To the Graduate Council:

I am submitting herewith a dissertation written by Dennis John Moran entitled "Comparative Effects of Participation in a Physical Fitness Training Program Versus a Physical Education Class on Mood and Self-Image in Adolescents." I have examined the final copy of the dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

Kenneth R. Newton,
Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

The Graduate School

COMPARATIVE EFFECTS OF PARTICIPATION IN A PHYSICAL FITNESS TRAINING PROGRAM VERSUS A PHYSICAL EDUCATION CLASS ON MOOD AND SELF-IMAGE IN ADOLESCENTS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Dennis John Moran

December 1984

DEDICATION

I dedicate this work to the memory of my father, Dennis John Moran. He taught me in living to persevere when hope dimmed, to rely on my family and friends when my strength waned. Dad, I love you very much.

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ABSTRACT

Recently, interest in the relationship between physical fitness and mental health has increased. Some authors have suggested that increases in physical fitness are accompanied by increases in psychological well-being, in both adolescent and adult populations. Unfortunately, much of the research in this area has suffered from methodological flaws which have rendered the findings difficult to interpret.

This study was conducted in an effort to assess the relationship between initial fitness level and psychological well-being, as measured by scores on standardized indices of mood and self-image. An effort was also made to assess the impact of physical fitness training on a sample of normal adolescents. Fifty-six high school students who were enrolled in Physical Education classes served as subjects. While it was predicted that adolescents who participated in a seven-week physical fitness training program would evidence positive changes on mood and self-image measures when compared to adolescents who participated in a control group, this prediction was not supported. Possible motivational explanations for these findings are discussed along with implications for further research.

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CHAPTER I

INTRODUCTION

Mens sana in corpore sano.

Juvenal, circa 100 B.C.

For centuries, exercise has been regarded as useful in the maintenance of a sound mind in a sound body. In recent years, an increasing amount of attention has been paid to the purported physical and psychological benefits of exercise. While the general physiological benefits of physical activity have long been observed, more recently exercise effectively has been used to address specific physical health concerns. Additionally, regular physical activity has been regarded by some as helpful in ameliorating certain psychological problems.

Available evidence suggests that exercise reduces the risk of coronary artery disease, hypertension and obesity, in addition to reducing risk factors associated with smoking. Since each of these factors impacts negatively upon life expectancy and quality of life, it appears that exercise may increase longevity by mitigating the risk of certain life threatening physical diseases (Greist, Klein, Eishens, and Faris, 1978; Kasch, 1976; Palone, Lewis, Lanigan, and Goldstein, 1976).

One of the most longstanding views of man held that mind functions separately from body. This dualistic view has given way to the wholistic model, which suggests many links between physical and mental health. The break with tradition and the resulting shift toward an organismic view of man has been fostered in part by many reports of the theoretically mental health promoting benefits of exercise (Folkins and Sime, 1981).

The debate over the purported antidepressant effects of exercise has changed in focus from a question of "If?", to a question of "How?", "For whom?", "How much?", and "For how long?" (Greist, et al., 1978; Folkins and Sime, 1981; Ransford, 1982). Many early anecdotal accounts reported persons who exercised regularly experienced a sense of well-being following their activity (Glasser, 1976; Kostrubala, 1976; Layman, 1955; Regan, 1977). This so called "feel better" phenomenon (Morgan, Roberts and Feinerman, 1971) was asssumed to be an inverse of depressive phenomena, and it seemed to follow logically that exercise might mitigate depression. Numerous studies have attempted to demonstrate that presumed logic and to more clearly delineate the "antidepressant" properties of exercise (Blue, 1979; Greist, et al., 1978; Gutin, 1966; Morgan, 1968; Morgan, 1970; Morgan, et al., 1971). Several reviews of the

literature conclude that exercise does indeed have potential antidepressant benefits (Browman, 1981; Folkins and Sime, 1981; Morgann, 1969; Ransford, 1982; Sime, 1979).

The relationship between physical activity and depression is only one area where physical well-being has been linked to psychological well-being. Changes in physical activity levels and (the often presumed) resultant changes in physical fitness levels have been reported to positively enhance self-perception (Collingwood, 1972; Jasnoski, Holmes, Soloman, and Aguair, 1981; Jorgenson and Jorgenson, 1979; Leonardson and Gargiuto, 1978); to promote positive personality changes (Cureton, 1963; Folkins, Lynch, and Gardener,, 1972; Ismail and Trachtman, 1973; Ismail and Young, 1977; Renfrow and Bolton, 1979); to reduce anxiety (Bahrke and Morgan. 1978; deVries, 1981; Morgan, 1974; Irwin, 1974); to improve life satisfaction (Dickie, Ludwig, and Blauw, 1974; Morris, 1983; Morris and Husman, 1978); to affect the aging process (Buccola and Stone, 1975; Kasch, 1976; Palone, et al., 1976); to have potential benefit for chronic mentally ill patients (Dodson and Mullens, 1968; Lion, 1978; Morgan, 1968; Rudd and Margolin, 1969; Smith and Figetakis, 1970; Watters and Watters, 1980); and to positively affect adolescent adjustment (Collingwood and

Engelsgjerd, 1977; Hilyer, Wilson, Dillon, and Caro, 1982).

Studies of geriatric populations appear to support the notion that improved psychological functioning accompanies increases in levels of physical activity and physical fitness (Buccola and Stone, 1975; Powell, 1974; Stamford, Hambacher, and Fallica, 1974). Parallel conclusions have been drawn in studies of alcoholics (Dodson and Mullens, 1968; Guthrie and Gary, 1972); anxiety neurotics and "anxious" normals (Morgan, 1979; Morgan and Horstman, 1976; Morgan, Roberts, Brand, and Feinerman, 1970; Muller and Armstrong, 1975; Orwin, 1973; Orwin, 1974); and depressives and "depressed" normals (Kavanaugh, Shephard, and Tuck, 1975). Preliminary findings also suggest that exercise may benefit chronic mentally ill populations (Conroy, Smith, and Felthous, 1982; Powell, 1974; Timmerman, 1954). However, other studies of psychotic patients showed no change following exercise (Clark, Wade, Massey, and Van Dyke, 1975; Kramer and Bauer, 1975; Smith and Figetakis, 1970).

Given the varied and potentially beneficial application of physical activity to various aspects of psychological functioning, it has been temptimg to view vigorous exercise as panacea for psychological ills (Andersen, 1979). While such a notion is obviously

simplistic, physical fitness programs have been seriously promoted as an important treatment adjunct which may have significant psychotherapeutic value for many populations.

CHAPTER II

REVIEW OF THE LITERATURE

The notion that there exists a positive relationship between physical and mental health has been considered by various disciplines. In recent years, the question of the nature of that presumed relationship has been pursued with increased vigor. Numerous investigations have reported finding a positive relationship between increased level of physical activity and improvement on various psychological variables. Exercise has been associated with improved tolerance of physiological stress and reduction in anxiety (Bahrke and Morgan, 1977; Carter and Francis, 1982; Docktor and Sharkey, 1971; Driscoll, 1976; Heywood, 1978; Michael, 1957; Morgan, 1976; Morgan and Costill, 1972; Orwin, 1974; Wood, 1977); with improved mood (Blue, 1979; Brown, Ramirez, and Taub, 1978; Carter and Francis, 1982; Greist, Klein, Eichens, and Faris, 1979; Kavanaugh, et al., 1975); with improved self-concept (Collingwood, 1972; Hanson and Neddle, 1974; Hilyer and Mitchell, 1979; Mauser and Reynolds, 1977; McGowan, Jarman, and Pedersen, 1974); with improved sense of well-being (Brunner, 1969; Morgan, et al., 1970; Young, 1979); and with an improved perception of quality of life (Morris, 1983; Morris and Husman, 1978).

Efforts to investigate the effects of physical activity upon mental health, however, have been somewhat hampered by the absence of a unifying theoretical framework from which to explain any relationship found between somatic and psychic phenomena. Positive mood changes found to accompany increases in activity levels have been attributed to various and diverse sources: the cathartic effect of exercise (Heywood, 1978); the diversional quality of the activity (Bahrke and Morgan, 1977); endocrine and blood plasma changes associated with vigorous exercise (Docktor and Sharkey, 1971; Michael, 1957); and inhibition of the arousal associated with anxiety (Driscoll, 1976; Orwin, 1974). Perhaps because interest in this area of research evolves from many diverse disciplines, such as psychology, physiology, health and recreation, and medicine, no theoretical explanation has yet been offered that adequately integrates the physical, physiological, and psychological issues.

In addition to the lack of theoretical grounding, the available literature also suffers from a lack of methodological sophistication. There are few examples in the literature of well-designed investigations into the nature of the relationship between exercise and psychological well-being. In a recent review, Folkins

and Sime (1981) found that of the more than one hundred studies reviewed, only about fifteen percent qualified as true experiments. Approximately fifty percent of those studies employed pre-experimental designs which failed to adequately control for sources of internal invalidity (Campbell and Stanley, 1963). For instance, the one-group pretest-posttest design, a pre-experimental design employed in many studies in this literature, does not control for extraneous variables which might produce effects that may confound the effect of the treatment variable. Since this design does not utilize a control group, threats to internal validity such as test-taking effects, selection bias, maturation, and history are not adequately controlled. Change observed in the treatment group may have been attributable to a shift stimulated by pre-testing (Test-taking effect), the sample studied may have been predisposed to evidencing a treatment effect (selection bias), the passage of time may have contributed to the finding (maturation), or changes in diet or home environment (history) may have influenced the experimental outcome.

It is important to note, however, that despite the theoretical and methodological limitations in the literature, there does seem to be considerable consistency among the findings reported. The few

available studies of true clinical populations do suggest that vigorous physical activity is both physically and psychologically beneficial.

The literature can be fairly readily divided into investigations of the effect of acute versus chronic exercise. Acute exercise typically involves a single bout of vigorous activity which is preceded by a pretest measure and followed by a posttest. Acute exercise often involves sub-maximal exercise in which the subject sustains a fairly high percentage of his predicted maximal heart rate for a brief period of time (Bahrke and Morgan, 1977; Morgan, et al., 1970). Chronic exercise refers to frequent activity (three to five times per week) sustained for a number of weeks or months. Studies employing acute exercise, then, would examine the possible immediate effects of physical exertion, whereas studies of chronic exercise may potentially examine more longlasting effects which may or may not be a function of change in level of fitness. Unfortunately, many early investigators employed no measures of cardiovascular fitness leading to the suspicion that although subjects' activity levels increased, no gain in level of fitness was necessarily obtained.

In subsequent sections, potential theoretical understandings of the nature of the somatic and psychic

relationship are discussed. Also, literature relevant to the nature of this relationship is reviewed. Although findings of various non-experimental and pre-experimental reports are discussed, particular attention is paid to those experimentally controlled investigations which document physical fitness training programs.

Theoretical Perspectives on Fitness Training and Mental Health

As has been noted, research into the psychological effects of physical activity in general, and more specifically physical fitness training, has been hindered by the lack of a unifying theoretical framework from which to understand and explain the potential interaction of somatic and psychic phenomena. Traditionally, philosophy, medicine and psychology have upheld a dualistic view of man; that is, mind is separate from body. Early efforts to offer a more integrated understanding of the human organism were met with harsh skepticism (Kretschmer, 1925; Sheldon and Stevens, 1942).

The constitutional theory of personality (Sheldon and Stevens, 1942) postulated a behavior-physique relationship. Sheldon theorized that human behavior could be explained in terms of two basic dimensions, physique and temperament. He isolated three core components for the assessment of physical structure:

endomorphy (roundness and fattiness), mesomorphy (muscularity), and ectomorphy (linearity). Each component was rated on a seven point scale to produce a composite "somatotype." Based on a factor analysis of psychological traits, Sheldon selected twenty traits that correlated with each of the somatotypes. Three temperament components, visceratonia (being socially at ease), somatotonia (being active and assertive), and cerebrotonia (being socially withdrawn and tense) were also rated on a seven point scale to produce the composite temperament. Sheldon and Stevens (1942) reported high positive correlations between somatotype and temperament and these correlations formed the basis for the constitutional theory of behavior.

Despite the neat and compact nature of Sheldon's theory, it is probably overly simplistic to attribute independent variable status to physique (Fisher, 1976). Sheldon himself has conceded that attempting to explain personality solely on the basis of the individual's constitutional pattern would be as fruitless as attempting such an explanation solely from the life history of the individual (Sheldon and Stevens, 1942).

More recently, Harris (1973) has proposed a "somatopsychic" model in an effort to provide a "framework for causation" which can be utilized to

generate hypotheses regarding the effects of exercise upon psychgological variables. This theoretical framework holds essentially that human behavior is influenced by bodily function and activity (Harris, 1973). As Harris (1970) notes, psychologists and physiologists have rarely worked together in addressing possible psycho-physical relationships. Psychologists have seldom paid attention to physiological and physical factors which may influence psychological variables, while the converse is often true of physiologists. Inquiries have typically been hypothetical and speculative, rather than experimental (Harris, 1970). The somatopsychic theory represents an effort to integrate, in a causal model, physiological and psychological phenomena.

Many theoretical rationales for the purported relationship between physical activity and psychological well-being have been advanced to explain specific findings, rather than to address broader somatic and psychological relationship issues.

In attempting to explain the finding that vigorous physical activity was effective in remediating anxiety attacks in agoraphobics, Orwin (1973) theorized that in vigorous exercise the anxiety response (or agoraphobia) may be inhibited at a physiological level since the

autonomic system is already activated coping with the urgent metabolic demands attendant to vigorous physical activity. Orwin further notes that the patient can cope cognitively more effectively by attributing the felt internal excitation to a known external behavior, thereby reducing anxiety related to the person's experience of internal arousal (e.g. heart palpitations, rapid heart rate, increased respirations). "Presumably the inhibition of lack of awareness of anxiety in relation to the external environment leads to a realization that the situation is no longer anxiety provoking and this gives rise to expectations of a similar response in the future" (Orwin, 1973, p. 178). Driscoll (1976) arrived at a similar conclusion, finding that aerobic exercise produced a physiologic arousal response which effectively competed with anxiety arousal.

Exercise physiologists, noting changes in blood plasma levels of certain neurotransmitters associated with specific moods following exercise, discuss a biochemical relationship through which physical activity may produce positive changes in psychological well-being (Ransford, 1982). Specifically, the author suggests that exercise influences moods by producing elevations in the levels of catecholamines (e.g. seratonin and norepinephrine) in the body.

Unfortunately, there has been no well organized effort to explain the psychological effects which may accrue to physical fitness training, and the research in the area has been largely atheoretical.

Investigations of the Physiological Adaptations to Chronic Physical Activity and the Relationship to Stress

Physiological adaptations to vigorous physical activity fall into two major categories: acute and chronic (Wilmore, 1977). Acute adaptations occur during a single bout of activity. Chronic adaptations are changes that result from physical fitness training and the resultant cardiovascular conditioning effect. Several investigators have studied the effect of exercise upon physiological parameters concluding that exercise may affect physiological mechanisms allowing the individual to adapt more effectively to stress.

Michael (1957) noted that fit subjects showed less adrenal activity under conditions of stress than unfit subjects. He concluded that prolonged exercise resulted in a condition that allowed subjects to tolerate stress more easily.

Docktor and Sharkey (1971), after training subjects three times per week for five weeks, found that following an initial increase in vanilmandelic acid (an indicator of the presence of catecholamines), concentrations of the

acid decreased as training continued. This finding lends support to the contention that the body becomes accustomed to chronic moderate stress (in the form of exercise) so that the body is conditioned to deal more easily with other stressors. Other authors (e.g., de Vries, 1968) suggest that the tension relieving quality attributed to exercise is associated with the reduction in resting muscle action potential following physical fitness training.

A more recent investigation considered the effectiveness of exercise in reducing physiological signs of stress in university students (Sime, 1977). Subjects manifested anxiety symptoms concerning an impending stressor, a written examination. Subjects were randomly assigned to either an exercise, a meditation, or a placebo-pill group. Although all subjects evidenced significant reductions in muscle tension and blood pressure, only the exercise group showed significant reductions in resting heart rate and electrodermal responses to vigorous activity. Sime concluded that exercise, and to a lesser extent meditation, can effectively reduce the physiological signs of stress and anxiety.

Investigations of the Psychological Impact of Physical Activity

Interest in psycho-physical relationships has an extensive history. It has long been assumed that there is a positive relationship between physical and mental health (Harris, 1970). For centuries, the importance of athletic competition has been emphasized for its presumed usefulness in preparing participants both physically and mentally for the rigors of battle. More recently, physical activity has been touted as an effective therapeutic tool in promoting and maintaining psychological well-being (Andersen, 1979; Greist, et al., 1979; Kostrubala, 1976; Regan, 1977). However, despite the current popular acceptance of the importance of the relationship that is purported to exist between physical and mental health, the literature contains few reports of well-designed experimental studies.

The widely reported "feel good phenomenon" that is said to follow from regular physical activity found its initial support in the many anecdotal accounts in the literature of the benefits reported to accrue to exercise. These personal accounts serve as highly subjective testamonials to the improved sense of well-being that has often been associated with regular exercise (Kostrubala, 1976; Regan, 1977; Sheehan, 1975).

Kostrubala (1976) felt that running could be an important adjunct to psychotherapy because the activity may have stimulated access to the patient's unconscious. He described a running/group psychotherapy treatment which met three times per week and in which individuals suffering from depression, schizophrenia, anorexia nervosa, and "life style changes" all reported reductions in sympomatology and improvements in life functioning. Unfortunately, this account was of uncontrolled studies which did not measure any possible improvements in level of physical fitness which the participants may have experienced. It is therefore arguable, at best, to attribute the patients' reported mental health gains to the exercise. This type of report does little more than raise intriguing questions about the type of potential relationship between physical and mental health.

The remainder of the relevant literature offers sparse data on which to base answers to the questions raised. Pre-experimental intact comparison group designs have often been employed to compare athletes and non-athletes and fit and unfit subjects on a wide range of social, psychological and personality variables. As a group, athletes have been reported to be more self-confident, assertive, tough-minded, and emotionally stable than their non-athletic counterparts (Clark, 1967;

Ogilvie, 1968; Ogilvie and Tutko, 1967; Werner and Gottheil, 1966). Fit subjects appeared less anxious, less depressed, and possessed a greater sense of well-being than unfit subjects (Brunner, 1969).

More recently, quasi-experimental and, occasionally, true experimental designs have been employed to study the impact of physical activity upon psychological variables such as mood, self-image, and life satisfaction (Folkins and Sime, 1981).

Exercise and Anxiety. The impact of physical activity on anxiety has received much attention and has stirred some controversy in the literature. While many authors have reported the anxiety-reducing effects of both acute and chronic exercise, it has been suggested that vigorous physical activity may be contra-indicated for certain highly anxious individuals.

Physical activities of varying frequency, intensity, and duration have all been reported to reduce anxiety levels among anxious subjects. Handlon (1963) reported that bowling reduced the level of anxiety in his subjects, despite the fact that the activity clearly did not alter cardiovascular fitness. Several authors have reported that vigorous acute physical activity promotes a reduction in state-anxiety levels in both "normal" and "clinically anxious" subjects (Morgan, 1979; Morgan and

Horstman, 1976; Wood, 1977). Chronic physical activity has also been shown to reduce state-anxiety levels in normals and psychoneurotics (Kowal, Patton, and Vogel, 1978; Popejoy, 1968; Young, 1979).

In contrast, the reports of Pitts and McClure (1967) and Pitts (1969) suggest that physical activity, instead of improving the psychological condition, may actually be contraindicated for certain highly anxious or anxiety prone individuals. The Pitts-McClure hypothesis proposed that an exercise metabolite (lactate) could provoke an anxiety attack in anxiety neurotics (Pitts and McClure, 1967). Pitts (1969) further suggested that anxiety symptoms could occur in normal subjects under stress as a result of accumulated excess lactate. While this hypothesis has found some support in the literature (Fink, et al., 1969; Kelley, et al., 1971), Grosz and Farmer (1969) have shown that the infusion of sodium lactate, the method employed in the studies cited, produces a metabolic change (alkalosis) which is quite different from the physiological changes which accompany vigorous exercise (acidosis). Thus, the metabolic response to lactate in the system through infusion of sodium lactate and through exercise are quite different (Bahrke, 1979). Further, evidence from studies of highly anxious individuals engaged in an exercise program is

contrary to the results predicted by the Pitts-McClure hypothesis (Driscoll, 1976; Orwin, 1973; Orwin, 1974).

Bahrke and Morgan (1978) speculate that it is diversion, not exercise, meditation, or biofeedback that accounts for anxiety reduction following exercise, while other authors suggest that exercise is useful in reducing particular types of anxiety. A recent study (Schwartz, Davidson, and Goleman, 1978) hypothesized a cognitive dimension and a somatic dimension of anxiety. Those authors suggest that exercise may be more useful in reducing somatic anxiety, while an activity such as meditation may be more useful in reducing cognitive anxiety. Using an anxiety scale developed to differentiate somatic from cognitive aspects of anxiety, Schwartz and his co-workers examined anxiety reponses of forty-four experienced exercisers and thirty-three experienced "passive" meditators. The findings supported the authors' hypothesis that exercise has a greater effect upon somatic anxiety.

From the foregoing discussion, it is clear that many questions remain about the effect of exercise upon anxiety. While the literature offers strong support for the contention that physical activity can be effective in reducing anxiety, the frequency and intensity of the activity required to produce this positive change has not

been specified. Additionally, the manner through which this change occurs appears quite complex, and no clear explanations have been offered which adequately integrate the data.

Exercise and Depression. Several authors have suggested that depression ranks as the foremost mental health problem facing Americans today (Greist, et al., 1978; Lilliefors, 1978; Secunda, 1973). It has been estimated that as many as fifteen percent of American adults exhibit significant depressive symptoms (Secunda, 1973).

The literature concerning the effects of physical activity upon depression appears to support the contention that vigorous activity may promote an improvement in mood in persons exhibiting a moderate degree of depression. Several authors suggest that exercisers are less depressed and feel better than sedentary controls (Carter and Francis, 1982; Morgan, et al., 1971), and that exercise training programs tend to promote reductions in depression and improvement in mood particularly in subjects initially identified as depressed (Folkins, Lynch, and Gardner, 1972; Kavanaugh, et al., 1977; Morgan, et al., 1970).

Brown and his coworkers (1978) found that depression in university students improved after participation in an

exercise training program. Similar findings have been reported for post-coronary patients who engaged in exercise rehabilitation programs (Kavanaugh, et al., 1977; McPhearson, et al., 1967). Morgan (1976) also reported finding subjective reductions in depression in exercise-trained prison inmates, despite the fact that objective tests for depression yielded normal range scores for these subjects before, during and after termination of the study.

Folkins, Lynch and Gardener (1972) studied the psychological effect of fitness training on a group of college students enrolled in a jogging course. The authors found that the more depressed subjects were initially, the greater benefit they seemed to obtain from the activity. These authors concluded that those initially in the poorest physical and psychological condition would exhibit the greatest physical and psychological gains with improved fitness. This assumption was supported in the findings of a 1970 study which reported that fitness training did not significantly impact depression for sixty-seven college professors studied (Morgan, et al., 1970). Closer inspection of the data revealed that of eleven subjects who scored in the depressed range on the Zung depression scale at pretest, each increased his level of fitness and

scored in the non-depressed range at the end of the study. Further, none of the remaining fifty-six subjects scored in the depressed range at post-test.

Once again, critical questions regarding the effect of physical activity upon mood remain unanswered. While the literature generally supports the assumption that exercise is beneficial for persons who are depressed, the frequency and intensity of the exercise necessary to achieve any antidepressant effect is unclear.

Exercise and Self-Esteem. Self-esteem is a term which typically refers to the affective attitudinal component of a complex system of conceptions one has about oneself, namely, the self-concept (Martens, 1975).

Probably the most common effect attributed to physical exercise is the "feel better" phenomenon, which is fairly uniformly reported by investigators who concern themselves with the psychological effects of physical activity (Morgan, et al., 1970). Numerous studies report that while subjects may exhibit no significant changes on measures of physical fitness, depression, anxiety, etc., the subjects do tend to report that the experience has left them "feeling better" (Brunner, 1969; Naughton, Bruhn, and Lategola, 1968; Mann, Garrett, Farhi, Murray, and Billings, 1969; Morgan, et al., 1970).

Further, when fitness effects have been documented, subjects have uniformly shown improvements in self-concept. Physical fitness training programs with male rehabilitation clients (Collingwood, 1972); with obese males (Collingwood and Willet, 1971); among college students (Hilyer and Mitchell, 1979); and among adult females (Hanson and Neddles, 1974) have all reported concomittant improvements in self-concept.

Further support for the notion that exercise enhances self-concept is found in a number of studies which suggest that subjects who engage in exercise training programs experience increased self-sufficiency, increased self-confidence, and increased self-assuredness (Folkins, et al., 1972, Dowell, Badgett, and Landis, 1970; Hartung and Farge, 1978; Sharp and Reilly, 1975). These investigations and others have equated improvements in self-concept with improvements in psychological fitness. The assumption has been that changes in physical fitness, which are firmly tied to exercise, are accompanied by changes in psychological fitness, even though a causal relationship has not been demonstrated.

Although the evidence suggesting a link between physical activity and psychological fitness in this area is less ambiguous, investigators disagree on whether simple physical activity (e.g. Brunner, 1969) or gains in

physical fitness (e.g. Folkins, et al., 1972) are necessary to produce a positive change in self-esteem.

Exercise and Life Quality. Some authors have reported that participation in an activity program may enhance the subjects' perception of their quality of life. In one such study, undergraduate college students participated in a fifteen week endurance conditioning program (Morris and Husman, 1978). Subjects were asked to respond to the Pflaum Life Quality Inventory (PLQI) prior to and following the exercise conditioning program. Results showed a positive change in the subjects' perception of quality of life following conditioning. Morris (1983) studied the effects of four different activities on the reported life quality of older adults. Again using the PLQI as a pre- and post-activity measure, the author found that activities which are more physically intense (aerobic dance and ballet) were associated with significant improvements in subjects' reported life quality. Subjects who were involved in less vigorous activities (ballroom dance and doll making) failed to show any significant change in life quality over the twelve weeks of the study. Since no fitness measure was employed in the latter study, improvements in life quality reported may not necessarily be associated

with changes in fitness levels, although the findings are suggestive of such an association.

Exercise and Psychiatric Populations. While much of the available literature concerning the relationship between exercise and mental health has considered the impact of various types of activity programs upon both "normal" subjects and those scoring in the clinically significant ranges on various measures of mood, a few studies of true patient populations have been reported. In general, the findings reported in those investigations lend support to the hypothesis that exercise programs hold some promise as important therapeutic adjuncts.

Several studies of anxious and depressed psychiatric patients have yielded results similar to those found with normal and analogue patient populations. Psychiatric patients who participate in vigorous physical activity have reported feeling less anxiety (Orwin, 1973) and less depression (Blue, 1978; Greist, et al., 1978).

While chronic mentally ill patients generally are viewed as refractory to change, several studies have employed exercise programs in an effort to assess their impact upon psychotic behavior. Exercise programs with chronic psychiatric patients have been reported to result in improved mood (Conroy, Smith, and Felthous, 1982; Dodson and Mullens, 1969; Lion, 1978); improved self-

image (Dodson and Mullens, 1969); improved body-image (Smith and Figetakis, 1970); and improved cognitive functioning (Powell, 1974).

Unfortunately, none of the available studies documented a positive change in cardiovascular fitness. This and other serious methodological flaws have hampered these investigations (e.g. small subject samples, inadequate or absent control groups, inconsistent definitions of "vigorous physical activity"). Additionally, as has been noted, definitions of "exercise" and "physical fitness training" have varied widely among the studies cited; therefore, the intensity and duration of physical activity required to produce the desired psychological benefit remains unclear.

Despite these flaws, the preliminary findings do seem to indicate that physical fitness training may have a beneficial psychological impact on mental health among adult clinical populations.

Exercise and Juvenile Populations. The literature reviewed supports the contention that fitness is positively correlated with psychological health, and it strongly suggests that an increase in one's level of physical activity promotes improved psychological functioning. Much of the research considering the impact of physical activity upon mental health has been

conducted upon adult populations. This leads one to question whether fitness training might have similar effects at earlier developmental stages. Unfortunately, few examples of well controlled, methodologically sound studies of the effects of exercise on youth appear in the literature. As was noted previously, intact comparison group designs have been employed in efforts to compare fit with unfit and athlete with nonathlete populations. Because this type of research does not control for error from selection bias, conclusions about the effect of activity upon psychological well-being cannot be drawn.

The data in the area are sparse and inconclusive. A study by Jasnoski and Holmes (1981) reported that young adult women who participated in a fifteen-week aerobic conditioning program benefitted both physically and psychologically. At pre-test, high fit subjects were more self-assured, more emotionally stable, and less depressed than low fit subjects. Following the conditioning program, the subjects who evidenced positive gains on cardiovascular fitness measures were reported to be more self-assured and less tense than nonexercising controls. Other aspects of personality appeared unaffected by the exercise.

A study by Neal (1977) offered somewhat contradictory findings. Ninth-grade boys participated in

research comparing the effects of fitness training, group counseling, combined counseling and fitness training, and a control condition on subjects' self-esteem. The program was ten weeks in duration and all subjects were pre- and post-tested on measures of fitness and self-esteem. While pre-test findings were not reported, the author found at post-test a significant increase in cardiovascular fitness among both the fitness group and the fitness and counseling group. However, there were no significant differences at post-test on measures of self-esteem. Thus, one of the most consistent findings among adult populations (improved self-esteem) was not found among early adolescents. Reasons for this are unclear, but may have to do with the observation that self-esteem is at its lowest ebb for early adolescent boys, becoming more stable with increasing age (King, 1971; Profinsky and Farrier, 1980).

In a recent study of the effect of various pre-conditions on a language training program, Watters and Watters (1980) observed the self-stimulatory behavior of five autistic boys through twenty-seven language training sessions. These pre-conditions, television watching, physical exercise, and a session on academics, were randomly presented prior to language training. Exercise sessions consisted of eight to ten minutes of jogging.

Subjects participated in no more than one pre-condition per day and four sessions per week. Results indicated that autistic boys exhibited significantly less self-stimulatory behavior following exercise than following either of the other pre-conditions. Because of the brief duration and infrequency of the exercise sessions, it is probable that no fitness effect was obtained. The authors concluded that exercise was effective in reducing self-stimulatory behavior in a way comparable to a massed practice procedure. This procedure proposes to eliminate a behavior by having the patient repeatedly perform the behavior.

Studies of the effects of physical activity programs upon delinquent males have reported that behavioral and psychological benefits accrue to youth who are more physically active. Collingwood and Engelsgjerd (1977) studied the relationship between physical activity and delinquency. The authors noted that delinquent youth tend to be below average both in reported physical activity levels and in levels of physical fitness. The authors also noted a relationship between low self-esteem and delinquent behavior. Juvenile offenders were involved in a physical activity program designed to improve fitness. Youth were encouraged to select activities in which they could continue to participate

following the study. The authors reported a marked drop in recidivism at one year follow-up for youth who completed the program. While these findings lend support to the hypothesis that improved fitness leads to improved behavior and self-esteem, this study did not employ adequate control groups and no formal tests of statistical significance were made.

A recent study by Hilyer and his coworkers (1982) considered the effect of a systematic physical fitness training program delivered by counselors for one and one-half hours per day, three days per week for twenty weeks. The experimenters used Cooper's one and one-half mile run test as a cardiovascular fitness measure (Cooper, 1972). The authors found that although the experimental group scored less favorably than the control group on the majority of the psychological measures at pre-test (e.g. were more anxious, depressed, angry, and confused), these differences were reversed at post-test. Experimental subjects evidenced significant gains in cardiovascular fitness as well as on psychological measures of mood and self-esteem.

From the foregoing discussion, it is clear that more systematic, well-controlled research into the question of the effect of physical activity, and particularly physical fitness training programs upon psychological

variables in youthful populations is needed. The question of the psychological impact of physical activity on youth is important when one considers the stress and threats to self-esteem that confront adolescents. That the adolescent's body is rapidly changing and that effectiveness of efforts to cope with these changes are widely variable has been well documented (e.g. Profinsky and Farrier, 1980). Strenuous activities are viewed as essential in aiding the developing youth in managing a changing body and learning new motor patterns (Miller, 1979). If exercise offers the same low cost, highly accessible psychological benefits to youth which have been reported among adults, then educators could assist developing young people in identifying exercise strategies which may help them cope more effectively with the difficulties adolescence presents.

The Purpose of the Study

The purpose of this investigation is to address three primary questions:

1) Are commonly reported differences on measures of psychological well-being found between intact groups (i.e. athletes and non athletes) also found in comparisons of high and low fit adolescents enrolled in a high school physical education class? That is, do high

fit subjects score better on measures of mood and self-esteem than low fit subjects?

2) Are the generally reported positive changes which accrue to adults engaging in fitness training programs also reported among adolescents?

3) Assuming that changes are reported, are the positive changes reported to accrue to exercise simply a function of increased activity, or are they a function of changes in physical fitness?

While many studies report the positive psychological benefits which accrue to adults who become more physically active, few researchers have undertaken controlled investigations of the effects of exercise upon an adolescent population. The literature contains no studies which compare the effect of increased physical activity with those of increased physical fitness in a controlled experimental study.

Adolescence has been described by many authors as a period of marked emotional stress accompanied by depression and anxious mood, as well as feelings of low self-esteem (Profinsky and Farrier, 1980). Concerns about identity are common for these youth who are no longer children, but are not yet adults. Adolescents characteristically evidence widely discrepant maturity levels on physical, emotional, sexual, and social

dimensions. For years, physical educators have advocated using exercise as an aid to youth in their efforts to gain mastery over their rapidly developing bodies, while some argue that strenuous activity is essential in helping the child to manage their bodies and learn new motor patterns (Miller, 1979).

If improved fitness among adolescents is accompanied by reduced feelings of anxiety, reduced depression, and an improved sense of self-esteem (findings commonly reported among adult samples), it would follow that adolescents who were more physically fit would be better able to tolerate stressors commonly encountered by youth. Vigorous exercise could then become an important coping skill, aiding adolescents in managing their social, emotional, as well as their physical selves.

In this investigation, both physiological and psychological variables were under consideration. Physiological variables included resting heart rate, recovery heart rate (heart rate five minutes post-exercise minus resting heart rate), and performance (distance covered) on Cooper's (1968) twelve minute run. Psychological variables included reported levels of depression, anxiety, and hostility (as measured by the Multiple Affect Adjective Checklist--MAACL), five aspects of self-image: Impulse Control, Emotional Tone, Body and

Self-Image, Mastery of the External World and Superior Adjustment (as measured by the Offer Self-Image Questionnaire for Adolescents--OS-IQ).

This study represents an initial effort to investigate the effects of both physical activity and physical fitness training on adolescents who participate in a high school physical education program.

Hypotheses to be Tested

1. Subjects who are classified as "high fit" at pre-test will exhibit lower levels of anxiety, depression and hostility than subjects who are classified as "low fit" at pre-test.

2. Subjects who are classified as "high fit" at pre-test will exhibit higher scores on measures of self-image than subjects who are classified as "low fit" at pre-test.

For hypotheses 3 through 13, significant differences are predicted between experimental (physical fitness training) subjects' scores and control (general physical education class) subjects' scores at post-test on all variables. Additionally, significant changes in the predicted direction are expected within the experimental group from pre-test to post-test. The specific predictions are:

3. Experimental subjects will exhibit a significant reduction in resting heart rate (RHR).

4. Experimental subjects will exhibit an improved recovery heart rate (five-minute post-exercise heart rate minus resting heart rate).

5. Experimental subjects will show a significant increase in physical fitness level (as measured by total distance run during a twelve-minute fitness run).

6. Experimental subjects will exhibit significant reduction in level of state anxiety (as measured by the A-Anxiety Scale of the Multiple Affect Adjective Checklist-MAACL).

7. Experimental subjects will exhibit significant reduction in level of depression (as measured by the D-Depression Scale of the MAACL).

8. Experimental subjects will exhibit significant reduction in level of hostility (as measured by the H-Hostility Scale of the MAACL).

9. Experimental subjects will exhibit significant gains on a measure of level of "Impulse Control" (as measured by the Impulse Control scale of the Offer Self-Image Questionnaire).

10. Experimental subjects will exhibit significant gains on a measure of "Emotional Tone" (as measured by

the Emotional Tone Scale of the Offer Self-Image Questionnaire).

11. Experimental subjects will exhibit significant gains on a measure of "Body and Self Image" (as measured by the Body and Self Image scale of the Offer Self-Image Questionnaire).

12. Experimental subjects will exhibit significant gains on a measure of "Mastery of the External World," (as measured by the Mastery of the External World scale of the Offer Self-Image Questionnaire).

13. Experimental subjects will exhibit significant improvement on a measure of "Superior Adjustment," (as measured by the Superior Adjustment scale of the Offer Self-Image Questionnaire).

14. Subjects' self-ratings of perceived effort will be significantly positively correlated with subjects' post-exercise heart rate.

CHAPTER III

METHODOLOGY

This investigation compared the effects of a seven-week physical fitness training program on high school physical education students with the effects of participation in a non-fitness producing physical education activity class. Variables studied were physiological and psychological in nature and included resting heart rate, residual heart rate, distance run in twelve minutes, depression, anxiety, hostility, and five self-image measures obtained from the Offer Self-Image Questionnaire for Adolescents.

The strategy for this investigation was to involve experimental subjects in a seven-week program of jogging/running a predetermined distance each day, four days per week. Because it was anticipated that experimental subjects were not all equal in their level of physical fitness, separate training regimens were developed for three separate levels of fitness (see Table 1, Appendix D). These rograms were comparable to running exercise programs described by Cooper (1968), and they were expected to be of sufficient intensity, duration, and frequency to produce a cardiovascular fitness effect among participants within each fitness level.

These factors, intensity, duration and frequency, were essential considerations in the development of an exercise training program. Intensity referred to the percent of maximum aerobic capacity required by the work. This could also be expressed in terms of maximum heart rate determined by the formula: 220 - age in years = maximum heart rate. Exercise demanding 50% - 80% of maximum aerobic capacity (60% - 90% maximum heart rate) was expected to be of sufficient intensity to produce a cardiovascular (C-V) fitness effect.

Duration referred to the length of time the individual spent exercising at the desired intensity. Duration of approximately 15 - 45 minutes is considered optimal. Duration is an important factor affecting subject compliance with an exercise regimen (Pollock, Wilmore, and Fox, 1978).

Frequency referred to the number of times per week the individual engaged in the activity. According to Wilmore (1978), three to five sessions per week is considered optimal for all but the highly trained athlete. Exercise of less frequency than three times per week offers minimal aerobic benefit since, in effect, each session begins the conditioning process anew. Exercise of greater frequency than five times per week

will produce increased fitness; however, the additional gain is minimal.

The mode of training in this investigation was jogging and running. Mode of training refers to the type of physical activity performed by the individual. While theoretically any activity which is of sufficient frequency, intensity, and duration will produce a cardiovascular fitness effect, in general moderate to high energy cost activities (e.g. running, walking, cycling) show significant cardiorespiratory gains while intermittent activities that are low in energy cost (e.g. golf and bowling) show no cardiovascular improvement (Pollock, Wilmore and Fox, 1978).

This study was not exhaustive in that only a small sample of the population was included. The data obtained from this sample may provide information from which to conduct further research concerning the effects of physical fitness training on adolescent populations.

Subjects

Subjects for this study were fifty-six high school students who were currently enrolled in a physical education class, who volunteered to participate and who were determined by their physician to be medically fit to participate in the research. All subjects were free of any cardiopulmonary diseases and any history of such

diseases. Because of the young age of the subjects, cardiac risks of vigorous exercise were considered to be minimal. Subjects volunteering for the study were not involved in any program of regular physical activity beyond their class participation. Subjects age, grade in school, height, weight, and typical daily activities were noted.

Prior to admission into this study, subjects were told that they would be participating in research concerning the relationship between psychological fitness and physical fitness. Subjects were informed about their rights as participants, that they could refuse to answer any or all questions, and that they could terminate their involvement in the program at any time. Subjects were informed that specific questions about the purpose of the study would be answered at the conclusion of the training program. Subject's confidentiality was guaranteed, and parental consent to participate was obtained.

The investigator employed a "Pre-test, Post-test Control Group Design" as outlined by Campbell and Stanley (1963). This design was utilized because its structure effectively controlled for many sources of internal validity (e.g. history, maturation, testing, regression, selection). Prior to pre-testing, two of four physical education classes were specified as an experimental

class, and the remaining two classes were designated control classes.

For the purpose of subsequent statistical analyses, all subjects (both experimental and control) were assigned to a fitness category based their pre-test performance on the twelve-minute run. These assignments were made in the manner described by Cooper (1968). The groupings by fitness category were used in two ways. To test hypotheses one and two, all subjects were assigned to a fitness category. This assignment was for the purpose of statistical analysis only, and subjects were not advised of their fitness category. Then, at the beginning of the fitness training program and on each training day, experimental subjects were informed of their fitness category (Group II, Group III, or Group IV) and of their target distance for that day.

Apparatus

All subjects had their resting heart rate measured, participated in a twelve-minute jog/run, took the Multiple Affect Adjective Checklist (MAACL), and took the Offer Self-Image Questionnaire for Adolescents (OS-IQ). Heart rate was measured by taking the carotid pulse for ten seconds. Multiplying this result by a factor of six yields beats per minute. Carotid pulse was obtained by

placing the index and middle fingers of one hand lightly against the side of the subject's larynx.

The MAACL (Zuckerman and Lubin, 1965) is a 132-item paper-pencil inventory of adjectives developed for clinical evaluation and research applications. The test is self-administered and is suitable for group administrations. The "Today Form" of the test measures current affect states with instructions to check those adjectives which describe how the subject feels at the time of testing. Scores are provided for A-Anxiety, D-Depression, and H-Hostility. The Today form is reported to be sensitive to changes in affect which result from such experiences as combat training (Moos, 1975) and therapy sessions (Mackeen and Herman, 1974).

The OS-IQ (Offer, Ostrov, and Howard, 1974) is a 130-item paper-pencil test used to assess adolescents' self-image. Subjects respond to descriptive statements on a scale of six responses ranging from "Describes me very well" to "Does not describe me at all." The test is standard scored with high standard scores indicating a good ability to cope. The test provides evaluation in eleven subscales. Five of these subscales (Impulse Control, Emotional Tone, Body and Self-Image, Mastery of the External World, and Superior Adjustment) were used in

this study. The test is self-administered and is suitable for group administration.

Procedures

Pre-Test. Subjects were pre-tested during the first two days of the class. During the first class period, subjects completed the MAACL and the OS-IQ. Inventories were group administered in the subjects' classroom.

Fitness testing was conducted on the second day of class. After "dressing out" for the fitness run, subjects were assigned a number and seated. Placards, with the subject's identifying number, were worn by each subject during the fitness run so that the number of laps run by each subject could be accurately recorded. Fitness testing was conducted in the school's gymnasium. Subjects were instructed to sit quietly. Quiet talking was permitted. After the subjects had been seated for five minutes, resting heart rates were taken by one of two registered nurses who served as assistants to the experimenter. After resting heart rates were obtained, subjects were given the following instructions:

> "You are about to take a fitness test. Each of you is asked to run as many laps around the gym as you can in twelve minutes. We ask that you give your best effort. If you must slow down, that is okay, but remember to give your best effort. If you must stop running, that also is okay. We do not want you to hurt yourself; we only want you to give your best

> effort. Please, run only in the blue area (a 3 feet wide band surrounding the basketball floor). Do not cut corners. If you wish to pass another runner, please pass on the outside (side away from the court).
>
> After the eleventh minute of your run, you will be asked the question 'How hard are you working?' Select from the yellow chart the number which best describes how hard you are working at that time. When you are told to stop, please run to the center of the basketball court where a nurse will take your heart rate. You may then cool down in the volleyball area of the floor. Another heart rate will be taken five minutes after you stop running. Are there any questions?"

Prior to beginning the run, subjects were allowed to stretch and loosen up for several minutes. The subject wearing placard "1" was the first subject to run. Remaining subjects were started in numerical order at one minute intervals. Subjects' laps were counted by one of two assistants, one who counted even numbered subjects and one who counted odd numbered subjects. Each subject's self-rating of perceived effort was recorded by an assistant at the eleventh minute of the run in response to the question "How hard are your working? (see Appendix B). "Post-exercise heart rates were taken for ten seconds, immediately after the subjects stopped running. Five-minute post-exercise heart rates were taken with subjects seated, five minutes following the fitness run.

Experimental Condition. Subjects in the physical fitness training program were assigned to a fitness

category based on the distance they ran during the twelve-minute fitness run. As was noted previously, an exercise running schedule was developed for subjects in each fitness category (see Table 1, Appendix D).

Subjects followed the procedure to be described during four class periods each week. Class length was fifty-five minutes. After "dressing out" for the Physical Education class, subjects took their assigned place on the gymnasium floor. Subjects took their own resting heart rate, using the previously described method for taking carotid pulse for ten seconds. The experimenter signalled students when to begin counting their heart rate and when to cease counting. Each student then recorded his/her resting heart rate on a daily activity chart. Subjects then engaged in a brief warm-up of approximately five minutes of stretching and bending exercises. Following warm-up, subjects were reminded of that day's goal. The goal for a given subject on a given day included the distance and the length of time that those in his/her fitness category were expected to run on that day. The experimenter then signalled subjects to begin the day's activity. Subjects were verbally encouraged to complete the prescribed distance within the prescribed time period. With one minute remaining in the exercise period, subjects were

asked to rate their perceived level of exertion with the following statement: "On a scale from seven to nineteen, where seven means very, very easy and nineteen means very, very hard, rate how hard you are working." At the end of the prescribed time, subjects were asked to stop running and immediately began taking their carotid pulse for ten seconds. This post-exercise heart rate was recorded in the daily activity log along with the subject's rating of perceived exertion. Subjects were then asked to relax for five minutes at which time they again took a carotid pulse for ten seconds. This five-minute post-exercise heart rate was also recorded in the subject's daily log. Subjects were then dismissed from class.

Fitness training continued four times per week for seven weeks. Adjustments in intensity of the workload were built into the exercise schedule (see Table 1, Appendix D).

Control Conditions. Subjects in the control condition followed the normal procedure for physical education classes. They participated in a variety of activities such as bowling, softball, volleyball, basketball, and dodgeball. While some of the various activities involved vigorous exercise, the activities were not sustained for sufficient time for a fitness

effect to accrue. Control subjects followed the same procedure outlined for experimental subjects in terms of obtaining resting heart rates, post-activity heart rates, and levels of perceived exertion. In addition, control subjects followed the same warm-up routine as the experimental subjects.

Post-Test. Post-test conditions parallelled pre-test conditions. On consecutive days, subjects took the psychological inventories and then completed a twelve-minute run. Resting heart rate was obtained in the exact manner described at pre-test. Subjects kept their original numbers at post-test and ran in the same order that they ran at pre-test.

CHAPTER IV

RESULTS

Introduction

This investigation was designed to test hypotheses concerning specific aspects of the relationship between physical fitness and psychological well-being. First, hypotheses regarding expected differences between high-fit and low-fit subjects on psychological measures of mood and self-image were tested. Secondly, hypotheses concerning the comparative effects of participation in a physical fitness training program versus participation in a high school physical education class on physical fitness, mood and self-image variables were tested. Finally, the hypothesis that adolescents' self-rating of perceived effort would be positively correlated with their post-exercise heart rate was also tested.

The relationship between initial level of fitness and level of psychological fitness was analyzed using both Spearman rank-order correlations and t-tests. These analyses were accomplished by comparing the mood and self-image scores of subjects who were classified as high fit at pre-test with the mood and self-image scores of subjects who were classified as low fit at pre-test.

The effect of training on subjects' physical fitness level was measured using three fitness variables: resting heart rate, post-exercise recovery heart rate, and the distance subjects could run during a twelve-minute fitness run. The comparative effect of training on experimental and control subjects' mood was measured using change scores (post-test score minus pre-test score) on the Anxiety, Depression and Hostility scales of the Multiple Affect Adjective Checklist (MAACL). The comparative effect of training on experimental and control subjects' self-image was measured using change scores (post-test minus pre-test) on five self-image variables: Impulse Control, Emotonal Tone, Body and Self-Image, Mastery of the External World, and Superior Adjustment scales of the Offer Self-Image Questionnaire for Adolescents (OS-IQ).

The effect of training on fitness, mood and self-image can be conceptualized in four ways. First, one can compare absolute levels of fitness, mood and self-image between groups receiving fitness training versus physical education class before training and again after training. In this study, this was done by analyzing pre-test scores and post-test scores on each dependent measure (three fitness variables, three mood variables and five self-image variables) using t-tests to test significance of

difference between group means (experimental versus control).

Second, one can compare amount of change from pre-test to post-test between groups. In this study, this analysis was done by comparing change scores (post-test minus pre-test) on each dependent variable using t-tests to test differences in the magnitude of mean change for each group. Third, one can compare training groups with respect to frequency and direction of change. Thus, in this study Chi-Square analyses were conducted to test differences in the direction of change on each dependent measure between groups. Finally, one can look at amount of change within fitness training and physical education groups. To do that, this investigation employed Paired Comparison t-tests to assess the changes in fitness, mood and self-image within the groups.

The relationship between adolescents' self-rating of effort and post-exercise heart rate was assessed using Spearman rank-order correlation coefficients.

Because groups were not balanced with regard to sex, analyses were conducted to compare male with female subjects at pre-test on all dependent variables. Where significant sex differences were found, subsequent comparisons of experimental and control groups were made by sex to insure that observed differences could not be

attributed to different numbers of males and females in the two groups.

In order to facilitate the presentation of the investigation's findings, this chapter is divided into four sections: Relationship Between Level of Physical Fitness and Psychological Functioning, Comparative Effects of Physical Fitness Training and Physical Education Class Participation on Fitness, Mood and Self-Image Variables, Relationship Between Perceived Effort and Post-Exercise Heart Rate, and Additional Analyses.

Relationship Between Level of Physical Fitness and Psychological Functioning

The relationship between physical fitness level and psychological functioning was analyzed in two ways. First, Spearman rank-order correlation coefficients were computed correlating performance on each of the three fitness measures with scores on each of the mood and self-image variables. Secondly, the difference between low-fit and high-fit subjects' scores on each dependent measure at pre-test was assessed using t-tests.

Spearman rank-order correlation coefficients were calculated on pre-test data to test the hypothesis that a positive relationship exists between fitness level and psychological functioning among adolescents. Results of this analysis did not support the hypothesis. A

marginally significant negative relationship was found to exist between fitness (as measured by distance run in twelve minutes) and the measure of Superior Adjustment (rho = -.25, $\underline{p}$ = .05). No other significant relationships were found; however, fitness measures consistently negatively correlated with self-image measures.

For the purpose of statistical analysis, subjects were divided according to level of fitness. This was accomplished by assigning each subject (both experimental and control) to a fitness category. (Level 1 through Level 4) based on their performance during a twelve-minute fitness run, with Level 1 being the lowest level of fitness (less than one mile run in twelve minutes) and Level 4 being the highest fitness category (more than 1.5 miles run in twelve minutes) (Cooper, 1968). All subjects were then divided into low-fit and high-fit groups in two ways. The first compared subjects in fitness Level 1 and Level 2 with subjects in Level 3 and Level 4. The second compared subjects who ran less than a specified distance in twelve minutes (1.25 miles) with those who ran more than a specified distance in twelve minutes (1.50 miles). These distances correspond to categories outlined by Cooper (1968) for persons with poor fitness (less than 1.25 miles run in twelve minutes)

versus persons with good fitness (more than 1.50 miles run in twelve minutes). This latter analysis represented an effort to compare the extremes among the low-fit and the high-fit subjects on mood and self-image measures.

When subjects were divided into low-fit and high-fit groups comparing fitness Levels 1 and 2 with fitness Levels 3 and 4, it was found that 75 percent of males fell into the high-fit group, while 81 percent of the low-fit group were females. Since the groups were highly unbalanced with regard to sex of subjects, it was decided to conduct these comparisons separately for males and females. The results of these analyses are presented in Tables 2 and 3, Appendices E and F. High-fit males scored significantly lower than low-fit males on the measure "Mastery of the External World," t (22) = 2.08, $p < .05$. While this was the only significant finding noted between high-fit and low-fit males, there appeared to be a general trend among males for those who were low fit to score higher at pre-test on measures of self-image than males who were higher fit. Comparisons of low-fit and high-fit females at pre-test yielded no significant findings.

When the extremes of high-fit and low-fit subjects were compared, it was found that no female subjects fell into the extremely high-fit category. Again, because of

the clear lack of balance regarding sex among the high- and low fit groups, only differences among high-and low-fit males were considered. The results of these analyses are presented in Table 4, Appendix G. These findings supported the trend observed previously. Low-fit males scored consistently higher on all measures of self-image than high-fit males, with significant differences found on two pre-test measures: Body and Self-Image, t (14) = 2.11, $p < .05$, and Mastery of the External World, t (14) = 2.59, $p < .05$. All other differences between the extreme groupings were not significant.

Comparative Effects of Physical Fitness Training and Physical Education Class Participation on Fitness, Mood and Self-Image Variables

Hypotheses concerning the comparative effects of a seven-week fitness training program and a physical education class on high school students were tested in four ways. Differences in absolute levels of fitness between experimental and control groups were evaluated by comparing group means at pre-test and again at post-test on each of the dependent measures. Changes from pre-test to post-test were evaluated by comparing the magnitude of mean change between groups and by comparing differences in direction of change between groups. Finally, within

group changes from pre-test to post-test were assessed using Paired Comparison t-tests.

Tables 5, 6, and 7, Appendices H, I, and J present means and standard deviations at pre-test for each dependent variable and means and standard deviations at post-test for all dependent measures between groups and between sexes. Inspection of these analyses indicated that experimental subjects scored significantly higher at pre-test on the following measures: Body and Self-Image, t (54) = 2.10 , $p < .05$; Mastery of the External World, t (54) = 2.75 , $p < .01$; and Superior Adjustment, t (54) = 2.82, $p < .01$. However, these differences were no longer evident at post-test. In fact, there were no significant between group differences on any of the fitness, mood or self-image measures at post-test. Between sex differences were found at pre-test on one fitness and one self-image measures. Males ran significantly farther at pre-test than females, t (54) = 4.99, $p <.0001$; this highly significant difference was also observed at post-test, t (54) = 5.07, $p < .0001$. Females scored significantly higher at pre-test than males on the measure of Superior Adjustment, t (54) = -3.21, $p < .01$. This difference was somewhat stronger at post-test, t (54) = -3.68, $p < .001$. No other

significant differences between groups or between sexes were found at either pre-test or post-test.

Change scores (post-test minus pre-test) were compared to assess differences in magnitude of mean change between groups for all dependent variables. On those variables where between sex differences existed at pre-test, mean change scores were also analyzed separately for males and females. The results of these analyses are presented in Table 8, Appendix K. These results indicated that experimental subjects experienced a significant gain in fitness (as measured by distance run in twelve minutes) as compared to controls t (54) = 4.60, $p < .0001$. Experimental males improved significantly more, t (22) = 5.03 , $p < .0001$, in distance run (M = 5.71 laps, $S.D.$ = 3.65) as compared to untrained controls (M = -1.89 laps, $S.D.$ = 3.75). Experimental females also improved in distance run; however, this difference was not significant when compared to mean change for control females. Although no significant mood or self-image changes were observed, control subjects again showed a trend toward improving their mean scores on measures of self-image as compared to fitness-trained subjects.

Analyses were employed to assess differences in direction of change between experimental and control

subjects from pre-test to post-test. For the purpose of these analyses, change scores were grouped into a two-by-two matrix, with groupings being made in the most conservative manner. Thus, for the variable "Distance Run in Twelve Minutes" where an increase was expected for experimental subjects, the Chi-Square matrix was arranged as follows: Cell 1 -- Experimental subjects who increased in distance run, Cell 2 -- Experimental subjects who showed no change plus Experimental subjects who decreased in distance run, Cell 3 -- Control subjects who increased in distance run, Cell 4 -- Control subjects who did not change plus control subjects who decreased in distance run. Analysis of each matrix was corrected for continuity; or, where expected frequencies for a given cell fell below five, Fisher Exact Probabilities were computed. Results of these analyses showed highly significant changes in distance run by experimental subjects in the predicted direction, X^2 (1) = 11.55, $p < .0001$. An analysis of these results by sex revealed a significant sex difference. A Fisher Exact Probability Test found that experimental males significantly more often increased their distance run compared to control males ($p < .0001$). However, this difference was not significant when female experimentals were compared with

female controls. No other Chi-Square analyses were significant.

In an effort to further clarify the effects of participation in the fitness training program, Paired Comparison t-tests were performed on each of the dependent variables. These analyses compared a specific group's performance at pre-test with that same group's performance at post-test. These findings show highly significant reductions in resting heart rate for both experimental, t (34) = -5.81, $p < .0001$, and control, t (20) = -4.21, $p < .001$, subjects. Experimental subjects significantly increased the distance they ran in twelve minutes from pre-test to post-test, t (34) = 6.52, $p < .0001$. This difference was strong for both experimental males, t (34) = 5.65, $p < .0001$, and experimental females, t (21) = 4.27, $p < .001$. While experimental subjects showed no significant changes from pre-test to post-test on any of the mood or self-image variables, control subjects showed significant immprovements on three of the self-image measures: Body and Self-Image, t (20) = 2.33, $p < .05$; Mastery of the External World t (20) = 2.55, $p < .01$; and Superior Adjustment, t (20) = 2.39, $p < .05$. No other paired comparisons were significant.

Because it appeared that males and females reponded differently to the fitness training program, separate analyses were conducted between experimental and control groups by sex on mood and self-image variables to determine if males and females were different in their psychological response to exercise. A Chi-Square technique was used to compare differences in the direction of change from pre-test to post-test for experimental and control subjects. For the purpose of these analyses, two-by-two matrices were arranged for each variable within group by sex in the manner previously described. Results of these analyses indicated that experimental males scored lower on the measure of depresson significantly more often than control males (Fisher Exact Probability Test yielded $p = .05$). Experimental females showed increases in their level of impulse control significantly more often than control females (Fisher Exact Probability Test yielded $p = .01$. No other findings were significant.

In summary, while experimental and control subjects did not significantly differ on either physical fitness or mood variables at pre-test, experimental subjects' pre-test scores were significantly higher than controls on measures of Body and Self-Image, Mastery of the External World, and Superior Adjustment. At post-test,

these significant differences had vanished. It is clear from the analyses of change scores and Paired Comparison t-tests that both experimental males and females improved their level of fitness from pre-test to post-test; however, only experimental males improved on the measure of depression, and only experimental females improved on the measure of Impulse Control. These were the only significant changes on psychological variables among the experimental subjects. Control subjects significantly improved on measures of self-image.

In addition, between sex differences were noted on two measures. Males appeared more fit than females at pre-test and females apeared better adjusted than males at pre-test. The difference between males and females on the measure of Superior Adjustment was somewhat stronger at post-test.

Relationship Between Perceived Effort and Post-Exercise Heart Rate

Subjects' self-rating of their effort at the eleventh minute of the twelve-minute fitness run were correlated with their post-exercise heart rate by computing a Spearman rank-order correlation coefficient. This analysis was done for all subjects at pre-test and again at post-test. Results of this analysis indicated a nonsignificant negative correlation between perceived

effort and post-exercise heart rate (rho = -.02) and a nonsignificant positive correlation between the two measures at post-test (rho = .15). A by sex analysis indicated that no significant difference between the relationship of perceived effort and post-exercise heart rate existed for males or females.

CHAPTER V

DISCUSSION

Introduction

This study was undertaken in order to compare the effects of participation in a fitness training program with those of participation in a Physical Education class on the fitness level, mood and self-image of an adolescent population. Previous studies of the psychological effects of fitness training and of physical activity among adults suggested that many positive physical and psychological changes could be expected to follow from increased physical activity. Following up on the apparent beneficial effects of physical fitness training for adults, a few investigators extended the focus to adolescents. Their findings, however, have been mixed, and methodological questions make interpretation difficult. The majority of studies reported were poorly controlled. Also, many of the previous studies of both adult and adolescent populations had inherent problems of participant bias; that is, subjects were persons who volunteered to participate in fitness studies, and who, therefore, may have been predisposed to anticipate a positive outcome. For these reasons, it was felt that a controlled study, conducted in a natural setting (i.e.

the classroom) upon a naturally occurring group (i.e. students enrolled in physical education classes) would be useful in clarifying the psychological benefits for adolescents which were presumed to accrue to improved physical fitness.

In an effort to discuss the findings of this study in a clear, organized manner, this chapter has been divided into several sections. Differences found at pre-test between high-fit and low-fit subjects are discussed. Next, the comparative effects of participation in a physical fitness training program versus participation in a Physical Education class on the fitness level, mood and self-image of the subjects are discussed. Then the relationship between subjects' self-rated perception of effort and an objective measure of effort (post-exercise heart rate) is discussed. Finally, implications and suggestions for further research are presented.

Pre-Test Differences Between High-Fit and Low-Fit Subjects on Mood and Self-Image

Hypotheses 1 and 2 addressed the assumpption that differences existed between fit and unfit individuals on measures of mood and self-image. This assumption was an extension of the sound mind--sound body concept, and it had found some previous support in the literature where fit subjects were reported to be less anxious, less

depressed, and to have a greater sense of well-being than unfit suubjects (e.g. Brunner, 1969). In addition, numerous comparisons of athletes with non-athletes found the athletes to possess a higher degree of several positive qualities (i.e. self-confidence, assertiveness, emotional stability), creating speculation about potential psychological benefits for those who exercised regularly (e.g. Ogilvie, 1968; Ogilvie and Tutko, 1967).

This study tested the hypotheses that subjects who appeared "high-fit" at pre-test would exhibit better mood (i.e. lower levels of anxiety, depression and hostility) and better self-image (i.e. greater impulse control, stronger body and self-image, higher level of adjustment) than subjects who appeared "low-fit" at pre-test. These hypotheses were tested using correlational techniques as well as t-tests comparing mean scores of high-fit and low-fit subjects on standardized measures of mood and self-image.

Results of these analyses did not support the hypotheses. On the contrary, no differences were found between high-fit and low-fit subjects on measures of mood, and low-fit subjects scored consistently higher on measures of self-image than did high-fit subjects. Low-fit subjects scored significantly higher on the measure of Impulse Control than the high-fit subjects.

Furthermore, when differences between high-fit and low-fit subjects were analyzed controlling for sex of subject, low-fit males scored higher than high-fit males on all measures of self-image. These differences were more pronounced when extremes among low-fit and high-fit males were compared.

Since no significant relationship was found between fitness level and mood, and a significant relationship was found between lack of fitness and specific aspects of positive self-image, it seems clear that the relationship between physical and psychological fitness is somewhat different among adolescents than it has been reported to be among adults.

One possible explanation for this difference might lie in the different meaning that the concept of physical fitness might hold for adults versus adolescents. Being "unfit" for an adult may have implications about the individual's relative lack of physical health, relative vulnerability to illness, or relatively advanced age which, in turn, may have an adverse effect upon the individual's mood or self-esteem. Since the chief developmental task of adolescence is the establishment of a stable, independent identity (Erickson, 1950), the mood and self-image of an adolescent may be more closely tied

to the degree of success the individual feels regarding the accomplishment of this task.

Comparative Effects of Participation in a Physical Fitness Training Program Versus Participation in a Physical Education Class

Hypotheses 3 through 13 concerned the anticipated effects upon fitness level, mood and self-image of subjects who participated in a fitness training program versus those who participated in a Physical Education class. The discussion of the findings relevant to these hypotheses has been divided into three sections: effects upon fitness level, effects upon mood and effects upon self-image.

Effects Upon Fitness Level. It was hypothesized that subjects who participated in the exercise training program would show training effects in the form of reduced resting heart rate, improved recovery heart rate and increased distance run during the twelve-minute fitness run. Only the hypothesis concerning increased distance run in twelve minutes was supported.

All subjects' resting heart rates were significantly reduced, a finding which was felt to reflect the fact that subjects in both groups became more familiar and more at ease with the procedure for measuring heart rate from pre-test to post-test because each subject had

repeated practice taking heart rates as part of their particular program. Recovery heart rate, which was not significantly affected by fitness training, was also felt to have been influenced by the drop in resting heart rate shown by both groups. Since recovery heart rate was determined by the formula: five-minute post exercise heart rate minus resting heart rate, the marked drop in resting heart rate found in both groups obscured any real changes in recoevry heart rate, rendering data on this variable uninterpretable.

Despite the failure to find support for the hypotheses concerning changes in resting and recovery heart rates, it was clear that a training effet, as measured by a significant increase in distance run during twelve minutes, was obtained for experimental subjects, both male and female. The literature has suggested that women respond to fitness training at least as well, if not better, than do men (Matthews and Fox 1976), because women typically have lower initial fitness levels. However, in this study, the training effect was stronger among males than among females. This somewhat surprising finding may reflect a difference in the way in which the male and female subjects were observed to approach the training. Male experimental subjects showed greater enthusiasm for the fitness training than the females.

Males appeared to run harder, appeared less likely to walk, and appeared less concerned about the effect that vigorous exercise might have upon their personal appearance (i.e. males made fewer comments about their dislike of perspiration) than did females. The female subjects appeared more willing to challenge the need for exercise both directly (through negative comments) and indirectly (through class absence). These factors, although they were not directly measured, were felt to markedly affect the effectiveness of the fitness training for the male and female experimental subjects.

Effect Upon Mood. Hypotheses concerning the presumed positive effects upon mood among subjects who engaged in fitness training were not supported, except in the comparison of experimental and control males on the measure of depression. On the depression scale, while the magnitude of change from pre-test to post-test for the experimental and control males was not significantly different, fitness trained males showed reductions in level of depression significantly more often than males who participated in the Physical Education class.

Many investigations reported in the literature cite the anti-anxiety (e.g. Kowal, et al., 1978; Young, 1979) and anti-depressant (e.g. Brown, et al., 1978; Carter and Francis, 1982) properties of exercise training among

normal and mild to moderately anxious or depressed adults. The finding that normal adolescent males showed a reduction in their level of depression significantly more often than physically active controls lends support to the contention that vigorous physical exercise has potential anti-depressant effects for adolescents, a finding commonly reported in studies of adult populations.

Failure to find more extensive support for the presumed anti-anxiety and anti-depressant effects of exercise may reflect the difference in the way in which subjects were selected for this study versus the typical manner of subject selection among those studies reported in the literature. Most researches found in the literature used as subjects, persons who had volunteered for exercise training. For many of these persons, it seemed obvious that there was an expectancy that exercise would provide some benefit (e.g. cardiac rehabilitation, increased physical health). For the remainder, this expectancy appeared less obvious, but it was still likely to be present. This study employed as subjects "volunteers" who were required to participate in the fitness training as a part of their high school curriculum. These subjects agreed to participate when asked in the context of a Physical Education class; they

did not seek out physical fitness training for themselves. There was, therefore, no reason to expect that these subjects volunteered for exercise training in search of some presumed benefit which the training might afford. The absence of more clear findings that exercise was associated with improved mood may have been explained, then, by the absence of anticipation of benefits among the participants.

An alternative interpretation of the apparent lack of relationship between changes in fitness level and changes on measure of mood was found in the fact that the population considered was composed of normal adolescents, not clinical patients. Thus, there was less room for improvement on measures of mood. A post hoc between group analysis was conducted using t-tests to compare extreme scores (extremely anxious, extremely depressed and extremely hostile) in each group on each mood variable. Since these subjects had the most room for improvement, it seemed logical to expect that any differential effects of exercise training versus Physical Education class participation would be most noticeable for these subjects. However, this analysis yielded no significant findings. Both experimental and control subjects who were extreme on measures of anxiety, depression, and hostility at pre-test showed reductions

on these measures at post-test. This finding was consistent with the concept of regression to the mean; however, it offered little information about the relationship between physical activity and mood.

Effect Upon Self-Image. The findings of this investigation did not support the hypotheses concerning the self-image enhancing effects which exercise training was presumed to have, except among experimental females who improved their level of impulse control significantly more often than control females. While there was a clear but nonsignificant trend in which control subjects improved on measures of self-image and experimental subjects showed no change, no groups' scores improved above the average range for self-image on any of the specific self-image measures. Clearly, exercise training did not result in benefits to the participants in the form of improved self-image.

The literature on the psychological effect of fitness training contains considerable support for the contention that exercise enhances self-concept among adults (e.g. Hartung and Farge, 1978; Sharp and Reilly, 1975) and among adolescents (e.g. Hilyer, et al., 1982). The assumption has been that as one experiences improvements in degree of fitness, there are parallel improvements in one's feeling of self-esteem. For many

of the populations studied, such an assumption appears to have face validity. It seems reasonable to expect that obese males, cardiac rehabilitation patients or even juvenile delinquents would feel better about themselves when their level of physical fitness markedly improves.

One possible explanation for the lack of broader support offered by this study for the self-esteem enhancing effects of vigorous exercise may again be related to the population under consideration. As was noted previously, participants in this study were not volunteers in the true sense of the word. Collingwood and Engelsgjerd (1977), in a study of the relationship between physical activity level and delinquency, stressed the importance of encouraging subjects to engage in activities which the subject chose and which had the potential for the subject to maintain. Subjects in this fitness training program had no choice in the type of activity which they performed, nor did they have a choice about the duration of that activity. They were free only to choose not to participate (e.g. not to dress out for class on a given day) or to choose not to participate fully (e.g. not to run the required distance within the required time). Both of these choices had potential negative consequences for the student-subject (loss of grade points for the former, loss of approval of peers

and teachers for the latter). While subjects in the Physical Education class had similar limitations on their "choices", they engaged in activities which were perceived by the fitness training subjects as "more fun" (read: less boring), such as bowling and volleyball. In effect, the fitness training group operated at a disadvantage. They often complained that they were being asked to do more than their counterparts in the regular Physical Education classs, and that their activities were not as rewarding as those of the control group. Thus, the finding that the control males reported a greater feeling of mastery over their environment was consistent with the sentiments expressed by the fitness training subjects.

Another, somewhat related explanation of the finding that physically active controls improved on measures of self-image, as compared to fitness trained subjects may lie in the idea that self-image, among adolescents, is not firmly tied to cardiovascular fitness level. As was discussed previoulsy, since adolescents are relatively "high fit" in a total health sense, they may place little value on gains in physical fitness, gains which may be difficult to objectively detect. It may be that adolescents feel good about themselves when they take part in activities in which there is a clear outcome

(e.g. bowling or volleyball) and where their improvement is more immediately and directly evident. That is, improved bowling scores may provide a better impetus for improved self-esteem than a less evident increase in aerobic capacity.

It is important to note that the increase in self-image reported for Physical Education class participants, although a significant increase on three of five self-image meaures, was still below the mean for the experimental subjects on each of the five self-image measures at post-test. Scores for all subjects were below the adolescent norm on all self-image measures at both pre-test and post-test. Changes among the control group's self-image scores, therefore, may have reflected a regression to the mean.

Relationship Between Perceived Exertion and Post-Exercise Heart Rate

It was hypothesized that a positive relationship would exist between a subject's self-rated perception of exertion during exercise and that subject's post-exercise heart rate. Borg (1982) developed a Rating for Perceived Exertion (RPE) scale which could be used to quickly and accurately allow the individual to estimate the intensity of effort during exercise and which could also give the observer valid information about the relative intensity

of one individual's effort versus another individual's effort. In this study, the hypothesis that there would be a positive relationship between self-rated perceived exertion and post-exercise heart rate (an objective measure of effort) was not supported.

Two likely explanations for this finding are offered. First, since there was no correlation between perceived exertion and post-exercise heart rate, one may speculate that adolescents are not competent judges of their own level of physical effort. They may simply not attend to the proper cues. The second explanation of the finding focuses on different issues. Specifically, it may be that the adolescent is quite capable of making accurate judgements of his/her level of effort, but that they intentionally give inaccurate reports. This latter formulation fits more closely with the observation that some subjects who were obviously pushing themselves during exercise training, reported that the work was "easy". It may be that maintaining an image (be it "working hard" or "hardly working") is more important to the adolescent than giving an accurate reporting of his/her true level of effort.

Summary, Implications and Suggestions for Further Research

In summary, this research was undertaken to investigate the relationship between physical fitness and psychological variables in an experimentally controlled study of an adolescent population. Pre-test differences between high-fit and low-fit subjects, as well as comparative changes between a seven week fitness training program and a Physical Education class on mood and self-image variables were analyzed. Results of these analyses indicated that no differences existed between high-fit and low-fit subjects on measures of mood at pre-test; however, low-fit subjects appeared to have a somewhat better self-image than high-fit subjects at pre-test. These findings were contrary to those previously reported in the literature. Additionally, physically active controls improved on measures of self-image while fitness trained subjects generally showed no gain in either mood or self-image. Only two findings were consistent with those predicted by the literature. Experimental males decreased in depression scores significantly more often than control males, and experimental females improved on a measure of Impulse Control significantly more often than control females.

The findings of this study were most significant by their absence. The subjects under consideration were a "normal" adolescent population, and it may be argued that this fact worked against the research's utility. However, the majority of studies reporting a positive impact upon mood and self-image by fitness training in the literature also employed "normal" populations. The most significant finding of this study was the conclusion that the relationship between physical and psychological fitness is neither simple, nor direct. While fitness training may have potential psychological benefits which accrue to participants, other variables significantly impact, and possibly negate those potentials. Primary among those variables may be the degree to which fitness is important to the participants, and the degree to which participants expect to experience psychological benefits.

Although this study was not designed to adequately attend to sex role differences which may influence the relationship between physical and psychological fitness, some sex differences were observed. These may also be related to the relative importance of physical fitness to males versu sfemales.

Several questions raised by this study deserve attention in future investigations. A logical follow-up to this study would involve the recruiting of a similar

population of true volunteers to participate in a replication of this study. This would provide a basis for answering questions raised about the lack of motivation on the part of the fitness training subjects who, in this study, appeard to feel coerced into participating. Participants might also be given some choice about the type of activity they engage in to get more fit.

Another approach to follow-up from this research would involve employing a non-active control group (e.g. an English class) to control for the fact that this study compared two different forms of physical activity. Some authors suggest that vigorous exercise yields psychological benefit (e.g. Kowal, et al., 1978), while other emphasize the diversional quality of any activity (e.g. Bahrke and Morgan, 1978). This study did not directly address this issue.

A question raised by this study concerns the possible difference of adolescents' response to exercise and that of adults. Further investigation into this issue is needed to determine more clearly for whom is exercise beneficial as a tool for promoting psychological well-being. It may be that because of their relatively high level of physical health, adolescents may perceive

physical healtth promoting interventions to have little relevance for them.

In line with this question, a similar study carried out on a clinical adolescent population would also be useful in further clarifying the value of exercise as a psychotherapeutic adjunct for adolescents. Such research has begun in earnest for many adult clinical populations, with promising results (e.g. Greist, et al., 1979).

This was one of the first well-controlled studies of normal adolescents. The results of this research raised questions about accepting the assumption that an increase in physical fitness level leads to improved psychological well-being. Obviously, additional research is needed before these questions can be clarified.

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APPENDICES

APPENDIX A

Informed Consent Form

You are being asked to participate in an experiment which will attempt to investigate the relationship between exercise and psychological functioning. In addition to taking part in your regular physical education class activities, your participation will require that you complete a checklist and a questionnaire which asks for information about how you feel about yourself. The checklist and questionnaire will be given during regular class time during the first and last week of your class, and will take a total of about 45 minutes to complete.

Your participation in this study will be held in confidentiality. To accomplish this, you will be provided with a copy of this form with a number on it. This number will serve as your identification throughout the study. At no time will your name appear in conjunction with this number.

Please understand that your participation in this study is voluntary. You may refuse to participate or you may discontinue at any time without penalty. We do not expect that your participation in this study will cause you any discomfort. If you do experience any discomfort which you feel is related to your participation in this study, you are encouraged to contact Dennis Moran at the phone number below. Your participation in this study will offer you an opportunity to view psychological experimentation first hand. Beyond this you will be provided with information about your psychological and physical response to exercise following the study. No personal risks to participants are expected.

At the end of this study, I will be happy to discuss the exact nature of the experiment with you and will attempt to answer any questions which you might have.

Your signature below indicates that you have read this consent form and agree to participate in this study.

Students under age 18 must also have parental permission to participate. Parents must sign in the space provided.

Thank you for your cooperation,

Dennis Moran
2524 S.W. 54th Place
Oklahoma City, OK 73119
682-3928

_____	_____
Student's signature	Parent's signature
_____	_____
Date	Date

APPENDIX B

Perceived Effort Scale

19	VERY, VERY HARD	19
17	VERY HARD	17
15	HARD	15
13	MODERATE	13
11	EASY	11
9	VERY EASY	9
7	VERY, VERY EASY	7

APPENDIX C

Pre-Activity Warm-Up Exercises

Overhead Arm Reach	- 6 repetitions
Horizontal Arm Swing	- 6 repetitions
Side-Straddle Hop	- 20 repetitions
Hurdler Stretch	
Modified Jogger Stretch	
Toe Point - Toe Curl	- 6 repetitions
Standing Toe Touch	- 6 repetitions

APPENDIX D

Table 1

A By-Week Outline of the Fitness Training Program

Week	Distance in Laps* Fitness Category II	III	IV	Walk/Run	Time Goal (minutes)	Freq/Week
1	16	18	20	W/R	11:00	4
2	16	18	20	RUN	9:30	4
3	16	18	20	RUN	8:45	2
	24	27	30	RUN	15:00	2
4	16	18	20	RUN	8:30	2
	24	27	30	RUN	14:00	2
5	16	18	20	RUN	7:55	2
	24	27	30	RUN	13:00	2
6	24	27	30	RUN	12:30	2
	32	36	40	RUN	18:00	2
7	24	27	30	RUN	11:55	2
	32	36	40	RUN	17:00	2

*16 laps = 1 mile

APPENDIX E

Table 2

Mean Scores at Pre-Test on Mood and Self-Image Variables for Low-Fit Students

	All Students (32)		Males (6)		Females (26)	
Variable	M	SD	M	SD	M	SD
Mood:						
Anxiety	6.97	4.98	6.17	3.37	7.15	5.32
Depression	11.59	8.47	12.83	6.79	11.31	8.90
Hostility	8.39	6.00	11.50	7.20	7.65	5.60
Self-Image:						
Impulse Control	51.16	14.97	55.83	7.14	50.08	16.16
Emotional Tone	53.31	15.88	51.67	7.26	53.69	17.36
Body & Self-Image	52.47	17.36	56.83	13.60	51.46	18.19
Mastery of the External World	44.59	17.97	55.17	12.00	42.15	18.40
Superior Adjustment	51.09	16.53	41.50	13.98	53.31	16.50

NOTE: Numbers in parentheses indicate n's

APPENDIX F

Table 3

Mean Scores at Pre-Test on Mood and Self-Image Variables for High-Fit Students

	All Students (24)		Males (18)		Females (6)	
Variable	M	SD	M	SD	M	SD
Mood:						
Anxiety	6.67	4.00	6.61	4.30	6.83	3.25
Depression	12.25	7.36	11.33	7.67	15.00	6.09
Hostility	8.46	4.76	8.33	5.08	8.83	4.07
Self-Image:						
Impulse Control	42.62	14.87	44.17	14.21	38.00	17.20
Emotional Tone	47.33	13.03	47.56	13.67	46.67	12.01
Body & Self-Image	45.54	16.89	45.33	14.32	46.17	24.77
Mastery of the External World	44.96	12.69	42.78	12.78	51.50	10.80
Superior Adjustment	45.21	16.72	40.72	15.80	58.67	12.16

NOTE: Numbers in parentheses indicate n's

APPENDIX G

Table 4

Mean Scores at Pre-Test on Mood and Self-Image Variables for Extremely High-Fit and Extremely Low-Fit Males

	Extreme Low-Fit Males n=5		Extreme High-Fit Males n=11	
Variable	M	SD	M	SD
Mood:				
Anxiety	6.20	3.77	6.09	4.09
Depression	13.00	7.58	9.82	7.37
Hostility	12.60	7.47	8.45	5.14
Self-Image:				
Impulse Control	56.20	7.92	44.55	13.74
Emotional Tone	51.40	8.08	46.45	15.40
Body & Self-Image	59.80	12.85	43.27	15.15
Mastery of the External World	56.80	12.66	38.91	12.89
Superior Adjustment	44.40	13.46	39.45	14.36

APPENDIX H

Table 5

Mean Scores on Fitness Variables at Pre-Test and Post-Test by Treatment Group and Sex

Group	n	Resting Heart Rate		Recovery Heart Rate		Distance Run	
		M	SD	M	SD	M	SD
Pre-Test:							
Experimental	35	14.91	2.02	4.60	3.03	19.04	4.39
Control	21	15.62	2.01	3.71	3.21	21.52	5.08
Male	24	14.83	2.18	3.62	3.40	23.19	4.90
Female	32	15.44	1.90	4.37	2.77	17.56	2.91
Post-Test:							
Experimental	35	13.03	1.44	5.11	1.83	23.03	4.80
Control	21	13.14	2.41	4.91	2.86	21.06	4.03
Male	24	12.71	2.01	4.71	2.11	25.42	4.70
Female	32	13.34	1.69	5.73	1.57	19.94	2.79

APPENDIX I

Table 6

Mean Scores on Mood Variables at Pre-Test and Post-Test by Treatment Group and Sex

	n	Anxiety		Depression		Hostility	
		M	SD	M	SD	M	SD
Pre-Test:							
Experimental	35	6.57	4.15	12.23	7.75	8.14	5.78
Control	21	7.29	5.23	11.29	8.43	8.86	4.98
Male	24	6.50	4.02	11.71	7.35	9.12	5.68
Female	32	7.09	4.96	12.00	8.49	7.88	5.31
Post Test:							
Experimental	35	6.83	4.50	11.40	8.00	9.00	5.57
Control	21	6.33	4.79	10.43	6.66	9.33	4.93
Male	24	6.29	4.34	10.92	6.67	8.92	4.58
Female	32	6.91	4.79	11.12	8.13	9.28	5.49

APPENDIX J

Table 7

Mean Scores on Self-Image Variables at Pre-Test and Post-Test by Treatment Group and Sex

		Impulse Control		Emotional Tone		Body and Self-Image		Mastery of the External World		Superior Adjustment	
	n	M	SD	M	SD	M	SD	M	SD	M	SD
Pre-Test:											
Experimental	35	48.89	16.59	52.03	14.39	52.89	19.08	49.00	16.59	53.17	16.28
Control	21	45.19	13.22	48.62	15.85	43.98	12.54	37.67	11.77	40.90	14.80
Male	24	47.08	13.68	48.58	12.37	48.21	14.76	45.88	13.49	40.92	15.07
Female	32	47.81	16.77	52.38	16.56	50.47	19.24	43.91	17.48	54.31	15.75
Post-Test:											
Experimental	35	51.20	15.46	52.97	13.43	54.46	17.48	52.86	18.29	53.09	16.72
Control	21	45.24	17.59	51.48	12.70	49.38	16.11	46.14	15.10	46.71	14.24
Male	24	50.54	13.92	48.79	13.30	49.25	18.29	46.17	20.19	42.50	14.95
Female	32	47.78	18.12	55.12	12.41	55.03	15.84	53.47	14.39	56.84	14.07

APPENDIX K

Table 8

Mean Change Scores for Fitness, Mood and Self-Image Variables

Variable	Experimental n=35 M	Experimental n=35 SD	Control n=21 M	Control n=21 SD
Fitness:				
Resting Heart Rate	-1.87	1.92	-2.48	2.64
Recovery Heart Rate	0.51	3.53	1.19	4.42
Distance Run (12 min.)	3.99	3.62	-0.46	3.31
*Males Only	5.71	3.65	-1.89	3.73
**Females Only	2.97	3.26	1.10	1.93
Mood:				
Anxiety	0.26	4.59	-0.95	5.52
Depression	-0.83	9.10	-0.86	8.37
Hostility	0.86	5.84	0.48	5.10
Self-Image:				
Impulse Control	2.31	11.55	0.05	13.65
Emotional Tone	0.94	12.01	2.86	9.90
Body & Self-Image	1.63	15.19	5.43	10.69
Mastery of the External World	3.86	22.91	8.48	15.25
Superior Adjustment	-0.09	14.68	5.81	11.15
*Males Only	-0.77	18.98	4.36	10.84
**Females Only	0.32	11.93	7.40	11.80

*There were 13 experimental males and 11 control males
**There were 22 experimentalfemales and 10 control females

APPENDIX L

Description of Psychological Measures

Multiple Affect Adjective Checklist (MAACL)

The MAACL was designed to address a need for a brief, self-administered test which would provide a valid measure of three clinically relevant affective states: anxiety, depression and hostility. While no attempt has been made to measure positive affects, the authors of the test feel that the scales are bipolar; that is, low scores on a scale indicate a state of positive affect. The scales are comprised of 132 adjectives. The "today" form of the instructions were used in this study. Students were instructed to select adjectives which describe how they felt at the time they completed the test. The three scales of the test have high internal reliability. Because the test is designed to be sensitive to changes in mood, retest reliability is not expected to be high. Studies of the validity of the scales indicate that all three scales correlate well with clinically observed anxious, depressed and hostile states. The anxiety scale, however, appears to be particularly vulnerable to denial of anxious mood by the respondent.

Offer Self-Image Questionnaire for Adolescents (OS-IQ)

The OS-IQ is a self-descriptive personality test that can be used for measuring the adjustment of adolescent boys and girls between the ages of thirteen and nineteen. The questionnaire is comprised of eleven subscales, five of which were included in this study. Each scale yields a raw score which can be converted to a standard score which controls for age and sex differences among the respondents. The scores reported for the groups in this study were standard scores, with a mean of 50 and a standard deviation of 15 points. As was noted, five of the eleven scales of the OS-IQ were employed in this study: Impulse Control, Emotional Tone, Body and Self-Image, Mastery of the External World, and Superior Adjustment.

The Impulse Control scale measures the extent to which the adolescent's ego is strong enough to effectively manage the various internal and external pressures which exist in his/her world. Low standard scores suggest that the adolescent has low frustration tolerance and that he/she often acts on impulse. A high standard score suggests a good ability to delay gratification.

The Emotional Tone scale measures the extent to which there is fluctuation in the adolescent's emotions

as opposed to feelings that remain relatively stable. A low standard score shows great emotional fluctuation, while a high standard score suggests that the individual has an ability to experience many affects satisfactorily.

The Body and Self-Image scale indicates the extent to which the adolescent has adjusted to or feels awkward about his/her body. A low standard score suggests awkwardness about body changes taking place during adolescence, while a high standard score indicates a well-defined self-concept within well-defined body boundaries.

The Mastery of the External World scale indicates how well the adolescent adjusts to the immediate environment. A low standard score suggests difficulty in completing tasks, while a high standard score indicates a well-functioning adolescent who is able to deal with frustration.

The Superior Adjustment scale can be defined as a measure of ego strength; that is, how well the adolescent copes with self, others and the world. A low standard score indicates that the adolescent does not deal effectively with the environment. A high standard score indicates a well-functioning coping system.

The OS-IQ was initially developed in 1962 by Daniel Offer. The test has been refined and edited several

times during the ensuing years. The test has been normed on both normal adolescent populations and a variety of clinical populations (e.g. anorectics, hospitalized delinquents, child abuse victims) (Offer, et al., 1974).

VITA

Dennis John Moran was born in Oklahoma City, Oklahoma, on February 15, 1950. He is the son of Dennis and Irene Moran. Elementary education was completed at Sacred Heart School. He attended Mount Saint Mary High School, graduating in 1968. He entered The University of Oklahoma, majored in Psychology, and graduated with a Bachelor of Arts degree in 1972. He then entered a doctoral training program in Clinical Psychology at Texas Tech University; however, he was drafted into the U.S. Army in the Fall of 1972. While in the military, he served as a course coordinator for the Psychology/Social Work Procedures course at the Army's Academy of Health Sciences in San Antonio, Texas. In September, 1976, he entered the doctoral training program in Clinical Psychology at The University of Tennessee. He completed his internship in Clinical Psychology at the Oklahoma University Health Sciences Center in Oklahoma City, Oklahoma in August, 1981. He received the Doctor of Philosophy degree in December, 1984.