates explained that the soul and the body were blended and should be developed in unison with one another, since one was needed to support the other (Plato, 1946). Sigmund Freud (1953) believed that the body is the core of a person's psychological identity. He lectured that a psychical process could not occur if there was not a physiological process and that the physiological process must come first. Early research investigating the interaction between mind and body can be traced back to Hippocrates, who created a doctrine which related physique with temperament (Tillman, 1965). The relationship between mind and body has continued to intrigue scientists and researchers in recent years. In addition to reporting the well-documented physiological benefits of exercise, investigators are also concerned with the psychological benefits. In fact, there seems to be an increased interest in discovering exactly what relationships exist between the psychological and physical functioning of an individual. A possible explanation for this increased interest is the current emphasis on health and healthy living. The hope of

developing a healthy body and mind appears to be appealing to people of all ages. According to Gallop (1980), nearly one-half of Americans indicate that they exercise daily.

In recent years, researchers have been busy trying to discover any direct associations between physical exercise and improvements in physiological and psychological functionings. A number of positive changes are believed to result from physical exercise. In an early report by the President's Council on Physical Fitness and Sports (1971), the relationship between psychological and physiological traits was discussed. The report stated that physically fit people are more energetic, optimistic, and action-minded when compared to people who are not physically fit. In addition, unfit individuals are reported to be more nervous, insecure, and tense. Individuals who demonstrated a high level of fitness are described as being more playful, independent, and emotionally mature than unfit individuals. Morgan (1984) reported that a state of the art workshop (sponsored by the National Institute of Mental Health) was held concerning the relationship between exercise and mental health. The workshop participants developed the following consensus statements on the benefits of physical exercise:

1. Physical fitness is positively associated with mental health and well-being.
2. Exercise is associated with the reduction of stress emotions such as state anxiety.
3. Anxiety and depression are common symptoms of failure to cope with mental stress, and exercise has been associated with a decreased level of mild to moderate depression and anxiety.

4. Long-term exercise is usually associated with reductions in traits such as neuroticism and anxiety.
5. Severe depression usually requires professional treatment, which may include medication, electroconvulsive therapy, and/or psychotherapy, with exercise as an adjunct.
6. Appropriate exercise results in various stress indices such as neuromuscular tension, resting heart rate, and some stress hormones.
7. Current clinical opinion holds that exercise has beneficial emotional effects across all ages and in both sexes.
8. Physically healthy people who require psychotropic medication may safely exercise when exercise and medications are titrated under close medical supervision (Morgan, 1984, p. 95).

These statements offer support to the claim that exercise can positively affect an individual both physically and psychologically. Most of the research on exercise and mental health, however, has involved individuals with some type of physical, emotional, or mental disability. In a recent literature review, Ben-Schlomo and Short (1983) reported that the conclusions of studies which used normal, non-rehabilitation subjects were found to be both inconclusive and contradictory. Additional experimental research investigating the relationship between physical fitness and mental health with non-rehabilitation individuals is warranted. In addition, further evidence is needed before counselors and other mental health professionals will begin to support physical conditioning as a useful facilitative mode.

Cooper (1970) suggested that the physiological benefits of exercise were best obtained through forms of exercise considered "aerobic."

Moreover, in 1978, the American College of Sports Medicine established that, to achieve physiological benefits of exercise, an individual needs to raise his/her heart rate to between 60% to 80% of maximum for at least 20 minutes, and participate in this exercise at least three times a week. The minimum frequency of physical exercise needed to produce measurable physiological benefits has been well established (American College of Sports Medicine, 1978). There is, however, presently no empirically based indication of how often (in terms of frequency of exercise) individuals need to continue exercising before they will obtain psychological benefits. Therefore, the purpose of this research is to investigate the effect of exercise frequency on depression and anxiety.

This chapter began with an introduction to the study. It will include the significance of the investigation, the statement of the problem, and the research questions. The chapter concludes with the definition of terms and the limitations.

Significance of the Investigation

Psychological problems involving anxiety states have been estimated to involve 2% to 4% of the general population (Wood, 1977). The President's Commission on Mental Health (1979) reported that approximately one-fourth of the population in the United States suffers from mild to moderate depression or other emotional problems. The prevalence of depression and anxiety as psychological problems has been the impetus for therapists and other mental health professionals to search for better ways of treating and preventing these disorders. A promising area of investigation is the use of physical exercise as a means of reducing anxiety and depression.

Research in this area indicates that participation in physical exercise has been shown to consistently reduce state anxiety in both normal and anxious individuals (Wilson, Berger, & Bird, 1981). Specifically, the study investigated the effects of running and of an exercise class on anxiety. Subjects were assessed as to pre and post state anxiety using the State-Trait Anxiety Inventory. This study is notable because all of the subjects scored within the normative range of anxiety. The results of this investigation showed a significant decrease in anxiety from pre to post exercise scores.

Research evidence also indicated that depressed individuals who engage in some form of physical exercise have consistently exhibited decreases in depression (Doyle et al., 1989). In the study, a group of moderately depressed women were assigned randomly to one of three groups. The first group ran four times a week for 30 minutes over eight weeks (aerobic), the second group worked out on a universal gym for the same amount of time (anaerobic), and the third group was placed in a wait-list control group. At the conclusion of the study, both the weight-lifting and the running group reported having a higher energy level, more pride in their appearance, and a higher self-esteem. The significance of this study is that both conditions reduced depression, even though neither group exercised enough to qualify for aerobic benefits. The results of this study suggested that nonaerobic exercise (weight-training) can be as psychologically beneficial as an aerobic exercise.

Although there is evidence that exercise has various positive benefits (Folkins & Sime, 1981) and that physical and psychological well-being are strongly correlated (Mechanic, 1980), there are some exceptions. For example, Morgan (1971) investigated the effect of physical exercise on normal subjects by administering the Depression Adjective

Checklist and the IPAT Anxiety Battery before and after a one-mile treadmill walk. The results indicated that the subject's depression or anxiety levels were not affected by involvement in physical activity. In similar studies, levels of depression and anxiety remained unchanged in the investigation of women (Margolis, 1982) and of the elderly (Perri, 1982).

Generally, however, exercise has been associated with an improved sense of well-being (Morgan, 1971). Research demonstrates that psychotherapists, however, are not comfortable with prescribing exercise for their clients (Royak-Schaler & Feldman, 1984; Burks & Keeley, 1989). A survey was conducted by Royak-Schaler and Feldman (1984) to determine the frequency with which exercise and diet recommendations were made by therapists. Most of the therapists surveyed reported that they did not make diet and exercise recommendations but they believed that making recommendations in this area was appropriate for psychotherapists. Burks and Keeley (1989) surveyed 232 members of the American Psychological Association (Division 29). Subjects were surveyed regarding their assessment and recommendation practices concerning exercise, nutrition, and physical fitness. The results of the research indicated that although few therapists reported assessing and recommending diet and exercise as frequently as other health behaviors, many believed they encountered conditions where these recommendations would be appropriate. Very few therapists (16%) had received any form of education concerning exercise and nutrition. More than half, however, believed that exercise and nutrition should be included as part of the graduate school curriculum.

Glasser (1976) suggested that participation in a positive addiction activity promotes psychological strength and increases life satisfaction. Glasser postulated that almost anyone who undertakes an exercise program

on a regular basis can become addicted. The exercise must be one that can be done alone and in a non self-critical manner (Glasser, 1981).

If it can be demonstrated that exercise addiction has a beneficial effect on psychological functioning, as has been suggested (Glasser, 1976, 1981), then training in physical fitness activities could become a valuable form of future counseling strategies. This study may also have important implications for counselor training. Counselors, in general, lack knowledge about exercise and mental health. The lack of knowledge and training in this area suggests a definite need for counselors to receive training in the importance of physical exercise (Burks & Keeley, 1989). Hopefully, additional findings will awaken counselor training programs to the potential importance of physical fitness in the counseling area. In the future, counseling training may be expanded to include the relationship between the body and the mind.

In summary, the notion of "sound body, sound mind" can offer many implications for counselors promoting more integrated and healthy behavior in their clients. Through its focus upon sound body as physical fitness and sound mind as reductions in depression and anxiety, this study may demonstrate further support for the use of physical training as a viable treatment modality. If it can be demonstrated that physical exercise can reduce an individual's level of anxiety and depression as suggested, determining how much exercise is needed to produce these results should have important implications for mental health.

Statement of the Problem

The question addressed in this study was: What are the effects of frequency of exercise and gender on selected measures of anxiety and depression?

Research Questions

The following questions were formulated and tested at the .05 level of significance:

1. Is there a significant difference in levels of anxiety between exercisers and non-exercisers?
2. Is there a significant difference in levels of depression between exercisers and non-exercisers?
3. Is there a significant difference in levels of anxiety among high, moderate, and low exercise frequency subjects?
4. Is there a significant difference in levels of depression among high, moderate, and low exercise frequency subjects?
5. Is there a significant interaction between gender, exercise frequency, and level of anxiety?
6. Is there a significant interaction between gender, exercise frequency, and level of depression?

Definition of Terms

The following list of terms was used in this study:

Aerobics. An endurance form of exercise that provides benefits when the heart and lung activities are stimulated for a sufficient period of time.

Anxiety. A feeling or emotion that is dominated by apprehension even though the nature or cause of the danger is unknown, as measured by the Taylor Manifest Anxiety Scale (Taylor, 1953).

Depression. Negative evaluations of the self, the environment and the future, acquired by past experience and activated by stresses as measured by the Beck Depression Inventory (Beck, 1970).

Physical Exercise. The process of developing one's body through some form of sport or training.

Physical Fitness. An ability to rapidly breathe large amounts of air, forcefully deliver large volumes of blood, and effectively deliver oxygen to all parts of the body (Cooper, 1982).

Positive Addiction. An activity that people choose to do because they believe it has value and is nonharmful. The activity must be one that can be done alone and in a non self-critical manner. If the activity is not performed, then they suffer feelings of withdrawal (Glasser, 1976).

Weight-training. A method of conditioning that involves repetitive action against submaximum resistance.

Limitations

This study was subject to the following limitations:

1. Since random sampling was not used in this study, the sample may not be generalizable to populations outside of Oklahoma State University. In addition, the sample may not be representative of the number of people who are presently involved in a positive addiction activity.
2. Self-report techniques used in collecting data on exercise frequency, depression, and anxiety present a limitation to this study.
3. The constructs of anxiety and depression are subjective in nature. This study was limited to the definitions of the constructs formulated by Taylor (1953) and Beck (1970).

CHAPTER II

LITERATURE REVIEW

Introduction

The review of literature is presented in three sections. The first section reviews the literature concerning the physiological benefits of physical exercise. The second section reviews the literature related to the psychological benefits of physical exercise. The third and final section examines the literature involving the relationship between physical exercise and depression and anxiety.

Physiological Benefits of Physical Exercise

Former President Dwight Eisenhower stated that "National policies will be no more than words if our people are not healthy in body, as well as of mind, . . . Our young people must be physically as well as mentally and spiritually prepared for American citizenship" (Steinhaus, 1957, p. 1).

Morehouse and Miller (1959) stated that physiological fitness implies the capacity for skillful performance and rapid recovery. Mathews (1965) believed that individuals could achieve physical fitness by attaining three goals. The three goals for physical fitness are strength, flexibility, and cardiovascular endurance. In order to accomplish these three goals, Mathews proposed that individuals need to participate in fitness activities that are appropriate for each category.

The President's Council on Physical Fitness (1963) originated several programs for fitness during President Eisenhower's tenure of office. Exercise programs offered to the American public were developed so that individuals could participate without any special equipment. The adult fitness program included three general types of exercises: warm-up, condition, and circulatory activities (President's Council on Physical Fitness, 1963).

Golding and Bos (1970) stated that there are four basic types of physical fitness and labeled them: calisthenics, jogging or running, progressive-resistance exercise or weight training, and isometric training. Morgan and Adamson (1968) developed a system of circuit training to obtain and maintain physical fitness. Circuit training is the progressive development of muscular and circulo-respiratory fitness and aims at the development of all-around fitness. Scholz and Johnson (1969) supported the circuit training approach but included isotonics, isometrics, weight training, flexibility exercises, and the sports approach as important elements in designing a fitness program.

Regardless of the type of exercise program in which individuals choose to participate, the results tend to be similar.

One important end result of the increased muscular strength and general endurance provided by exercise is an increase in the body's capacity for carrying on normal daily activities, a pushing back of fatigue limits. Valid research indicates that a fit person uses less energy for any given moment or effort than a flabby or weak person. (President's Council on Physical Fitness, 1963, p. 6).

Mayer (1966) stated that some of the statistical studies reported a relationship between physical inactivity and the development of cardiac

conditions. Heart disease is not only a major cause of death in the United States, but is also considered the main cause of disability among middle-aged persons. Obviously, the relationship between physical fitness and heart disease is one of national concern.

The effect of tension on 52 sedentary males was investigated by Kasch (1976b). This longitudinal study is of special significance because the experimenter believed that the results could help prevent ischemic heart disease. Sixteen subjects were studied for 15 years, and 36 additional subjects were studied for 10 years. All subjects had to either run or swim three times a week for a minimum of 40 minutes. The results of the study included a small weight loss, significant decline in resting heart rate, and lowering of the subject's blood pressure after 10 years of exercise program participation. In addition, the subject's heart and circulatory functions, which would normally have declined by 22% in 10 years, increased 19%. The findings of this investigation suggest that (at least for females), a program of regular physical exercise can reverse or arrest the normal decline in physical work capacity that occurs with aging.

Morris, Heady, and Raffle (1956) examined the health records and death certificates of 31,000 men employed by the London Transport System. In investigating the difference between bus drivers and conductors, the authors found that almost twice as many fatal attacks occurred in the bus drivers as in the conductors. Morris, Heady, and Raffle concluded that the physical exercise involved in the conductor's duties, compared to the absence of physical exercise in the driver's duties, accounted for this difference. The buses were double-decked; therefore, the conductors climbed the stairs to the upper deck many times each day while the bus drivers sat in their seats.

Cooper (1977) reported that involvement in physical exercise programs has been found to be a significant component of preventive medicine. The results of Cooper's study demonstrated that regular physical exercise was associated with an increase in the average American's life span and an almost 14% decrease in heart disease related deaths from the late 1960s.

Bowerman and Harris (1967, p. 14) stated that "Unquestionably, many factors are involved in causing heart attacks. Lack of physical exercise is only one. But medical research indicates it may be among the most important." Bowerman and Harris also stated that physically fit men had fewer heart attacks and a better chance of surviving heart attacks than unfit men. The authors strongly stressed the belief that people need to follow a regular plan of exercise. Moreover, they asserted that regularity was essential for physiological benefits.

Additional research indicated that a conditioning program was related to significant improvements in cardiovascular function and body composition (Pollock, 1974). This study examined the effect of training frequency on improving cardiovascular functioning and body composition for middle-aged men. The conditioning program consisted of running, jogging, and walking. Subjects were asked to commit to 20 weeks of training, 4 times per week, for 30 minutes each day at 90% to 95% of their maximum heart rate. The results revealed significant improvements in cardiovascular function and body composition.

Douglas and Becklake (1968) found that after training in physical fitness activities, subjects could perform any given work load with a significantly lower increase in heart rate, cardiac output, and minute ventilation. This indicated that subjects were able to maintain a

greater maximum work capacity with less stress on circulation and respiration than before training in physical fitness.

In addition to the studies promoting physical fitness as a beneficial factor in the prevention of heart disease, investigators claimed that physical fitness is also related to intellectual capacity. For example, Gutin (1966) investigated the effect of training in physical fitness on the ability of an individual to perform complex mental tasks. Subjects were assigned randomly to serve in either an experimental or control condition. Pre and post tests were conducted with 55 college males on Verbal Comprehension, Visual Pursuit, Verbal Reasoning, Symbolic Reasoning, and the Employee Aptitude Survey. Subjects in the experimental group were also required to participate in a 12-week program of isometric training, calisthenics, and circuit training. The results of the investigation indicated a significant relationship between the degree of physical fitness improvement and the degree of mental task improvement.

Gutin's (1966) results supported findings in Terman's (1925) classic series of studies which investigated the characteristics of boys who scored above the genius level on the Binet IQ test. The results of Terman's investigation clearly indicated that physical fitness abilities were predictive of genius in elementary school boys. The author found that high grip strength was a common characteristic of boys who scored over two standard deviations above the mean on the Binet IQ test.

Physical fitness characteristics were also found to be positively related to intelligence in a study by Powell and Pohndorf (1969). The authors found that the circulatory factors most characteristic of exercisers were also most related to fluid intelligence. The study tested 71 adult males on 8 physiological measurements and the Culture Fair Intelligence Test. Fluid intelligence was defined as the intelligence factors

that decrease as a person grows older. The subjects tested were between the ages of 34 and 75. To control for educational level, the subjects were primarily limited to university professors. The eight physiological measures were: serum cholesterol, sitting systolic blood pressure, total peripheral resistance, basal metabolic rate, blood pressure, post exercise, and the Scheider Index. Subjects were divided into three groups: regular exercisers, non-exercisers, and semi-exercisers. The results of this experiment found no significant difference between semi-exercisers and regular exercisers. Regular exercisers, however, had a higher average fluid intelligence than non-exercisers.

In a review of the literature concerning the relationship between physical fitness and mental achievement, Clarke (1982) concluded the following:

As a consequence of the evidence available, it may be contended that a person's general learning potential for a given level of intelligence is significantly affected by his or her degree of physical fitness. Thus, other things being equal, the quantity and quality of each individual's mental achievement should be greater when physically fit than when physically unfit. The person has the energy and stamina to mount and sustain intellectual effects, a preoperational state of vigor and an improved state of learning readiness exists. Consequently, physical education has a responsibility to improve the physical fitness of children and youth as a contributor to their potential success in scholastic pursuits (p. 8).

Further documentation of the physiological benefits of physical exercise was provided by Young and Ismail (1978). Their study investigated the ability of certain biochemicals to discriminate between high

and low physical fitness groups. Serum cholesterol, serum testosterone, urinary catecholamines, and serum glucose were the biochemicals studied. Subjects participated in a four-month exercise program that consisted of basic calisthenics, jogging, and recreational activities. Data were collected by pre and post testing the subjects involved. The post test results showed that physically fit subjects had higher testosterone levels and lower cholesterol, catecholamine, and glucose levels than subjects who were not physically fit.

When working in the area of rehabilitation medicine, Kraus (1965) reported that low back pain in 80% (N = 4,000) of his patients was due to underexercise resulting in muscular deficiency. He stated further that symptom-free adults were candidates for low back pain if they were unable to pass his minimum muscular fitness test.

In 1970, Dr. Kenneth Cooper developed and promoted a new physical fitness program called aerobics. Aerobics literally means "with oxygen." Cooper referred to aerobic activities as those that create a need for increased oxygen intake for a period of time sufficient to cause beneficial changes in the body. Cooper believes that the main reason for his program's popularity is that it provides people with a type of life insurance. The author defined aerobics as "a system of exercise designed to improve your overall health, but particularly the condition of the heart, lungs, and blood vessels" (p. 169).

In summary, research continues to chronicle the physiological benefits of physical fitness. The need for these benefits is evident in today's society. The lifestyle of many persons in the United States requires very little physical activity or opportunity to strengthen their cardiovascular system. If these individuals do not supplement their

lives with some type of physical exercise, they are increasing their chances for an early death.

Psychological Benefits of Physical Exercise

Investigation of the psychological effects of exercise is a recent phenomenon (Burks & Keeley, 1989). Initial research concerning the benefits of physical fitness has centered around the physiological effects of exercise. Public interest in the healthful benefits of physical exercise has increased dramatically in recent years and the research has paralleled this interest. The recent "fitness craze" has led investigators to a more serious examination of the psychological benefits obtained from physical exercise.

Many early studies involving the relationship between physical fitness and psychological well-being found no significant relationship between the two variables. As an example, Davis (1970) investigated the relationship between physical fitness and selected psychological variables. The study reported that involvement in a physical fitness training program did not produce significant psychological changes. In a similar study, Christian (1969) examined the relationship between physical fitness and self-concept in 189 male college students. After participation in a six-week physical fitness program, no significant difference was found between self-concept as measured by the Tennessee Self-Concept Scale and physical fitness as measured by a selected test battery.

Hammer and Willmore (1973) studied the relationship between personality measures and physiological alterations during a 10-week jogging period. They found very little correlation between these variables. Therefore, they concluded that cardiovascular fitness has very little

psychological predictive utility. Sonstoem and Metz (1969) also found no significant relationship between physical and psychological fitness. Utilizing 165 adolescent boys as subjects, they found no significant relationship between general self-esteem and levels of physical fitness.

Although early studies reported no significant findings between physical and psychological fitness, further review of the related research found that most of the documented investigations discovered significant rather than nonsignificant results (Dishman, 1985). Folkins, et al. (1972) examined the effects of physical fitness on psychological fitness. The authors studied changes in personality, mood, and work behavior variables among 75 college students enrolled in jogging and 62 college students enrolled in archery and golf. Physical fitness was measured by a timed run and resting heart rate. Psychological fitness was measured by the Multiple Affect Adjective Checklist and the Adjective Checklist. Five subscales derived from these two measures were used to operationally define psychological fitness. The five subscales used were: depression, self-confidence, anxiety, adjustment, and work efficiency. The 84 subjects in the study participated in a 16-week program of physical fitness that involved 32 actual sessions. Folkins et al. concluded that physical fitness significantly improved psychological fitness. The subjects that were in the poorest physical condition at the beginning of the program showed the most improvement at the end of the program.

Ismail and Trachtman (1973) discovered that when middle-aged men participated in a regular exercise program, their emotional stability, imagination, and self-sufficiency increased. Physiological measures were used to divide the subjects into physically most fit and physically least fit groups. It is noteworthy that feelings of guilt in the low-fitness

subjects increased during the same training period. The authors speculated that the increased feelings of guilt were due to subjects confronting their problems of physical fitness but not overcoming them and to the fact that the training encroached upon the subject's usual work time.

Ismail and Young (1976) examined personality differences in men, both before and after engaging in a physical fitness program. The physical fitness program consisted of jogging, calisthenics, and recreational activities. Forty-eight adult males were categorized according to measures of their physical fitness and age. The results of this study indicated that regardless of age, the high-fit males tended to be more emotionally stable, self-confident, intellectually inclined, composed, relaxed, easy-going, and less ambitious and unconventional than low-fit males.

Hartung and Farge (1977) studied the personality factors of a group of male middle-aged (40-49 years old) runners. Forty-eight subjects were administered the Cattell Sixteen Personality Factor Test Profile (16 PF). Results indicated that the subjects had high levels of imagination, self-sufficiency, and a tendency to be introverted. When compared to the general population, the middle-aged runners were found to be significantly more intelligent, forthright, self-sufficient, shy, sober, reserved, and imaginative. The authors hypothesized that the subjects' increase in personality factors was due to the fact that they were intelligent enough to foresee the possible benefits of running. It was not determined whether these factors were a result of, or a causal factor in, the subject's pattern of regular exercise.

A study was conducted to determine the effects of an aerobic conditioning program on the mental health of prison inmates (Pollock and Gettman, 1977). Previous results of studies using inmates suggested that

exercise should play a more serious role in inmate rehabilitation. The authors supported the position that aerobic conditioning programs, including jogging, swimming, cycling, and running, should be used to improve the physical and mental health of prison inmates.

Carter (1977) examined the relationship between physical exercise and happiness. Data were collected on the subjects' exercise patterns and on their levels of happiness. The results found a positive correlation between exercise and happiness.

Heaps (1978) investigated the relationship between physical fitness and psychological fitness. The subjects of this study consisted of 56 male college students. Subjects were tested with the Cooper's 12-Minute Run, the Index of Adjustment and Values, the Dominance Scale of the California Psychological Inventory, the Taylor Manifest Anxiety Scale (TMAS), the Hypochondriasis Scale of the Minnesota Multiphasic Personality Inventory, the Secord and Jourards' Body Cathexis Scale, and the Marlowe-Crowne Social Desirability Scale. The results indicated that the subject's perceptions of fitness related negatively to anxiety concerning bodily functioning and positively to self-acceptance. The researcher concluded that there is a definite psychological benefit following consistent exercise. This benefit, however, does not result from physical improvement, but instead is a result of the subject's emotional or psychological perception of the physical or personal value of exercise.

A similar study investigated the relationship between physical fitness and psychological fitness. Bolton and Renfrow (1979) grouped subjects into exercisers and non-exercisers based on their individual interviews with each subject. The researchers gathered basic demographic information, blood pressure, resting pulse rate, and measures of body fat on 23 male exercisers and 23 male non-exercisers. Personality traits of

both groups was measured with Cattell's Sixteen Personality Factor Questionnaire. The exercise group was found to be more expedient, forthright, reserved, suspicious, liberal, and self-sufficient than the non-exercise group.

Jasnoski and Holmes (1981) studied the effects of an aerobics training program on personality variables in 103 undergraduate women. Personality variables were assessed by the Self-Rating Depression Scale, the 16-Personality Factor Questionnaire, and the Type-A Personality Survey. The authors found that participating in the training program was significantly related to increased self-assurance, increased easy-goingness, increased imagination, decreased inhibitions, and decreased behaviors of the coronary-prone personality. Improvements in physical fitness were significantly related to increased liberalness, increased self-assurance, and decreased tension.

Additional studies offered positive findings in the area of physical fitness and its effect on self-concept. Collingwood and Willett (1971) investigated the effect of a physical training program on self-concept and body image. Five obese adolescent males served as the subjects in this experiment. The training program consisted of 30 hours of physical training during a period of three weeks. Self-concept and body image was measured by the Bill's Index of Adjustment and Values and a Short Form of the Body Attitude Scale. The results of the study showed a significant improvement in both self-concept and body image at the end of the three-week program.

Baron (1970) also investigated the effects of physical fitness on self-concept. The author tested 67 middle-aged men on measures of physical fitness and self-concept. It was discovered that as physical

fitness increased, subjects tended to be more positive in viewing themselves and others.

Variations in the self-concept of high school and college women was examined by Vincent (1976). Various groups of students were compared on the Tennessee Self-Concept Scale. The groups compared were high school athletes and women from competitive and noncompetitive athletic programs, college women athletes, nonathletes, general college students, and physical education majors. Vincent found that, in general, the college women who were physical education majors and the high school women from competitive programs had significantly higher self-concept scores than did the other groups.

Leonardson and Gargiulo (1978) found that aerobic physical performance and self-concept were not significantly correlated in their study using 11 male and 22 female college students. The subjects participated in a 10-week jogging program twice a week, for a total of 30 sessions. The results showed that actual physical performance did not significantly correlate to self-concept, but perceived physical fitness did.

Metcalfe and Johnson (1980) studied the effect of physical fitness training on the psychological fitness and self-concept of state employees. The fitness program consisted of a 10-week parcours exercise program. Psychological fitness included measures of job satisfaction, life satisfaction, self-concept, and body cathexis. The investigation concluded that the parcours exercise program had a positive effect on the psychological fitness of subjects.

Stalomas, Johnson, and Christ (1978) examined the effects of physical fitness on the treatment of obesity. The authors studied the effects of exercise, self-managed contingency components, and program adherence on behavior modification treatment of obesity. Measures were taken after

a 10-week treatment period, at a 3-month follow-up, and again at a 1-year follow-up. The study found significant weight loss in all groups after the 10-week program and at the 3-month follow-up. After one year, however, only the exercise and/or contingency management had maintained their weight loss.

Several researchers (Cronan & Howley, 1984; Ewing, Scott, Mendez, & McBride, 1984) have reported that the subjects who participated in their experiments experienced a general feeling of overall well-being. This sense of well-being was considered to be related directly to their involvement in physical activities. According to Cronan and Howley (1984), exercise changes the chemical balance in the body. This study found that exercise resulted in increased levels of endorphins and that it may be able to regulate norepinephrine levels. Endorphins are natural opiates which are believed to increase feelings of well-being and produce euphoria in subjects that exercise. In this way, the authors concluded that physical health may influence an individual's level of psychological health.

In summary, though past research has consistently shown that a relationship exists between physical fitness and psychological fitness, the exact manner and level of fitness required has not been established. The time factor involved in establishing how much exercise is enough or not enough has not been determined.

It is generally agreed upon by researchers that "Psychological changes are firmly tied to changes in physical fitness" (Folkins et al., 1972, p. 507). However, researchers are unable to agree upon what actually causes the relationship. For example, Pargman and Baker (1980) offered the explanation that opiate-like substances called endorphins are the causal mechanisms responsible for the "runners' high" that some long

distance runners experience. However, Farrell, Gates, Maksud, and Morgan (1982) pointed out that there is an enormous amount of individual differences associated with plasma endorphin activity. This individual variation would call into question the argument that accounted for the changes in well-being which have been observed. In addition, Riggs (1981) stated that beta-endorphins may not actually cross the blood-brain barrier, which would mean that exercise-induced changes in serum endorphin levels are unrelated to cortical endorphin levels.

Dishman (1985) has proposed an alternative psychological theory to explain the link between improvements in physical fitness and improvements in psychological well-being. He asserted that exercise, per se, may not cause a reduction in anxiety and depression. Rather, he discussed what he considers are likely alternatives to exercise in a comprehensive review of the evidence connecting exercise with decreased depression and anxiety. These include psychological processes like social reinforcement, attention effects, and expectancy of benefits. This theory supports Heap's (1978, p. 403) belief that "It is a person's feeling or attitude about his physical condition, not his actual fitness, which is related to certain kinds of psychological functioning."

Physical Exercise and Depression and Anxiety

Depression and anxiety are two of the most pervasive psychiatric problems affecting society in the United States. Due to the prevalent amount of stress and pressure among Americans, most people will need to find a way to deal with the anxiety in their lives (McPherson et al., 1967). The number of psychological problems which involve anxiety states has been estimated to include between 2% and 4% of the general population (Wood, 1977). Gaudry and Spielberger (1971) reported that highly anxious

children tend to be unpopular and have a poor self-image. Moreover, the authors found that high anxiety is related to lower grades and a higher drop-out rate at both the school and university level. Additionally, the incidence of suicide among adolescents has doubled in little more than a decade (Crumley, 1990). Depression is widespread in today's world and is believed to be the most common type of psychopathology that physicians will encounter with patients (Secunda et al., 1973). It is also believed to be the underlying cause of many of the physical complaints that physicians are asked to treat (Akiskal & McKinney, 1979).

In view of these factors and the widespread amount of people who suffer from anxiety and depression, it is apparent that a continued search for more methods to treat and prevent these disorders is needed. The treatments of depression and anxiety most widely used today include psychotherapy and psychotropic medication. Medicine does offer some treatment possibilities. Tricyclics and monoamine oxidase inhibitors have been shown to be moderately successful in treating depression and anxiety (Morris & Beck, 1972).

Several researchers (Doyle et al., 1989; Greist et al., 1979) are supportive of the benefits that many depressed and anxious people appear to have obtained from involvement in physical exercise. They believe that physical exercise itself can be a valuable treatment modality.

The following studies have either examined the effects of physical exercise on anxiety and depression in people with coronary heart disease (CHD), or they have investigated the effects of exercise on populations that were considered to be clinically depressed. For example, Folkins (1976) examined the effects of exercise on the anxiety and depression levels of men who were considered at high risk for coronary heart disease. The study compared exercise treatment groups with no treatment

groups. The results indicated that men at high risk for coronary heart disease who were assigned to an exercise treatment, had lower levels of anxiety and depression than those who received no treatment.

In a series of studies of the relationship between running and depression, running was found to be as effective as time-limited or unlimited psychotherapy (Greist et al., 1979). The researchers examined the effect of running as a treatment for mild or moderate depression. In the first study, 13 male and 15 female clients who were seeking help for depression were assigned randomly to one of the different treatment groups. The clients were assigned randomly to either psychotherapy or running. The Symptom Checklist-90 (SCL-90) was used to assess clients as being free from psychosis, significant suicidal risk, and need for antidepressant medication. Clients participating in the running group were tested using a maximal treadmill test and a resting electrocardiogram. These clients ran at least three times weekly. The SCL-90 scores were taken at two-week intervals over the 10-week period of the program. The results of the study showed an equal decrease in measured depression for running and psychotherapy groups.

In the second study by Greist et al. (1979), the runners had lower scores on the SCL-90 group than the psychotherapy groups. The authors determined through these studies that properly supervised running was at least as effective as either time-limited or time-unlimited psychotherapy in alleviating the symptoms and complaints of depressed clients.

Kavanaugh and Shephard (1977) used the Minnesota Multiphasic Personality Inventory (MMPI) to identify a population of subjects who suffered from severe depression. These subjects participated in a regular fitness program for a period of two to four years. The authors found that the subjects showed significant improvements in depression, while the other

MMPI scores remained unchanged. Kavanaugh and Shephard believed that there was a correlation between improvement in depression, adherence to the exercise program, and their increase in physical fitness.

McCann and Holmes (1984) examined the effects of aerobic exercise, relaxation, and no treatment on depressed women. In this investigation, depressed undergraduates were assigned randomly to one of the three experimental conditions. The results of the study indicated that depression levels in the aerobic exercise group decreased significantly more than the relaxation and no treatment groups.

In a similar study, Klein et al. (1985) investigated the effects of running, meditation, and group psychology on a depressed population. The depressed subjects were assigned randomly to one of three groups: running therapy, meditation therapy, or group psychotherapy. Interestingly, the results of the study demonstrated that all three groups showed similar decreases in depression. Results such as these suggest that an aerobic training effect is not necessarily needed for improved well-being.

There are, however, studies which support the notion that running or other forms of aerobic exercise are needed to alleviate depression (Martinsen, Medhus, & Sandvik, 1985; Sachs, 1982). In the study by Martinsen, Medhus, and Sandvik, 43 diagnosed depressed hospital patients were randomly assigned to either a control group or a training group. The subjects in the treatment group were involved in a nine-week, one-hour aerobic exercise program three days a week. Subjects in the control group participated in occupational therapy. Depression was measured with the Beck Depression Inventory. Subjects in the treatment group were found to have a significantly greater decrease in depression and a significantly greater increase in maximum oxygen uptake capacity when

compared to the control group. These results suggested that the subjects who experienced the greatest increase in oxygen uptake capacity also experienced the largest reductions in depression.

In a study on the effects of exercise on anxiety, depression, and psychology, running was defined as a treatment modality in psychotherapy (Sachs, 1982). Sachs hypothesized that running could be used as a psychotherapeutic tool alone or as an adjunct to other forms of psychotherapy. As a result of his study, Sachs concluded that running and exercise may lead to reductions in anxiety and depression and improvements in self-confidence, self-sufficiency, and feelings of control.

The majority of the studies investigating the relationship between psychological fitness and physical fitness have reported that an aerobic form of exercise may be effective in the treatment of depression and anxiety (e.g., Klein et al., 1985; McCann & Holmes, 1984; Greist et al., 1979). These authors suggested that an improvement in cardiovascular fitness is necessary in order for an exercise program to improve depression and anxiety. In a study by Doyne et al. (1989), these issues were addressed and a nonaerobic form of exercise (weight training) was found to be as effective as an aerobic form of exercise (running). Doyne and her colleagues assigned a group of moderately depressed women to either run four times a week for 30 minutes over eight weeks, work out on a Universal gym for the same amount of time, or be placed in a wait-list control group. At the end of the eight weeks, subjects in both exercise groups reported significant reductions in depression, higher energy levels, and more self-esteem. Doyne et al. concluded that nonaerobic exercise may be as effective as aerobic exercise in the alleviation of depression.

The difference between males and females in studies relating psychological constructs and exercise has also been examined (Folkens et al, 1972). Folkens et al. looked at the exercise studies that dealt with psychological constructs and physical fitness, in which both males and females participated. The researchers concluded that women improved more than men, because women are usually less psychologically fit at the outset. Pre-tests of women showed higher levels of anxiety and depression than men; however, after exercise women showed significant improvement in both of these areas.

The relationship between physical exercise and anxiety has received considerable attention in the literature. In reviewing the literature concerning anxiety, it is important to differentiate between state and trait anxiety. Researchers typically use trait anxiety measures in assessing the effects of chronic exercise and state anxiety measures in assessing the effects of acute exercise. The present study investigated chronic rather than acute exercise; however, studies examining the effects of acute exercise on anxiety are also reviewed, since they pertain to the psychological benefits of exercise.

Of particular interest to this study is a investigation conducted by Wilson et al. (1981), which compared the effects of exercise and running with a control activity (eating) on state anxiety. The results of the study showed that the initially more anxious a runner was, the more actual benefit running provided in reducing state anxiety. The most significant finding from this study, however, was the conclusion that frequency of running, not the actual distance covered or running history, was the single-most important feature in reducing anxiety. The more frequently the subjects ran, the more their anxiety was decreased.

In another study which tested the claim that state anxiety would be reduced following acute exercise, Raglin and Morgan (1987) assessed subjects' blood pressure and state anxiety before and after exercise to examine possible shifts in blood pressure and anxiety. Subjects were assigned to rest quietly for 40 minutes or perform aerobic exercise. The State-Trait Anxiety Inventory was administered to subjects before and after exercise participation. State anxiety and blood pressure were reduced following both conditions. These results suggest that aerobic exercise is associated with reduced levels of state anxiety.

The literature concerning anxiety and exercise has been fairly consistent in reporting that exercise can improve an individual's anxiety level (Raglin & Morgan, 1987; Wilson et al., 1981). A recent study, however, suggested that exercise may not be an appropriate form of reducing anxiety in all individuals. According to this study by Cameron and Hudson (1986), approximately 20% of their subjects experienced an acute increase in anxiety while participating in acute physical exercise. The subjects who were presented with a diagnosed anxiety disorder showed greater severity of anxiety than did the subjects who were not diagnosed as anxious. The authors concluded that this study clearly demonstrated that significant individual differences exist in subjects' responses to exercise.

The present study is more concerned with the literature that involves the assessment of chronic exercise, since that is the focus of this investigation. The studies that follow pertain to the effects of chronic or habitual exercise on anxiety.

In a study by Goldwater and Collins (1986), 51 adult males were assigned to one of two conditioning programs. These programs were designed to resemble each other; however, only one included a cardiovascular

conditioning effect. Anxiety was measured by the TMAS. Subjects in the treatment group were asked to participate in intense aerobic workouts five days a week, while subjects in the control group participated in noncardiovascular activities like badminton, volleyball, and marching two days a week. The results of the study indicated that both groups showed a significant improvement in cardiovascular fitness, with the experimental group showing a significantly greater improvement than the control group. Subjects in the experimental condition also showed less anxiety on the TMAS, although the differences between the groups only bordered on statistical significance ($p = 0.055$). An interesting note about this study is that the exercise did not have to be cardiovascular in nature to show an improvement in subjects.

Another study which examined trait rather than state anxiety is the study by Hayden, Allen, and Camaione (1986). They examined the differences between 40 subjects in a 12-week aerobics program with 25 subjects on a waiting list control condition. The experimental condition consisted of a variety of isorhythmic activities designed to promote cardiovascular levels during 60-minute classes conducted three times per week. The results found that subjects in the experimental group demonstrated significantly greater improvements on measures of trait anxiety, depression, self-esteem, absence from work, sickness, efficiency of work performance, job satisfaction, response to stress, visits to a physician, and quality of sleep. The subjects' self-ratings were corroborated by informants who knew the subjects well. These informants were required to complete the measures the way they felt the subjects would. These informant ratings were then compared to self-ratings to limit potential subject biases.

The effects of exercise on the trait anxiety of 60 male juvenile delinquents were studied (Hilyer et al., 1982). The 60 subjects were assigned randomly to either a treatment or a control group. Subjects in the experimental group participated in a fitness training program consisting of weight lifting and running for a 20-week period. A possible confounding variable in this study was that subjects in the experimental group also received counseling on self-discipline and other areas. Three well-validated measures of anxiety were used. The results for all three measures of anxiety showed a significant decrease in the exercise group's and an actual increase in the control group's levels of anxiety. However, due to the confounding nature of the counseling variable, these results could have been due to the increased counseling and attention provided in the experimental group.

Summary of the Literature Review

The literature on the relationship between physical conditioning and mental health presents strong evidence that positive benefits may be occurring as a result of physical exercise. These positive results have been cited in a review of literature that encompassed both the physiological and the psychological effects of physical training. However, these positive findings must be cautiously interpreted because of the many methodological weaknesses in some of the investigations. Sometimes these weaknesses include experimental bias, no appropriate control groups, nonrandom subject assignment, analogue populations, absence of statistical rigor, and/or small sample size (Doyle et al., 1989).

Many of the studies (Greist et al., 1979; Klein et al., 1985; McCann & Holmes, 1984) primarily focused only on clinical populations. The

results from clinical populations are not necessarily generalizable to a nonclinical population.

Results of the studies dealing with the physiological effect of exercise are clearer due to the precise instruments used to measure physiological changes. Physiological results are based on the fact that physical exercise of sufficient duration, intensity, and frequency will produce specific physiological changes in the body. While no absolute definition of physical fitness was determined, it was demonstrated that variables like strength, flexibility, and cardiovascular pulmonary endurance are at least components of physical fitness.

The review of the literature concerning the effects of physical exercise on depression and anxiety resulted in three common conclusions. First, a majority of the literature found that in following some form of physical exercise, subjects showed significant improvements in both depression and anxiety, even though a cause-effect relationship was not established. The second common conclusion was that subjects who were initially in the poorest physical or psychological condition showed the most improvement in both areas. The third conclusion was that, following physical exercise, women tended to show greater improvement in depression and anxiety than men.

As Simons, McGowan, Epstein, and Kupfer (1985) pointed out, the question of mechanism of positive effects of physical exercise on mental health is not the only question which needs further research. The relationship between an antidepressant response and the proper dose of exercise remains unknown. Although the parameters of exercise necessary to produce a physiological effect are known, these may not be identical to those required to produce a psychological effect. The present study was designed to investigate these questions.

CHAPTER III

METHODOLOGY

The purpose of this study was to examine the effect of levels of exercise and gender on depression and anxiety. In this chapter, the subjects involved in the study and the instruments used to measure depression and anxiety are described. The methodology and procedures used in this investigation are also explained. Specifically, the chapter deals with the following areas: demographic information and selection of subjects, research design, treatment procedures, and the statistical analysis.

Subjects

The subjects involved in the study were 160 students from a large state university in the southwestern section of the United States. The subjects (80 males and 80 females) were students enrolled in leisure science and recreation courses during the 1990-91 school semester. The subjects had a mean age of 20.5 years, with males averaging 19.8 years of age and females averaging 21.1 years of age. In order to achieve the power of .80 (alpha level .05), it was determined that an average of 20 subjects per cell was needed. The sample was stratified by gender and by levels of exercise frequency (high, moderate, low, and none). The classifications were: (1) non-exercisers--subjects who reported that they do not participate in regular exercise, (2) low-frequency exercisers--subjects who reported exercising twice a week or less, (3) moderate

frequency exercisers--subjects who reported exercising three to four times a week, and (4) high frequency exercisers--subjects who reported exercising five to seven times per week.

Instrumentation

Taylor Manifest Anxiety Scale

In order to measure subjects' anxiety in this study, the TMAS was used (Taylor, 1953). The TMAS consists of 50 items which five clinical psychologists selected from the MMPI as being indicative of manifest anxiety. For this study, the revised version of the scale, which consists of 50 true/false items, was used. The items of the TMAS measure chronic anxiety, physiological reactivity, sleep disturbance, sense of personal inadequacy, and motor tension. The subject marks each of the 50 items either true or false. These items are then scored by summing the total number of anxious responses. Those who score highly are considered to be extremely anxious individuals.

This test was normed on 1971 college students between the years 1948 and 1951. The TMAS was also tested for reliability and validity on 683 airmen at Lockland Air Force Base in basic training, and 201 night school students at Northwestern University.

Reliability. Taylor (1953) conducted reliability studies on her original and revised TMAS and found a Pearson product-moment correlation of .85 between the old and new version of the scale. These results were found with the new scale being administered to 59 introductory psychology students three weeks after they took the older version of the scale. A coefficient of stability was obtained for the new version, with a test-retest coefficient of .88 being reported. This suggested that the TMAS

demonstrated good stability in measuring anxiety over time, in spite of the fact that an individual's level of anxiety can be expected to change across time.

Validity. Several validity criteria have been used to examine the TMAS. Hoyt and Magoon (1954) compared counselor ratings of anxiety with the TMAS. They found that when scores on the TMAS were trichotomized and compared with counseling ratings, the adjusted contingency coefficient was .47. In a study by Holtzman, Calvin, and Bitterman (1952), they reported high correlations (.99 and .86) between the TMAS and the Winne Scale of Neuroticism, which was empirically validated and sensitive to anxiety. Buss (1955) conducted a follow-up item analysis of the TMAS. Four psychologists interviewed 64 patients and rated them on a five-point scale for manifest anxiety. The patients were later given the TMAS. A correlation of .60 was found between scores on the TMAS and the interview ratings of the four psychologists.

Beck Depression Inventory

The Beck Depression Inventory (BDI) consists of 21 items written to reflect 21 different symptoms or characteristics of depression (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The original version of the scale was developed by Beck and his associates in 1961. The revised version, developed in 1978, avoided the use of double negative statements and eliminated the repeating of the same questions in alternate forms (Beck, Rush, Shaw, & Emery, 1979). The revised version is extremely clear and easy to understand. It can be administered to people with a reading level as low as the eighth grade, because the directions are clear and the statements are easy to understand (Beck et al., 1979).

Each of the 21 items on the BDI consists of four statements, which are ranked in order from 0-3 in terms of severity of the symptom. The subject chooses the statement closest to his/her present state. These ratings are then summed by taking the highest score circled for each item and adding the total number of points for all items. The score obtained is the total depression score. The symptoms and attitudes measured by the BDI are the following: mood, pessimism, sense of failure, dissatisfaction, guilt, sense of punishment, self-dislike, self-accusations, suicidal ideation, crying, irritability, social withdrawal, indecisiveness, body image distortion, work inhibition, insomnia, fatigability, anorexia, weight loss, somatic preoccupation, and loss of libido (Beck et al., 1961).

Reliability. Beck (1970) studied test-retest reliability by administering the BDI to 38 psychiatric patients on two different occasions. He found that the changes measured by the BDI tended to parallel the changes in the clinical reading of depression. This study reported reliability figures above .90, which indicated a consistent relationship between the subjects' clinical states and their scores on the BDI. Internal consistency was also demonstrated by significant relations between each item of the BDI and total scores, and by an odd-even item correlation of .86 Spearman-Brown corrected to 1.93 (Beck, 1970).

Validity. Beck (1970) reported on a study examining the validity of the BDI in comparison with psychiatric ratings of patients. Psychiatric patients served as the subjects in the study. The study demonstrated correlation coefficients of .65 and .67 between the BDI and the psychiatric ratings. Other measures of concurrent validity were studied by comparing the BDI with the Depressive Adjective Checklist (DACL) and the

MMPI. The subjects used in both comparisons were psychiatric patients. The results of the comparison between the BDI and the DACL was a correlation of .66. The results of the comparison between the BDI and the MMPI was a correlation of .75 (Beck, 1970). Beck and Steer (1984) compared versions of the BDI in psychiatric patients. The alpha coefficient for 598 inpatients and outpatients on the 1961 version was .88, and the alpha coefficient for 248 outpatients on the 1978 version was .86. The study concluded that the internal consistencies of both versions were comparable.

Research Design

The present study utilized a causal comparative method with a 2 x 4 multivariate factorial design. The factors in this design were frequency of exercise (high, moderate, low, and none) and gender (male, female). The causal comparative method was chosen because the independent variables could not be manipulated. This method determines if a relationship exists between the independent variables (exercise frequency and gender) and the dependent variables (anxiety and depression). This method also determines the degree of relationship that exists between the independent and dependent variables.

Procedures

Permission to use subjects from classes in leisure science and recreation was obtained from the Institutional Review Board and the class instructors. Subjects were required to sign an informed consent form before data collection began (Appendix A). Subjects were told that they could obtain a summary of the results of the study. Confidentiality on all measures was protected. All subjects were given a packet containing

a demographic questionnaire (Appendix B), the TMAS (Taylor, 1953), and the BDI (Beck et al., 1961).

The demographic questionnaire asked subjects for the following information: age, gender, classification, and information on type and amount of exercise. In order to protect against carry-over effects, the TMAS and the BDI were presented in alternating order and arranged, likewise, into two different packets. Each test packet began with one of the two possible combinations of the TMAS and the BDI and then followed with the demographic questionnaire.

After the packets were distributed, the investigator then instructed subjects to read the directions on each instrument and to answer each item as honestly and completely as possible. Subjects were allowed as much time as they needed to complete the required information and return the packets.

Research Questions

The following questions were formulated and tested at the .05 level of significance:

1. Is there a significant difference in levels of anxiety between exercisers and non-exercisers?
2. Is there a significant difference in levels of depression between exercisers and non-exercisers?
3. Is there a significant difference in levels of anxiety among high, moderate, and low exercise frequency subjects?
4. Is there a significant difference in levels of depression among high, moderate, and low exercise frequency subjects?
5. Is there a significant interaction between gender, exercise frequency, and level of anxiety?

6. Is there a significant interaction between gender, exercise frequency, and level of depression?

Analysis of Data

A two-way, multivariate analysis of variance (MANOVA) was performed on the data. MANOVA was selected for two reasons. First, MANOVA is specifically designed to be used with multiple dependent variables. Second, MANOVA was selected over a series of ANOVAs because of the protection it affords against Type I errors. The Type I error rate was set at .05. Frequency of exercise (high, moderate, low, and none) and gender are the independent variables. The dependent variables of depression and anxiety were tested for significance on exercise frequency and gender. Univariate analysis of variance (ANOVA) was employed as post hoc procedures. In addition, the Tukey test for pairwise comparisons was performed as a post hoc procedure when warranted.

CHAPTER IV

RESULTS OF THE STUDY

Introduction

The purpose of this chapter is to present the results of the statistical analyses utilized to test the six research questions. The purpose of this study was to investigate the relationship between the independent variables, level of exercise and gender, and the dependent variables, anxiety and depression levels.

The following research questions were tested at the .05 level of significance:

1. Is there a significant difference in levels of anxiety between exercisers and non-exercisers?
2. Is there a significant difference in levels of depression between exercisers and non-exercisers?
3. Is there a significant difference in levels of anxiety among high, moderate, and low exercise frequency subjects?
4. Is there a significant difference in levels of depression among high, moderate, and low exercise frequency subjects?
5. Is there a significant interaction between gender, exercise frequency, and level of anxiety?
6. Is there a significant interaction between gender, exercise frequency, and level of depression?

A multivariate analysis of variance (ANOVA) was utilized to test whether or not exercise frequency (high, moderate, low, and none) and gender influenced subjects' scores on measures of anxiety and depression. MANOVA was selected for two reasons. First, MANOVA is specifically designed to be used with multiple dependent variables. Second, MANOVA was selected over a series of ANOVAs because of the protection it affords against Type I errors. Univariate analysis of variance (ANOVA) was employed as a post hoc procedure. The Tukey test for pairwise comparisons was also performed as a post hoc procedure when warranted. In addition, a multivariate analysis of covariance was utilized to determine if age affected the relationship between levels of exercise and anxiety and depression.

Research Findings

A 2 x 4 between subjects' multivariate analysis of variance (MANOVA) was performed on the two dependent variables anxiety and depression. The multivariate assumptions of normality, homogeneity of variance-covariance matrices and linearity were examined and found to be satisfactory. Multicollinearity was, however, found to exist between the two dependent variables ($r = 0.761$) (Table 1). This indicated that the measure for anxiety (TMAS) and the measure for depression (BDI) share much of the same variance. Further, this finding suggested that subjects who tended to score toward the depressed end on one scale would tend to score towards the anxious end on the other scale.

The multivariate Wilk's Lambda criteria were examined to determine if an interaction existed between a subject's gender and exercise frequency, as well as for the main effects of gender and exercise frequency. The results indicated that the combined dependent variables were affected

significantly by exercise frequency ($F(6,302) = .564, p < .05$), but not by gender ($F(2,151) = .995, p > .05$) or their interaction ($F(6,302) = .582, p > .05$). These results are summarized in Table 2.

Table 1

Pearson Correlation Matrix

| Variable | Gender | Exercise Frequency | Anxiety | Depression |
|--------------------|--------|--------------------|---------|------------|
| Gender | 1.000 | | | |
| Exercise Frequency | 0.000 | 1.000 | | |
| Anxiety | -0.044 | -0.553 | 1.000 | |
| Depression | -0.055 | -0.589 | 0.761 | 1.000 |

Table 2

Multivariate Tests of Significance

| Effect | Test Name | Value | Approximate F | Degrees of Freedom | Significance |
|-----------------------------|---------------|-------|---------------|--------------------|--------------|
| Gender | Wilk's Lambda | .995 | .383 | 2,151 | .682 |
| Exercise Frequency | Wilk's Lambda | .564 | 16.716 | 6,302 | .000* |
| Exercise Frequency x Gender | Wilk's Lambda | .977 | .582 | 6,302 | .744 |

* $p < .05$

A univariate analysis was then performed to investigate the effects of level of exercise frequency on the two dependent variables. The univariate analysis for anxiety scores revealed significance for the main effect of exercise frequency ($F = 24.534$, $p < .05$) (Table 3).

Table 3
ANOVA Summary Table for Anxiety

| Source | SS | DF | MS | F | D |
|--------------------|----------|-----|----------|--------|--------|
| Exercise Frequency | 4643.269 | 3 | 1547.746 | 24.539 | 0.000* |
| Error | 9589.050 | 152 | 63.086 | | |
| Total | | 155 | | | |

* $p < .05$

The results of the univariate analysis for depression scores were similar to the results of the univariate analysis for anxiety scores. The analysis found significance for the main effect of exercise frequency ($F = 30.757$, $p < .05$) (Table 4).

Since univariate F's were significant for exercise frequency on both dependent variables, a Tukey specific comparison test of the means was conducted to determine the location of the differences. The results of the Tukey test for depression score data (reported in Table 5) revealed that all the exercise groups scored significantly better than the non-exercise group. In addition, the high exercise frequency group scored significantly better than did the moderate, low, and non-exercise groups.

Table 4

ANOVA Summary Table for Depression

| Source | SS | DF | MS | F | D |
|--------------------|----------|-----|---------|--------|--------|
| Exercise Frequency | 2396.150 | 3 | 798.717 | 30.757 | 0.000* |
| Error | 3947.200 | 152 | 25.968 | | |
| Total | | 155 | | | |

* $p < .05$

Table 5

Tukey's Specific Comparison Test for Depression
by Levels of Exercise

| | Level 4 1.275 | Level 3 6.250 | Level 2 6.875 | Level 1 12.200 |
|------------------|------------------|------------------|------------------|-------------------|
| Level 4 (1.275) | -- | 4.975* | 5.6* | 10.925* |
| Level 3 (6.250) | -- | -- | .625 | 5.95* |
| Level 2 (6.875) | -- | -- | -- | 5.325* |
| Level 1 (12.200) | -- | -- | -- | -- |

*dT = 3.14; $p < .05$

Note: Level 4 = High Frequency of Exercise, Level 3 = Moderate Frequency of Exercise, Level 2 = Low Frequency of Exercise, and Level 1 = Non-Exercisers

There was, however, no significance found between the moderate and low exercise frequency groups.

The results of Tukey's test for anxiety score data differed from the depression score results in only one aspect. No significance was found between the low exercise frequency group and the non-exercise frequency group. Subjects' scores in the high and moderate exercise frequency groups did, however, indicate significantly less anxiety than subjects' scores in the non-exercise group. Also, subjects' scores in the high exercise frequency group demonstrated significantly less anxiety than subjects' scores in the moderate, low, and non-exercise groups. In addition, no significant difference was found between the moderate and low exercise groups (Table 6).

Table 6

Tukey's Specific Comparison Test for Anxiety
by Levels of Exercise

| | Level 4 7.775 | Level 3 15.450 | Level 2 19.175 | Level 1 22.175 |
|------------------|------------------|-------------------|-------------------|-------------------|
| Level 4 (7.775) | -- | 7.675* | 11.4* | 14.4* |
| Level 3 (15.450) | -- | -- | 3.725 | 6.725* |
| Level 2 (19.175) | -- | -- | -- | 3.0 |
| Level 1 (22.175) | -- | -- | -- | -- |

*dT = 4.70; $p < .05$

Note: Level 4 = High Frequency of Exercise, Level 3 = Moderate Frequency of Exercise, Level 2 = Low Frequency of Exercise, and Level 1 = Non-Exercisers

Although it was not a research question, an additional analysis was conducted to examine the relationship between age, levels of exercise, and anxiety and depression. A multivariate analysis of covariance (MANCOVA) was utilized to determine if age could effect the relationship between exercise frequency and anxiety and depression. The results of the MANCOVA reported in Table 7 revealed that age of subjects did not influence significantly the relationship between exercise frequency and anxiety and depression.

Table 7
Multivariate Analysis of Covariance

| Effect | Test Name | Value | Approximate F | Degrees of Freedom | Significance |
|--------------------|---------------|-------|---------------|--------------------|--------------|
| Exercise Frequency | Wilk's Lambda | .571 | 16.190 | 6,300 | 0.000* |
| Gender | Wilk's Lambda | .975 | .635 | 6,300 | 0.702 |
| Age | Wilk's Lambda | .989 | .840 | 2,150 | 0.434 |

Tests of Research Questions

To test research questions, an alpha level of .05 was used to evaluate the F ratios. Group means and standard deviations for each of the two dependent variables are reported in Table 8.

Table 8
Group Means and Standard Deviations of
Dependent Variables

| | N | Anxiety | SD | Depression | SD |
|---------|----|---------|-------|------------|-------|
| Level 1 | 40 | 22.175 | 8.302 | 12.200 | 6.301 |
| Level 2 | 40 | 19.175 | 8.009 | 6.875 | 5.336 |
| Level 3 | 40 | 15.450 | 7.679 | 6.250 | 5.429 |
| Level 4 | 40 | 7.775 | 7.644 | 1.275 | 2.439 |
| Males | 80 | 16.563 | 9.552 | 7.000 | 6.840 |
| Females | 80 | 15.725 | 9.531 | 6.300 | 5.869 |

Note: Level 4 = High Frequency of Exercise, Level 3 = Moderate Frequency of Exercise, Level 2 = Low Frequency of Exercise, and Level 1 = Non-Exercisers

Question One

Is there a significant difference in levels of anxiety between exercisers and non-exercisers? The results indicated that a significant difference does exist between scores on the dependent variables and levels of exercise frequency: high, moderate, low, and none (Wilk's Lambda (6,302) = .564, $p < .05$). Subsequent univariate analysis, as was shown in Table 3, supported the multivariate results that a difference did exist between levels of exercise frequency and subject scores on a measure of anxiety. A significant univariate F was found for the main effect of exercise frequency ($F = 24.534$, $p < .05$). A further post hoc comparison test between anxiety and levels of exercise frequency (see

Table 6) revealed a significant difference between exercisers and non-exercisers in the high and moderate exercise frequency groups, but not in the low exercise group.

Question Two

Is there a significant difference in levels of depression between exercisers and non-exercisers? The results of the MANOVA reported in Table 2 did indicate that a significant difference existed between exercise frequency and subjects' scores on a measure of depression (Wilk's Lambda (6,302) = .564, $p < .05$). Univariate analysis for depression (see Table 4) also revealed a significant difference between levels of exercise frequency and scores on a measure of depression ($F = 30.757$, $p < .05$). The results of the Tukey test for comparison of means between depression scores and levels of exercise frequency revealed that subjects' scores in all three exercise groups (high, moderate, and low) indicated significantly less depression than subjects in the non-exercise group (see Table 5).

Question Three

Is there a significant difference in levels of anxiety among high, moderate, and low exercise frequency subjects? The results of the Tukey specific comparison test reported in Table 6 shows that a significant difference did exist between subjects in the high exercise frequency group and those in the moderate and low exercise frequency groups. No significant difference was found, however, between low and moderate exercise groups.

Question Four

Is there a significant difference in levels of depression among high, moderate, and low exercise frequency subjects? Although the MANOVA and the univariate F tests revealed that a significant difference existed between exercise frequency levels and scores on a measure of depression (see Tables 2 and 4), it did not specify where the differences were located. Therefore, a Tukey specific comparison test between depression scores and levels of exercise frequency was employed (see Table 5). The results of the Tukey test revealed no significant difference between the low and moderate exercise groups. However, a significant difference was revealed between the high exercise group and the moderate exercise group, as well as between the high exercise group and the low exercise group.

Question Five

Is there a significant interaction between gender, exercise frequency, and level of anxiety? The results of the multivariate test of significance (reported in Table 2) did not indicate the existence of a significant interaction between gender and exercise frequency (Wilk's Lambda (6,302) = .977, $p > .05$).

Question Six

Is there a significant interaction between gender, exercise frequency, and level of depression? The results of both the multivariate and univariate analysis of variance (see Tables 2 and 4) indicated that a significant interaction did not exist between gender, exercise frequency, and level of depression. According to the Wilk's Lambda criterion, the combined dependent variables were not significantly affected by either

gender ($F(2,151) = .383, p > .05$), or the interaction between gender and exercise frequency ($F(6,302) = .582, p < .05$).

Summary of Results

Statistically significant differences among levels of exercise frequency were found for scores on measures of depression and anxiety. Specifically, subjects' scores in the, high, moderate, and low exercise frequency groups demonstrated significantly less depression than subjects in the non-exercise group, while subjects' scores in the high and moderate exercise frequency groups indicated significantly less anxiety than subjects in the non-exercise group. In addition, subjects' scores in the high exercise frequency group showed both significantly less anxiety and depression than subjects in the moderate, low, and non-exercise groups. Also, there were no significant differences between the low and moderate exercise frequency groups on both measures of anxiety and depression. No statistically significant differences were found for the main effect of gender or for the interaction effect of gender and exercise frequency.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The present study was designed to investigate the relationship between physical fitness and psychological well-being. This study had two primary purposes: (1) to investigate the effects of exercise participation on levels of anxiety and depression; and (2) to investigate the relationship between levels of exercise frequency (how often an individual participates in exercise), and anxiety and depression. A secondary purpose of this study was to examine the role of gender in the relationship between exercise and anxiety and depression.

The subjects in this study were 160 males and females from leisure and recreation courses at a large southwestern university. Eighty subjects were males with a mean age of 19.8 years and 80 subjects were females with a mean age of 21.1 years. The test data consisted of subjects' scores on the TMAS and the BDI. Participants in the study also completed a demographic questionnaire. Subjects were classified into one of four exercise groups: (1) non-exercisers--subjects who reported that they did not participate in exercise on a regular basis, (2) low frequency exercisers--subjects who reported exercising two or less times per week, (3) moderate frequency exercisers--subjects who reported exercising three to four times per week, and (4) high frequency exercisers--subjects who reported exercising five to seven times per week.

The following research questions were formulated and tested at the .05 level:

1. Is there a significant difference in levels of anxiety between exercisers and non-exercisers?

2. Is there a significant difference in levels of depression between exercisers and non-exercisers?

3. Is there a significant difference in levels of anxiety among high, moderate, and low exercise frequency subjects?

4. Is there a significant difference in levels of depression among high, moderate, and low frequency subjects?

5. Is there a significant interaction between gender, exercise frequency, and level of anxiety?

6. Is there a significant interaction between gender, exercise frequency, and level of depression?

A 2 x 4 multivariate analysis of variance (MANOVA) was used to test the research questions. Level of exercise frequency (four levels) and gender were the independent variables. The dependent variables were anxiety and depression levels. Alpha was set at .05. The multivariate analysis revealed a significant main effect for levels of exercise frequency but not for the main effect of gender or the interaction effect of gender and exercise frequency.

A subsequent univariate analysis also revealed significant differences among levels of exercise frequency and scores on depression and anxiety scales. Specific location of these differences were revealed by conducting a Tukey specific comparison test between depression and anxiety scores and levels of exercise frequency.

Subjects who reported participating in regular exercise scored significantly less depression than subjects who did not report participation

in regular exercise. Subjects who reported exercising the most frequently (five to seven times per week) scored significantly less depression and anxiety than subjects in any of the other three exercise frequency groups. However, there were no statistically significant differences between the low exercise frequency group (zero to two times per week) and the moderate exercise frequency group (three to four times per week) on the measures of anxiety and depression. In addition, no statistically significant differences were revealed for the main effect of gender and exercise frequency.

Conclusions

The results of this study suggest that participation in regular physical exercise can positively affect an individual's level of anxiety and depression. The people who reported involvement in regular physical exercise also reported lower levels of depression. In addition, the people who reported participating in the high and moderate exercise groups also reported lower levels of anxiety and depression.

The research question which hypothesized that a significant difference would exist among the scores of regular exercisers on measures of anxiety and depression was also supported. The subjects' scores in the high exercise frequency group revealed statistically less anxiety and depression than the subjects' scores in the low or moderate exercise groups. These results indicated that individuals who report participating more frequently in regular exercise may also report lower levels of anxiety and depression.

The main effect of gender and the interaction effect of gender and exercise frequency was not statistically significant in this study. This fact suggested that the relationship between exercise and anxiety and

depression is virtually the same for both men and women. These results are contrary to the study by Folkins et al. (1972), which reported that women showed significantly higher levels of anxiety and depression and a significantly greater improvement in both these areas following exercise than men.

Implications for Counseling Practice

Anxiety and depression continue to be a prevalent cause of emotional problems in today's world (President's Commission on Mental Health, 1979; Dishman, 1985). The results of the present study indicated that regular physical exercise is related to lower levels of anxiety and depression.

Numerous studies cited in the literature review support the conclusion that physical exercise is beneficial in the reduction of anxiety and depression (Doyle et al., 1989; Greist et al., 1979). However, counseling practitioners are still not utilizing physical exercise as a method of intervention (Burks & Keeley, 1989).

The present study provides further evidence that a positive relationship exists between participation in physical activities and reduced levels of anxiety and depression. Of particular importance was the finding that the individuals who reported the highest levels of exercise participation also reported the lowest levels of anxiety and depression. Hopefully, the additional support provided by the present study will increase the awareness of counselors and other mental health professionals to the potential importance of physical conditioning in the counseling area.

Recommendations for Further Research

As a result of this study, the following recommendations for further

study are made:

1. In the present study, frequency of participation in physical fitness activities was measured by subjects' self-reports. Improvements in the measure of these variables may be obtained through physiological tests, such as treadmill and ergometer tests that measure oxygen uptake.

2. The present study was restricted to a college population. The use of a noncollege sample may be indicated for further research.

3. Gender was not a significant factor in the present study. However, it is suggested that additional information is needed in this area. For example, a study comparing a group of same-sex exercisers with a group of coed exercisers may provide additional information.

4. There was a high degree of multicollinearity between the two measures used in this study. Both the instrument for anxiety and the instrument for depression appear to have been measuring approximately half of the same material. This raises the question of how adequately these two constructs (anxiety and depression) are defined. In order to provide more accurate information on what these constructs are measuring, a repeated measures design is recommended for future studies.

5. The majority of subjects in this study were in the younger age range (under 30 years). A similar study using the same variables and treatment process but utilizing a different age group could be beneficial.

6. The present study looked at exercise in general. No attempt was made to differentiate between aerobic and nonaerobic exercise. A similar study comparing aerobic and nonaerobic exercise is recommended.

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APPENDIXES

APPENDIX A
INFORMED CONSENT FORM

STATEMENT OF INFORMED CONSENT

Thank you for volunteering to participate in this study. This questionnaire packet is part of a study to understand the relationship between exercise and psychological well-being. Your participation is strictly voluntary; however, your decision to take the time to complete the study will provide important information. You may withdraw from participating in this study at any time for any reason whatsoever.

All information will be gathered in strict conformance with APA guidelines for human subjects participation. Your responses will be completely anonymous; no attempt will be made to attach your name to responses, and responses will not be shared with your instructors. The results of this study will only be reported as group data, not as individual responses. If you have any questions about this study, please contact Dr. James Seals, Applied Behavioral Studies, Oklahoma State University, (405) 744-6036. If you have any questions about your rights as a research participant, please contact the office of University Research Services, Oklahoma State University, 001 Life Sciences East, (405) 744-6991. We appreciate your cooperation and efforts.

I have read these instructions and understand my rights. I further understand that this sheet will be immediately removed from the rest of the packet.

(Signed)

(Witness)

(Date)

(Date)

Check here if you want feedback regarding the results of this study when they are available. Include your mailing address only if you want feedback. This page will be immediately detached from your responses.

(Name)

(Address)

(City, State, Zip)

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

DEMOGRAPHIC QUESTIONNAIRE

Please supply the following information:

Age ____

Gender: Male ____ Female ____

Marital Status: Single ____ Married ____

Classification: Freshman ____ Sophomore ____ Junior ____

Senior ____ Graduate ____

College Major: _____

Accumulated Grade Point Average _____

Are you a regular exerciser? Yes ____ No ____

How many times per week do you exercise? 0-2 ____ 3-4 ____ 5-7 ____

How long have you been exercising? Months ____ Years ____

Please indicate which form(s) of exercise you participate in on a regular basis. (Place an X by the appropriate response(s)).

Walking ____ Aerobics ____ Softball ____

Running/Jogging ____ Football ____ Tennis ____

Weight training ____ Baseball ____ Golf ____

Bicycling ____ Basketball ____ Track ____

Swimming ____ Wrestling ____ Other (please identify)

2
VITA

Todd R. DeWolf

Candidate for the Degree of
- Doctor of Philosophy

Thesis: THE EFFECTS OF LEVELS OF EXERCISE AND GENDER ON DEPRESSION
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Biographical:

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Education: Graduated from Lyman Hall High School, Wallingford, Connecticut, in June, 1979; received Bachelor of Science degrees in Psychology and Sociology from Oklahoma State University in May, 1984; received Master of Science degree from Oklahoma State University in May, 1987; completed requirements for the Doctor of Philosophy degree at Oklahoma State University in May, 1991.

Professional Experience: Group Facilitator, Parents Assistance Center, Stillwater, Oklahoma, January, 1985-May, 1985; Graduate Research Assistant, Oklahoma State University, August, 1982-May, 1986; Resident Group Therapist, The Country Place Residential Treatment Center, Litchfield, Connecticut, January, 1987-September, 1987; Psychiatric Consultant, United Social and Mental Health Services, Willimantic, Connecticut, Summer, 1988; Student Therapist, Student Mental Health Clinic, Stillwater, Oklahoma, August, 1985-May, 1986, January, 1988-September, 1990.