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THE EFFECTS OF EXERCISE  
ON PSYCHOLOGICAL FUNCTIONING

BY

DEBORAH ANN COE  
M.A., B.A., University of Redlands, 1973-74

THESIS

Submitted in partial fulfillment of the requirements  
for the degree of Master of Science: Clinical/Community Psychology  
in the Graduate Studies Program of the College of Social Sciences  
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## Introduction

\* Since the beginning of recorded history man has observed that the mind and body operate in such a way as to suggest a relationship between the two. From the ancient Greeks to the present day, theories have been formulated that mental and physical processes operate in mutual harmony. In support of this fundamental idea, theories have been developed proposing a variety of ways in which the mind and body interact, but very little research has been done to test these proposals until recently (Layman, 1955).

Most writers who attempt to treat psychological ills give passing notice to the importance of physical health in the maintenance of psychological adjustment (Caplan, 1964; Jahoda, 1958). However, those charged with the responsibility of caring for our health consistently point out that exercise is vital in maintaining proper physiological conditioning (Kraus, 1961; Vaisrub, 1978).

In reviewing the available literature on treatment modalities for mental illness, there is a notable lack of reference to studies that demonstrate the efficacy of physical exercise in remediating psychological disorders (Coan, 1977; Dannenmaier, 1978; Bradburn, 1969; Caplan, 1964; Jahoda, 1958). Although mental and physical processes appear to be reciprocally related a comprehensive review of the literature on the effects of exercise on psychological processes

does not yet exist. This paper reviewed the available literature in the field of psychology as well as related fields which considered the effect of exercise on both mental and physical functioning.

Moreover, it is the intent of this paper to review and evaluate existing theoretical and research data on exercise and mental health and to draw those conclusions the data seem to support. Future directions for research in this area will also be proposed. Finally, some psychological theories will be suggested to help organize the findings and hopefully promote more theory-based research rather than the scattered and unintegrated approach that now dominates research in this area. The following will provide the reader with a basic understanding of the physiological changes which come with exercise. It is not within the scope of this paper to critically evaluate this area but simply to give an overview of the relevant medical knowledge as it presently exists.

### Physiological Effects of Exercise

Physiological Changes Associated with Exercise. An association between mental and physical changes has long been suspected and speculated upon. Alexander Lowen (1958) has proposed that "a house is no stronger than its foundation" (p. 86). This notion prompted him and others to study physical functioning in its relationship to psychic functioning to determine the impact bodily changes might have on the psychological realm. Following this line of thought,

consideration will be given to the bodily changes which occur with exercise as a basis for better understanding possible psychological alterations.

Exercise produces both acute and long lasting modifications on the cardiovascular system. In attempting to maintain homeostatic balance all bodily systems alter upon demand. When the body is stressed, as in exercising, a "total bodily reaction" is mandatory to maintain equilibrium (Ulrich, 1960, p. 252). To meet the body's increased need for oxygen, heart rate and blood pressure increase (Kraus, 1961; Ulrich, 1960). Blood chemistry is changed to meet the increased demand placed on the heart (Kraus, 1961). In addition to the immediate effects of physical activity on the cardiovascular system, continuous exercise programs produce a variety of other changes. Scientific studies have shown that those who participate in regular physical activity decrease their resting heart rate and blood pressure (Carruthers, Edwards, Pride, Nixon, & DeMoncheaux, 1976; Morgan & Pollack, 1977; Rodstein, 1975; Buccola & Stone, 1975; Hutterer & Denes, 1975). Not only is oxygen capacity increased but as a consequence of increased coronary collateral vascularization due to repeated exercise, blood vessel size increases, oxygen content in arteries rises, and red blood cell mass and blood volume are increased (Carruthers et al., 1976; Rodstein, 1975; Rarick, 1960; Hutterer & Denes, 1975; Carter, 1977; Hartung & Farge, 1977).

There is some suggestive evidence that the nervous system benefits from regular exercise. "Speed of reaction to light and



sound" is decreased as a consequence of physical conditioning (Carter, 1979, p. 312). It has been proposed that physical activity may provide the brain sensory stimulation necessary for proper maintenance (Martin, 1977). Studies reveal that a 30 day period of exercise will bring about "gains in brain weight" in rats (Rarick, 1960).

The musculoskeletal system shows improvement as a consequence of routine activity. After a regimen of running training it was found that one group of men experienced an "increase in trunk flexibility" (Buccola & Stone, 1975, p. 136). It has been shown that exercise improves mobility by increasing muscle strength, and decreasing muscular massiveness and rigidity (Kraus, 1961; Lowen, 1958; Hutterer & Denes, 1975). Even formerly immobilized joints can regain a great deal of normal use through a structured exercise program (Hutterer & Denes, 1975). In one study exercise was used to regenerate damaged tissues (Hutterer & Denes, 1975).

In comparing runners with non-runners some studies suggest that exercise affects sleeping patterns. Walker, Floyd, Fein, Cavness, Lualhati, and Feinberg (1978) found total sleep time was different between the two groups with a trend for this to be higher in runners than in non-runners. More significant, the chronic exercisers experienced "a higher proportion and greater absolute amount" of non-rapid eye movement as opposed to rapid eye movement sleep; this higher proportion has been related to decreased anxiety (Walker et al., 1978; Baekeland & Lasky, 1966).

Individuals who involve themselves in a consistent exercise program have been found to have different biochemical compositions than individuals who do not exercise. Acute exercise brings with it lowered "urinary acidity, sodium and phosphorous excretion" (Passmore & Johnson, 1960). There is a general increase in metabolic rate with higher than usual sodium, nitrogen and osmotic excretions occurring during the recovery period following exercise which lasts up to seven hours after exertion (Layman, 1973; Passmore & Johnson, 1960). When exercising, epinephrine and norepinephrine output increase, as does output of serum glucose (Ulrich, 1960; Ismail & Young, 1977; Carruthers et al., 1976). Rise in cholesterol and plasma proteins have been noted as a result of exercise but attributed to a loss of fluids and accompanying hemo concentration (Carruthers et al., 1976). It has been suggested that "lipolysis and fatty acid utilization" are intensified with physical activity (Carruthers et al., 1976).

Studies show chronic exercise produces maximum biochemical alterations within three months and these levels stabilize indefinitely with continuous activity (Carruthers et al., 1976). At rest, the physically fit person has lower than normal serum glucose levels and lower values of serum cholesterol (Ismail & Young, 1977). The body uses lipids to provide energy. With persistent physical training serum testosterone levels rise bringing about growth of sexual tissue as well as synthesis of protein which is related to gains in muscle strength (Ismail & Young, 1977; Rarick, 1960). Resting levels of epinephrine and norepinephrine decrease with

extended physical training (Ismail & Young, 1977). Studies are presently being carried out to determine "biochemical changes in the brain that occur with exercise" (Martin, 1977, p. 88).

An inverse relationship has been established between the development of adipose tissues and exercise (Carruthers, 1976; Hutterer & Denes, 1975; Kraus, 1961; Buccola & Stone, 1975; Rodstein, 1975). (It is important to note here that while exercise may not bring about a significant decrease in weight, lean body mass increases with the toning and building of muscle tissue, with a concomitant reduction in fat.)

In surveying the literature regarding the effects of physical training on physiological and psychological functioning one relationship was repeatedly noted. Thus, while studies have shown varying responses to exercise on psychological measures, the tenet that physical training leads to improved physiological functioning has been firmly established (Ismail & Young, 1977; Carruthers et al., 1976; Martin, 1977; Kraus, 1961; Saipe, 1978; Rarick, 1960).

Physiological Changes Associated with Lack of Exercise. Just as exercise is a promoter of physical health, lack of exercise has been found to be directly associated with physiological disease and malfunction. Indeed, a new branch of medicine has developed to study hypokinetic diseases or those "caused by insufficient motion" (Kraus, 1961, p. 8). The effect of inactivity on the heart is as dramatic as is the positive benefit gained from regular exercise. Even a healthy, exercised heart exhibits signs of deterioration, such as

tachycardia, after experimental bed rest (Kraus, 1961). Positive gains achieved through regular exercise are short-lived once the activity is terminated. A return is experienced to increased heart rate, and lengthened deceleration upon termination of physical activity as well as decreased coronary efficiency and "resistance to strain" (Layman, 1977; Kraus, 1961). Inactivity disposes the heart to a variety of conditions as a consequence of the adrenergic preponderance or "progressive decline of vagal cholinergic and/or sympatho-inhibitory counter-regulatory power" (Kraus, 1961, p. 90). In more simple terms, the heart works harder than necessary which may lead to a host of maladies. These conditions include tachycardias (with deleterious effects on the circulatory system), angina pectoris (severe chest pain associated with stress--a consequence of inability to compensate for increased oxygen demand as a result of the dysfunction of sclerotic arterial system), myocardial degeneration and scattered dead tissue (a consequence of arterial hypertension, cardiac hypertrophy and coronary sclerosis), myocardial failure and pulmonary edema (Kraus, 1961; Wessel & Van Huss, 1960). Functional heart disease is increased by three factors which go hand in hand with inactivity; increased serum cholesterol level, obesity, and high blood pressure (Kraus, 1961). This is especially disconcerting when considering that "degenerative heart disease overshadows all other causes of death in this country" (Kraus, 1961, p. 52).

(Lack of exercise has long been associated with obesity. In attempting to "treat" this condition most people concentrate on the

energy consumption aspect rather than focusing their attention on caloric expenditure.) However, studies indicate that it is inactivity rather than food consumption which is the major cause of obesity (Layman, 1973; Kraus, 1961). In fact, two studies revealed that the obese subjects under study actually ate less than average-weight peers (Kraus, 1961; Layman, 1977). One study showed that sedentary individuals experience hormonal changes which, in turn, increase appetite (Layman, 1977). Obesity affects not only one's appearance, unfortunately, but also corresponds to an increase in mortality rate when occurring "in combination with diabetes, digestive diseases, and heart disease" (Kraus, 1961, p. 133).

The effects of inactivity are dramatically evidenced in the striated muscle system. "Action of the striated muscle influences directly and indirectly circulation, metabolism, and endocrine balance" (Kraus, 1961, p. 4). With disuse of muscles comes atrophy and reduction in their strength, as well as an inability to relinquish a state of muscular tension (Wessel & Van Huss, 1960; Kraus, 1961). In studying orthopedic patients with low back pain it was found that 80% of the patients examined did not evidence any structural abnormality but, rather, exhibited evidence of muscle weakness or stiffness as a consequence of disuse (Kraus, 1961). Patients who participated in a regular, exercise program experienced a gradual recovery with improvement in muscular functioning.

Sleep disturbance has long been proposed as a possible consequence of inactivity (Layman, 1977). A recent study carried out with

college students accustomed to exercise lends credence to this long posited theory. Subjects' sleep patterns were observed for two nights after participating in their customary exercise. They then terminated physical activity for a period of one month and were monitored on a weekly basis. Subjects reported a variety of undesirable changes including: increased restlessness, lessened sleep depth, increased periods of wakefulness as well as increased sexual tension (Baekeland, 1970). The researchers validated the subjects' claims of impaired sleep by way of electroencephalogram which indicated an increase in wakefulness and rapid eye movement density (Baekeland, 1970).

All of the physiological states described thus far have been linked with a variety of psychological components. These relationships will be brought out as warranted in the following sections.

#### Psychological Characterization of Athletes

The value of athletic programs on personal development and psychological well-being has long been proclaimed by coaches and physical educators. However, evidence for such claims has, until recently, been scanty. The newly developing field of sport psychology, which is a respected and well-supported discipline of scientific inquiry in many foreign countries, is now gaining acceptance in the United States (Singer, 1975). Heretofore the value derived from athletic activity was mainly supported by belief and hearsay and without objective data or the application of scientific methodology; "claims about the psychic benefits of physical activity

were quite extravagant" (Layman, 1974, p. 33). Sports psychologists are beginning to produce an array of studies which will take questions regarding sports and athletic participation out of the realm of the anecdotal and allow for scientific scrutiny.

In recent years sports psychologists have studied many areas of athletics; however, this review of the literature will limit its focus to studies which seek to determine whether common personality characteristics exist in athletes. Also of relevance to this review will be studies on the effect (if any) of sustained physical activity on psychological states. Two researchers advise that sport is "a microcosm of society--a mirror of life itself" (Finn & Straub, 1977, p. 56). In viewing the athlete, then, we might broaden our understanding of exercise's impact on all individuals. As the field of sports psychology is newly developing and consistent methods have, as of yet, to be established, studies have reported contradictory findings and should be interpreted with caution until better methods have been devised (Stevenson, 1975).

Self-Concept of Athletes. A great many researchers have chosen to study the self-concept of athletes. Self-concept has been defined as "a composite of numerous self-perceptions . . . encompassing all of the values, attitudes and beliefs toward oneself in relation to environment" (Ibrahim & Morrison, 1976, p. 69), "the core around which all personality characteristics are organized" (Harris, 1973, p. 163).

The following section reviews six articles which attempt to examine the self-concept of athletes. Three of these studies involved carefully defined populations, measures and control conditions (Ibrahim & Morrison, 1976; Daus & Templer, 1976; Snyder & Kivlin, 1975). Although Vincent's study (1976) does provide adequate samples and controls, the populations evaluated were not carefully defined. Balazs' (1975) study did not use appropriate sampling techniques, no doubt influencing her findings. Kukla & Pargman's (1976) study is generally poor with a small sample size, no control group and use of measures with nonestablished validity and reliability. A variety of measures were used in attempting to evaluate self-concept which may account for the inconsistency in findings. It is, therefore, difficult to compare these studies and formulate general sound conclusions at this point.

Ibrahim and Morrison (1976) administered the Tennessee Self-Concept Scale to 100 male and 100 female high school and college athletes as well as to 100 male and female, high school and college nonathletes. The groups were separated by school level and sex, to permit comparisons between same-sex groups. Scores obtained from all groups fell, most of the time, below established norms. The investigators indicated that this might be "due to the relatively younger age of the subjects" (Ibrahim & Morrison, 1976, p. 71). Results, in general, revealed that athletes had a poorer sense of themselves when compared to nonathletes. Athletes reported having a sense of lowered moral worth, personal worth, adequacy as family



member, and social worth. Nonathletes scored significantly higher than their athletic counterparts in measures of self-acceptance, behavior and general adjustment.

Daus and Templer's study (1976) of 67 football players from the time of their initiation in the sport, supports these findings which run counter to the accepted belief of the athlete as outstanding in personal, social as well as physical ability. These researchers were attempting to find a means by which they could predict whether a player would quit the football team. The Cornell Medical Index was administered in the first year of school and the subjects were followed for three years. Significant differences were found between "dropouts" and those who continued to play on the team. Daus and Templer found that "dropouts" scored higher on the psychiatric scale but similarly to "persisters" on the somatic scale. Investigators noted incidentally that the mean of the "persisters" were similar to scores reported in an earlier study for 2,176 U.S. Army inductees. From these findings they concluded that "the popular image of football players as being confident young men with superb mental and physical health may not be correct" (Daus & Templer, 1976, p. 230).

In her study of 24 female Olympic champions, Balazs (1975) obtained results which serve to confuse the issue regarding the notion of a universal athletic self-concept, as her findings are contrary to previously-mentioned reports. The author sought to generate information on women athletes as studies of this group, until recently, have been quite limited. There has been a

long-standing belief that females in sports are generally maladjusted and view themselves as less "feminine" than their nonathletic counterparts (Harris, 1973). This study, as well as others reviewed, contradicts this notion. Subjects, who were volunteers, were administered the Edwards Personal Preference Scale and Personal Data Questionnaire. Based on these measures, along with in-depth individual interviews, the researchers found women Olympic athletes to have "strongly internalized feelings of self-worth and self-esteem" as a consequence of parents' and coaches' positive influences (Balazs, 1975, p. 270). A detailed review of findings on personality traits will be discussed in a later section. A composite of results suggested that the female Olympic athlete is "a person with a rather positive self-concept" (Balazs & Nickerson, 1976, p. 48). These young women revealed a higher than average need (as compared with a national sample of adolescent females) for heterosexual involvement with a desire "to be regarded as physically attractive by the opposite sex" (Balazs & Nickerson, 1976, p. 48). This hardly supports the view of the female athlete as masculinely oriented (Harris, 1973).

Snyder and Kivlin (1975) tested the hypothesis that social negativism toward women in sports would result in female athletes' demonstration of lower scores on body image than female nonathletes. Research indicates "there is a positive relation between body concept and self-concept" (Layman, 1974, p. 41). A group of 275 female sport nonparticipants were compared to 328 women athletes "by means of

self-administered questionnaires" which measured their attitudes toward a variety of bodily processes and body parts (Snyder & Kivlin, 1975). The researchers noted a great disparity between the two groups with the athletes indicating clearly more positive feelings about their bodies than the nonathletes. Athletes had much more favorable responses to their energy level, posture, body build, hips, face, legs, profile, back, arms, bust, and health. The investigators believed their data raised "serious doubts about the stereo-types regarding women athletes" (Snyder & Kivlin, 1975, p. 197). The female athlete, when compared to her nonathletic peer, displayed a more positive self-concept as shown by her significantly more positive estimates of body image and physiological function.

Vincent (1976) compared the responses of 248 female nonathletes, 212 female athletes, and 180 physical education majors (both athletes and nonathletes) to the Tennessee Self-Concept Scale. Of the total group, 199 had not been a participant in high school athletic competition and 261 had been competitors. On the self-concept measure physical education majors scored significantly higher than nonathletes, athletes, non-high school participants and non-physical education majors, but not significantly above the high school participants. The high school sports participants scored significantly above all but physical education majors on total self-concept. Nonathletes scored significantly higher than athletes on the family self category. In the behavior and personal self categories, athletes scored significantly above non-physical education majors and

non-high school participants. When measuring the category self-criticism, which is "a healthy, normal openness and capacity for self-criticism" it was found that physical education majors and high school participants showed a "tendency to be slightly less open" than non-physical education majors, nonathletes and non-high school participants (Vincent, 1976, p. 221). High school participants and physical education majors scored lower, though not significantly, than all other groups on the variability score indicating their consistency in self-perception over all areas and lack of compartmentalization. Physical education majors expressed greater certainty in their self-opinions and showed significantly higher scores on this measure than non-physical education majors, non-high school participants and nonathletes. The results of this study indicate that those females who participated in competitive athletic programs while in high school show a more positive self-concept than those who did not. There were no significant differences between college athletes and nonathletes with similar measures of psychological well-being. The investigator concluded that the "generally significantly higher total and subscale of self-concept scores" in the high school athletic participants and physical education majors "seemed to be a factor in choice of physical education as a profession and of participation in high school athletic competition" (Vincent, 1976, p. 224). Rather than viewing the differences between groups as a function of athletic participation, Vincent suggests generally higher self-esteem and

greater resistance to self-criticism are prerequisite to involvement in sports competition.

One interesting finding brought out in a study by Kukla and Pargman (1976) is that the athletes studied perceived themselves as being more capable socially when involved in sports activities. In the investigation of an assortment of variables concerning the self-concept and personality of 30 female college athletes, the athletes stated they felt "closer to others, greater cooperation, friendlier" when occupied with athletics as compared to the rest of their social lives (Kukla & Pargman, 1976, p. 379). This observation contradicts that seen earlier in the study completed by Vincent, the athletes in that study characterized as slightly less open than nonathletes.

Summary--Self-Concept of Athletes. There seems to be divisive thinking regarding self-concepts of athletes. Based on the investigations reviewed it is apparent that there is no self-view common to all participants in sports activities. Although it has been generally accepted that athletes are self-confident with feelings of high self-esteem "studies of sports participation and interest in relation to self-concept . . . yield conflicting results" (Layman, 1974, p. 48).

Personality of Athletes. Many researchers have concentrated their efforts on viewing the personality in relationship to pursuit of athletic activity. Although a great many ideas have been generated, disparity in findings remain. Personality has been defined by Eysenck as the "more or less stable and enduring organization of a

person's character, temperament, intellect and physique, which determines his unique adjustment to the environment" (Arnold, 1968, p. 1). Personality is synonymous with "traits" and differentiated from "states" or the fluid elements of psychologic functioning. Investigators have sought to determine whether basic characteristics in athletes preexist entrance into sports or if they develop as a consequence of extended involvement (Kane, 1978).

The following section reviews seven articles which attempt to examine the personality of athletes. Three of these studies were empirical research involving carefully defined populations, measures and control conditions (O'Connor & Webb, 1976; Stoner & Bandy, 1977; Hartung & Farge, 1977). Two studies were empirical in nature but made assumptions as to the subjects' level of physical activity rather than validating this through objective evaluation of habits (Widdop & Widdop, 1975; McCutcheon & Phillips, 1976). Balazs' (1975) study did not use appropriate sampling techniques, no doubt influencing her findings. Kukla and Pargman's (1976) study is generally poor with a small sample size, no control group for comparison and uses measures with nonestablished validity or reliability. Once again, it is impossible to compare the findings of these studies because a standard battery of measurement was not employed.

Widdop and Widdop (1975) compared a group of 128 female teacher-education students with 123 female physical education students in an attempt to discern whether distinctive personalities exist in

athletically oriented females in contrast to nonathletes. The California Psychological Inventory, the Edwards Personal Preference Scale and Form "C" of the 16 Personality Factor Questionnaire were administered to all subjects. Significant differences were obtained on the latter measure with physical education majors appearing more "outgoing and warm hearted . . . happy-go-lucky and gay . . . conscientious . . . spontaneous . . . worldly and shrewd . . . (and self-sufficient" (Widdop & Widdop, 1975, p. 276). The physical education majors were also described as being higher in abstract thinking and socially less inhibited than their nonathletic counterparts. The Edwards Personal Preference Scale differentiated between the two groups of subjects with physical education majors portrayed as being more exhibitionistic, dominant and interested in heterosexual involvement than the female teacher education students. The physical education majors displayed lower organizational ability and loyalty and "were less likely to help friends in need of assistance or sympathy" (Widdop & Widdop, 1975, p. 277). The California Psychological Inventory depicted the physical education majors as being more robust, active, ambitious, hard-headed, outgoing, talkative, spontaneous, imaginative, enthusiastic, confident and aggressive. They were also described as having a "higher order of social presence" (Widdop & Widdop, 1975, p. 278). These investigators concluded that their findings provided strong indication of significant differences in personality measures for those active in sports compared with those not involved in regular physical activity. The

value of using a variety of measures when analyzing personality profiles was stressed.

A study by O'Connor and Webb (1976) sought to differentiate between four types of female athletic competitors and a nonathletic control group. The sample consisted of 55 undergraduates with a mean age of 19.6 years. The sports groups included athletes who participated in basketball, gymnastics, swimming and tennis. All subjects completed a questionnaire which revealed personal information, as well as the Cattell Sixteen Personality Factor Test. No significant differences between groups were noted on such personality traits as tenseness, apprehension, shrewdness, bohemianism, protension, realism, adventurousness, conscientiousness, surgency, aggressiveness, ego strength and sociability. Significant differences were discovered, however, on the four other factors. The sports groups, except for the basketball players, scored "well above the norm" for intelligence (O'Connor & Webb, 1976, p. 209). The swimmer, controls, and tennis group scored significantly higher than basketball and gymnastic groups on radicalism, which indicates a more experimenting attitude toward life. The basketball, control, and swimming groups were significantly more self-sufficient when compared to the tennis group on a measure of group dependence vs. self-sufficiency. The swimmers and basketball players scored significantly higher than tennis players and gymnasts on a measure of leadership potential. Although these findings are inconsistent with those obtained in previous studies, they do provide evidence which would suggest that



differences exist in personalities, not only between athletes and nonathletes, but also when comparing athletic subgroups.

Another study sought to distinguish differences in personality between college females who participated in team sports, individual sports and nonathletics. The Edwards Personal Preference Scale (EPPS) was administered to a total of 90 subjects; each group was made up of 30 females. The results revealed no significant differences between those females who participated in team sports and those who involved themselves in individual sports, as measured by the EPPS. There were, however, significant differences between athletic groups, and between female athletes and nonparticipants in sports on several of the EPPS scales. The nonathletes displayed a higher need for heterosexuality, intraception and change than did females who participated in team sports; the latter expressed a higher need for deference than the former. When compared to individual sports participants, nonparticipants evidenced "a higher need for intraception and change" (Stoner & Bandy, 1977, p. 334). These findings appear somewhat contrary to previous results, and serve to cloud the issue even further.

Hartung and Farge (1977) focused their attention on the personality of 48 male runners and joggers with a mean age of 47.3 years. It was their contention from the outset that the "fact of psychological and physical changes and adaptations of persons involved in regular exercise programs appears to be well established" (Hartung & Farge, 1977, p. 542). Results of their study support this point of

view. Subjects were volunteers and not representative of the normal population. Educational level and financial status were extremely high, most functioning in professional positions. Along with an extensive physiological evaluation (including total serum cholesterol and triglycerides, height and weight, skinfold thickness measured at a variety of body sites, heart rate, blood pressure, electrocardiogram, and a comprehensive health history), all subjects were administered the Cattell 16 Personality Factor Questionnaire (16 P-F). Physiologic measures placed the subjects "in a high classification of cardiorespiratory fitness for their age" (Hartung & Farge, 1977, p. 543). The group was divided between those who had participated in a marathon within the previous year (N = 25) and those who had not (N = 23). Although the two groups differed on a variety of physiologic measures (the marathoners being significantly superior to nonmarathoners), the two groups could be distinguished on only one personality variable; the marathoners scored significantly higher on imagination. When comparing the groups divided by age the younger group (N = 34, 40-49 years) displayed no significant differences when compared on both personality and physiologic variables with the older group (N = 14, 50-59 years). Comparing the total group to normative population means on the 16 P-F revealed significant differences on 7 of 16 personality factors. This volunteer group of runners were characterized as being more reserved and aloof with a sober, serious attitude than the normative group. They were seen as generally more cautious and introverted than the norm, but

more resourceful and confident. Also, these subjects responded in a manner which indicated they were highly imaginative with greater mental capability. Social clumsiness was suggested as characteristic with the sample being forthright and genuine. Although investigators went to great lengths in devising methods to substantiate physiological differences between this group and the normal population, unlike most studies reviewed thus far, results need to be interpreted cautiously as the sample measured does not typify a normal population in socioeconomic levels any more than it does in personality and physiologic measures. It is felt that the men they studied most likely became involved in running, as opposed to team sports, as a function of their tendency towards introversion. It was thought that their high levels of imaginativeness and self-sufficiency were a consequence of running rather than a determinant of choosing to run (Hartung & Farge, 1977).

As noted previously when discussing the self-concept of athletes, Balazs (1975) also concerned herself with viewing personality variables of 24 Olympic female champions. Along with measures of self-concept, the athletes sampled participated in comprehensive interviews and were administered the EPPS as well as a Personal Data Questionnaire. After compilation of data, analysis revealed "basic, identical patterns in the developmental dynamics" of the subjects (Balazs, 1975, p. 270). Subjects were provided a great deal of support and encouragement by their parents and early in life developed a strong drive for excellence. Scores obtained by these

Olympic athletes on the EPPS were "almost completely lacking in any deviant or abnormal attributes" in the group profile (Balazs, 1975, p. 271). Although there were no significant deviations from the norm, the group did score extremely high on achievement and autonomy scales. The athletes in this study have a great desire to succeed in life and trust in their own judgment.

McCutcheon and Phillips (1976) studied 94 males and 94 females, randomly chosen, from several college-level psychology classes in an attempt to determine whether an athletic personality exists. Subjects were administered the Philosophies of Human Nature Scale as well as a questionnaire to determine their sports attitudes and involvement. No significant differences were found between sexes. Males who participated in sports were not significantly different from their inactive counterparts. Females designated as low in sports participation, however, were "more likely to have an internal locus of control: and saw humans as complex beings" (McCutcheon & Phillips, 1976, p. 16). Female nonathletes, then, "believe that they control their own destiny" (Finn & Straub, 1977, p. 56). No other significant differences were noted by the authors.

Kukla and Pargman (1976) studied 30 female athletes investigating, among a number of variables, selected personality traits. Through the use of questionnaires and taped interviews it was noted by a team of three independent judges that varsity athletes displayed a high level of aggression, while those who participated in intramural sports were evaluated as moderate in aggression. The latter

were characterized as being low in dominance while the former were rated moderate. As these findings were obtained by rather subjective judgments results should be interpreted cautiously.

Summary--Personality of Athletes. As with the data compiled regarding the self-concept of athletes, there is also considerable disagreement as to whether one athletic personality type exists. Instead, findings suggest there is as much variability between athletic subgroups on personality traits as there is between athletes and nonathletes. Personality measures indicate further that personalities vary between those athletes involved in team sports as opposed to individual sports. The suggestion has been made that differences in personality between athletes and nonathletes may preexist entrance into sports. One researcher claims that sports involvement alters the personality in runners. It is impossible to arrive at any conclusive thought in light of the studies reviewed as research methodology ranges from objective to extremely subjective with the utilization of many different psychological measures. Until such time as consistent measures of personality are used to study the athlete, studies should be compared with caution.

Athletes and Psychological Well-Being. One last major area examined by researchers which is relevant to the study of psychological function in athletes is that of emotional well-being. The emotionally healthy person has been characterized as being relatively free from tension and anxiety, and lacking significant intrapsychic conflict. According to Layman (1972), one who is emotionally well

has "a feeling of security, a sense of self-worth" and "the capacity to enjoy life" (p. 164).

The following section reviews three articles which attempt to examine the psychological well-being of athletes. All three were empirical research involving carefully defined populations, measures, and control conditions (Snyder & Kivlin, 1975; Morgan & Pollack, 1977; Ibrahim & Morrison, 1976). As with the previously discussed studies on athletes, a variety of measures were used preventing any comparison of findings. As previous studies have indicated, differences exist between athletic subgroups as well as between male and female athletes. Because these studies evaluate different sexes and athletic groups this may account for the disparity in findings.

Snyder and Kivlin (1975), mentioned previously, attempted to estimate this variable in their study of 275 female nonathletes and 328 athletes. Through the questionnaire procedure they found "a strong positive relationship between athletic involvement and . . . psychological well-being" when compared to their non-sports participant peers (Snyder & Kivlin, 1975, p. 194).

In their study of 27 elite distance runners, Morgan and Pollock (1977) chose to focus on mental health function as one aspect of their investigation. Each subject was administered the State-Trait Anxiety Inventory, Somatic Perception Questionnaire, Depression Adjective Checklist, Profile of Mood States, Eysenck Personality Inventory along with an examination of their physiologic function. These athletes were found to "score appreciably below the population

mean for tension, depression, fatigue, and confusion, and above the mean for vigor" (Morgan & Pollock, 1977, p. 388). This was considered as being an indication of the athletes' superior mental health. As the runners were reported to have personality measures similar to that of the normal population the investigators concluded that although commitment to distance running had no impact on personality trait measures it did affect state measures thus indicating that "low anxiety and depression scores in runners represent a consequence of involvement in distance running rather than reflecting an antecedent condition" (Morgan & Pollock, 1977, p. 389). Superiority of physiologic functions of marathon runners was well documented in this study.

In Ibrahim and Morrison's study (1976) of self-concept comparing 100 athletes and 100 nonathletes, they also looked at affective functioning. All subjects were administered Shostrom's Personal Orientation Inventory (POI), a measure of self-actualization which discriminates between those with mental health problems and those who are relatively problem free. The groups were represented equally by males and females. College female athletes were found to be significantly different from their female peer nonathletes in self-actualization, flexibility, sensitivity to one's own feelings and needs, spontaneous expression of feelings, self-regard, ability to see opposites of life as related in a meaningful way, and ability to view their own anger as natural. There were no significant differences found in the males, although male athletes did score higher

than their nonathletic peers on ability to express feelings spontaneously, self-regard, and seeing man as essentially good (Ibrahim & Morrison, 1976, p. 77). These findings indicate that although athletic males are somewhat distinguished from their nonathletic peers in mental health functioning, female athletes studied were significantly more "actualized" than female nonathletes across many areas of the POI.

Summary--Athletes and Psychological Well-Being. This review of studies pertaining to psychological characteristics of athletes has been consistent with reviews completed earlier in that data collected have been generally contradictory and confusing (Stevenson, 1975; Harris, 1973; Singer, 1975; Layman, 1974; Widdop & Widdop, 1975). It has been suggested that this is a function of faulty research methods, however, many retain the belief that athletes are generally different from their nonathletic peers (Harris, 1973; Stevenson, 1975; Cofer & Johnson, 1960; Morgan, 1974). Inconsistent findings are most likely accounted for by differences between populations studied. Because it appears that there are variations between subgroups, studies should not lump athletes or sexes together as a group (Morgan, 1974). Longitudinal studies have been recommended as a remedy so that the psychological makeup of the athlete can be better brought into focus (Kane, 1978; Stevenson, 1975). This should assist in answering the question of whether athletes involve themselves in sports because of preexisting psychological needs or whether their personality structure is altered as a consequence of



sports participation (Stevenson, 1975; Morgan & Pollock, 1977; Cofer & Johnson, 1960).

Summary--Psychological Characterization of Athletes. Studies reviewed on self-concept of athletes are contradictory in their findings as to whether exercise serves to improve self-view. However, studies of females indicate a general agreement that athletes have more positive feelings about themselves when compared to inactive peers. Results of studies on personality are not consistent, however, athletes appear to be higher in activity level, having more energy and vigor. Additionally, many successful competitors are achievement oriented, and some display higher levels of self-sufficiency and aggression. Many studies measuring intelligence indicate a generally higher than average cognitive ability among athlete samples. This may be due to improved physiological state as suggested by studies performed on geriatric populations, which will be discussed later. Those who participate in individual sports are generally more introverted and imaginative than those who prefer competition in teams. There seems to be a general agreement in relative lack of psychologic disturbance when studying the affective domain in athletes.

The study of female athletes in the United States has been a more recent thrust in sports psychology. The notion that women suffer psychologically as a consequence of sports involvement due to a conflict between that role and being "feminine" is not supported by evidence reviewed. On the contrary, studies comparing female

athletes with nonathletic peers provide support to the notion that female athletes differ from physically inactive peers in a variety of positive ways. This warrants further investigation in the future. One hypothesis might be that the American female athlete's view of herself is enhanced through identification with a "superior" being, in this case the male athlete in our culture. An opposing view might hold that females who occupy themselves with sports pursuits are motivated to do so through self-selection, rather than by cultural expectation. This distinguishes them from their male counterparts and could account for the disparity in findings when comparing athletic males and females. Their initial decision to involve themselves in sports may be a function of characteristics which preexist, rather than being a product of, the experience of athletic participation.

#### Effects of Exercise on Geriatric Populations

A variety of factors have been analyzed in studying the consequence of regular physical activity in the elderly. Physiological changes occur in the process of aging which have led some to arrive at misconceptions regarding the value of exercise in the aged. Many operate under the misunderstanding that physical activity should be curtailed, or even discontinued, as they approach old age. In reviewing the literature it becomes quite apparent, however, that exercise rather than being an activity to avoid, can provide positive benefits to geriatric populations engaging in consistent, individualized programs.

Exercise has been shown to affect the aging process through its effect on the physiological system. Although there are biological processes operating to cause a general decline in function with age, even short-term physical activity has been demonstrated to "reverse some age-induced physiological changes" (Buccola & Stone, 1975, p. 136; Harris, 1973). Physical activity in the elderly, as in younger populations, brings about lowered blood pressure levels, decrease in weight, increase in body flexibility and increased oxygen consumption (Rodstein, 1975; Hutterer & Denes, 1975; Buccola & Stone, 1975). Exercise has been termed a "remedy" for the aged because it "delays atrophy and degeneration" (Hutterer & Denes, 1975, p. 138) and promotes general health and mobility. With exercise, the circulatory system benefits and the elderly, as well as younger individuals, show improved cardiac efficiency, lowered heart rate and vascular dilatation (Rodstein, 1975; Hutterer & Denes, 1975). Oxygenation of brain tissue is promoted by exercise thus counteracting the diminution in oxygen which is usually experienced with age (Crooks, 1977).

Effects of Exercise on Mental Functioning in the Elderly. The following section reviews three articles which attempt to examine the effects of exercise on mental functioning. Two of the studies were empirical research involving carefully defined populations, measures and control conditions (Powell, 1974; Crooks, 1977). Rodstein's (1975) study, however, represents nonempirical theoretical

discussions based on informal observation, with little clarification of methods used.

The effects of physical activity on cognitive function in the geriatric community has been given attention by researchers. Rodstein (1975) worked with residents in a home for the aged. He compared the effects of mild exercise for one group with a control group who participated in "arts, crafts, games and musical therapy for the same time periods" (Rodstein, 1975, p. 319). The initial response of exercise subjects after completing three months of hour-long sessions consisting of calisthenics and brisk walks, five days a week, might lead one to think that the exercise had had a detrimental rather than a positive effect on behavior. For example, the residents who exercised became more irritable and expressed their independence by verbalizing their complaints. Their newly expressed opposition towards hospitalization, however, was interpreted as evidence of improvement from formerly apathetic states. This group displayed a "marked improvement in recall, logical thinking, and reality orientation" (Rodstein, 1975, p. 319). The control group, conversely, evidenced no change from previous behavior.

Exercise has been said to provide "mental refreshment" for the aged (Hutterer & Denes, 1975, p. 138). Powell (1974) provides further fuel for this thought in his study of 13 male and 17 female geriatric patients. The mean age for both groups was 69.3 years. The average length of hospitalization for the group studied was 24.3 years. Before initiating a treatment program subjects were screened

to eliminate those with a history of heart problems, arthritis, and hypertension. "Severely regressed, noncommunicative patients were also disqualified" (Powell, 1974, p. 158). Three groups were formed, two treatment and one control group. The first treatment group performed calisthenics, and rhythmic movements as well as walked for hour-long sessions, five days a week, during a 12-week period. The second treatment group participated in social therapy with no involvement in physical activity. All subjects were tested with three cognitive measures (Wechsler Memory Scale, The Raven's Progressive Matrices Test, and The Memory-for-Designs tests) and two behavioral assessment questionnaires (Nurses Observation Scale for Inpatient Evaluation and the Geriatric Assessment Scale). These measures were administered prior to beginning the experiment and at the end of 8 and 12 weeks. At the beginning of the experiment "the groups were found to be statistically alike with respect to mental and behavioral functioning" (Powell, 1974, p. 158). After completion of eight weeks of treatment the groups displayed no significant differences. However, after completion of the full 12 weeks, significant differences favoring the exercise group were found in the scores obtained on the Wechsler Memory Scale and Progressive Matrices test. There was a slight, but insignificant, improvement on the Memory-for-Designs test in the exercise group. The social group displayed no significant differences from the control group in test results. Powell's interpretation was that lack of change on the Memory-for-Designs test evidenced the "irreversibility of change of those

mental abilities affected by organic brain damage" (Powell, 1974, p. 159). Powell concluded that geriatric patients who exercised evidenced improvement in thinking and memory, a "revitalization of mental abilities already extant, but in a state of disuse" (Powell, 1974, p. 160). It was postulated that physiological changes in the body stimulating the brain helped to bring about improvement in cognitive function.

Another study by Crooks (1977) supports this last contention. One variable Crooks studied was the effect physical activity had on mental functions. He studied 70 residents of a retirement community, ages ranging from 55 to 89 years. Five measures were utilized to determine cognitive ability: the Bender-Gestalt, and Digits Forward, Digits Backward, Similarities, and the Block-Design subtests of the Wechsler Adult Intelligence Scale (WAIS). Physiological measures including blood pressure, heart rate and physical (aerobic) activity ratings were taken. The active subjects "were characterized by  $VO_2$  maximum values and a more efficient cardiovascular system" (Crooks, 1977, p. 368). Significant correlations were found between Similarities, Block Design and Bender-Gestalt scores with the level of physical activity. Crooks found that "high ratings on extent of aerobic activity are related strongly to high scores on these tests of mental functioning" (Crooks, 1977, p. 349). Wechsler had noted a general decline in subtest scores with age, however Crooks' data suggested that performance is "not age related but instead was activity related" (Crooks, 1977, p. 369). Crooks arrives at

conclusions in line with previously discussed researchers in this area. He proposes that the elderly who do participate in a regular exercise program have "superior circulation and oxygenation of brain tissue" which may account for the disparity between their scores and those of their inactive peers (Crooks, 1977, p. 374).

Effects of Exercise on Psychological Well-being of the Elderly. The following section reviews four articles which attempt to examine the effect of exercise on the psychological well-being of elderly persons. Two of these studies were empirical research involving carefully defined populations, measures and control conditions (DeVries & Adams, 1972; Stamford, Hambacher, & Fallica, 1974). Guraedy's (1977) study, although empirical in nature, provided no attempt to measure the physical state of either subjects or controls. The reliance on assumption of physiological status rather than fact weakens this study. Hutterer and Denes's (1975) study represents nonempirical theoretical discussions based on their informal observations.

One investigator was interested in learning whether exercise might have some bearing on morale in a geriatric population. Guraedy (1977) studied a group of 64 elderly volunteers ranging in age from 62 to 90 years old who regularly participated in programs at a community center. The experimental group participated in hour-long exercise sessions consisting of warm-up stretching and range of motion exercises, a "stand-up, step-up exercise," and walking, three days a week (Guraedy, 1977). The control group regularly involved

themselves in card playing at the center. For a period of three months, at monthly intervals, the Revised Philadelphia Geriatric Center Morale Scale was administered to all subjects. This device is purported to be a reliable measure of morale, or the extent to which an older person "feels free from distressing symptoms, has feelings of syntony between self and environment, and has ability to strive appropriately" in the face of unavoidable reality (Guraedy, 1977, p. 8). Data collected at monthly intervals failed to reveal any significant difference between the experimental and control group on level of morale (Guraedy, 1977, p. 61). Physiological measures were not made, however, so improvement in actual physiological function could not be determined. It is the writer's opinion that the investigator could have improved the level of her study substantially by taking such measures. Without them, one can only arrive at conclusions from the study based on implication rather than fact.

Other researchers have studied psychological states of the elderly in an attempt to determine whether exercise might be a means of improving their mental outlook. In a study employing a very large group of participants, Hutterer and Denes (1975) arrived at conclusions contrary to the previous study. Their methods appear to be much more subjective, both studies suffering from significant methodological flaws. Hutterer and Denes utilized "gymnastic exercise" for a few minutes daily in treating a group of 338 elderly persons, ages 50 to 81. No physiological or psychological measures were reported in their journal article. They observed a reduction in



muscle contractions with consequent lessening of pain. They claim a dramatic disappearance of depression as their patients became better able to care for themselves "and acquire a feeling of security and self-assurance" (Hutterer & Denes, 1975, p. 138). It was their conclusion that as the physical system became more healthy so, too, does the "psyche" (Hutterer & Denes, 1975, p. 137). Their findings should be interpreted conservatively based on the lack of objective data.

In a study analyzing possible effects of physical activity on anxiety in elderly persons, DeVries and Adams (1972) arrived at some interesting conclusions. They investigated the response of 10 volunteers, ages spanning 52 to 70 years, to a variety of treatments. The subjects were chosen from a group of 60 retirees who characterized themselves as displaying a variety of symptoms indicative of anxiety. Selection was made on the basis of two criteria: a physician's release for exercise, and those scoring highest on resting muscle action potential. Muscle tension was measured by electromyogram (DeVries & Adams, 1972). The subjects served as their own controls and were tested for reduction of anxiety before and after random administration of: (a) 400 mgs. of meprobamate, (b) placebo (double-blind), (c) 15 minutes of walking which produced a heart rate of 100, (d) 15 minutes of walking which produced a heart rate of 120, and (e) control--with subjects reading. Tension was produced by having subjects compute arithmetic problems mentally, electrical activity increasing "twofold during mental stress of the

type used" (DeVries & Adams, 1972, p. 134). Data revealed significant reduction in muscle tension with both courses of exercise and no change with placebo, meprobamate, and the control activity. The authors concluded that "electrical activity in the skeletal musculature can be significantly reduced by both large doses of meprobamate (1600 mgs.) and physical exercise" (DeVries & Adams, 1972, p. 139). It was their feeling that exercise would be the treatment of choice for anxiety in the elderly due to the hypotensive effect of meprobamate with older persons. A reduction of tension was found to persist for at least one hour after termination of exercise.

A study completed by Stamford, Hambacher and Fallica (1974) focused on psychological changes associated with physical training in the elderly. The nine experimental geriatric patients had a mean age of 71.5 years. Care was taken to exclude persons with physical abnormalities which would preclude their involvement in an exercise program. The control group was made up of eight patients, mean age of 65.2 years. Exercise was performed on a daily basis by the experimental group for a 12 week training period. Subjects walked on a treadmill until they reached the point of "70% of the predicted age adjusted maximal heart rate" (Stamford, et al., 1974, p. 36). In an attempt to control for the effects of social interaction, the control group was also brought together daily to walk for one minute at a speed of one mile per hour. These researchers found that systolic blood pressure and heart rate, "decreased significantly in the experimental patient group as a result of training" (Stamford, et

al., 1974, p. 38). The control group, conversely, showed no change in physical functioning. Psychological testing revealed significant changes in the experimental group on two measures while the control group showed no significant changes. The Information subtest of the WAIS as well as a questionnaire geared to current events "were significantly changed following training" in a positive direction for the experimental group only (Stamford, et al., 1974, p. 40). Both the Draw-A-Person Test and Digit Span subtest of the Wechsler Adult Intelligence Scale failed to show a change in scores by either group of subjects. Informal observation of both groups revealed an increase in spontaneous social interchanges between exercise group members, with no such change in behavior in the control group. These researchers concluded that the results of the study offered "support to the concept of an improved psyche accompanying the enhanced physiological efficiency derived from participation in a physical exercise program (Stamford, et al., 1974, p. 41). The improvement in social interaction noted in this study is in opposition to the findings obtained by Rodstein whose subjects became more self-assertive in groups rather than more attentive to others' needs (Rodstein, 1975, p. 319).

Effects of Exercise on Personality in the Elderly. The following section reviews the one article available at this time which attempts to examine the effect of exercise on personality of the elderly. This study was empirical research involving carefully defined

populations, measures and control conditions. The study might have been improved by increasing the length of treatment.

A study of 36 older men completed by Buccola and Stone (1975) looked into the consequence of exercise on personality variables. As in previous studies, these older men were first screened for fitness by means of a physician's release as well as through results of electrocardiogram. Two groups were formed by the subject's own preference for exercise. One group, mean age 67.6, consisted of 20 subjects who selected a cycling program. The second group, with an average age 65.4, elected to participate in a walk-jog regimen of physical training. The programs were "designed to produce essentially the same energy expenditure" (Buccola & Stone, 1975, p. 135). Extensive physiological measures were taken before and after completion of a thrice-weekly, 14 week training program. These measures were: percentage of body fat, weight, vital capacity, estimated maximum  $VO_2$  reaction time, trunk flexibility, respiratory rate, heart rate, diastolic blood pressure, systolic blood pressure as well as pulse pressure. All subjects were evaluated with pre- and post-test Cattell 16 PF's. Results of physiological testing were in line with findings obtained in previously mentioned studies. Both groups evidenced decreases in weight and blood pressure readings and increases in maximum  $VO_2$ . Joggers improved their trunk flexibility and cyclists significantly decreased in percentage of fat. Personality factors varied in the joggers group only; the walk-jog group became "less surgent and more self-sufficient" (Buccola & Stone,

1975, p. 136). Between group analysis of the data failed to reveal any significant differences on physiological variables. The groups did show differentiation on two personality factors after completion of training: the cyclists were identified as "more surgent and tough-minded than the walk-jog group" (Buccola & Stone, 1975, p. 136). The investigators concluded that although exercise has demonstrable effect on physical functioning, it does not appear to influence personality traits to a marked degree. The walk-jog group developed profiles similar to habitual exercisers who have been "characterized as being low in factor F (de-Surgent)" (Buccola & Stone, p. 138).

Summary--The Effects of Exercise on Geriatric Populations. Studies on the elderly indicate the efficacy of exercise in the improvement of physiological health as well as in cognitive functioning. Although studies provide conflicting evidence as to the effects of structured physical activity on psychological functions, exercise does appear to suggest itself as a treatment for mild anxiety states in the elderly. One researcher noted that residents in homes for the elderly are involved in activities only "about a fifth of the time," the bulk of the day being reserved for "doing nothing" (Rodstein, 1975, p. 320). With this in mind it is of little wonder that some geriatric patients experience a lifting of spirits and an increased awareness when involved in an exercise program. In becoming more physically able, and thus less dependent on others for care, some have noted the elderly regaining "a feeling of security and

self-assurance" (Hutterer & Denes, 1975, p. 138). Further research is needed, however, to provide more data before definitive conclusions can be reached regarding the value of exercise in the improvement of mental outlook and self-concept in the elderly.

#### The Effects of Exercise on Cardiac Patients

As researchers have been able to establish a relationship between physical activity and improvement of the physical state of cardiac patients, they are now turning their attention to the study of exercise and its effect on the psychological component in heart disease. The response of patients to cardiac rehabilitation has demonstrated "that the traditional permanent invalidization of most cardiac patients was not only unnecessary but a grave mistake from every psychological and somatic" standpoint (Kraus & Raab, 1960, p. 116). Although there are categories of heart problems in which exercise would be contraindicated, the commonly held notion that one should forever abstain from exercise after a myocardial infarction has healed is not substantiated by objective data. As reviewed in the section of this paper on physiological consequences of exercise, the damaged heart is improved by exercise in a variety of ways including: "improved maximal oxygen uptake, enhanced myocardial-efficiency, enhanced peripheral perfusion, and favorable alterations in blood chemistry and fibrinolytic activity" (Eliot, 1976, p. 237). Recent studies of heart patients also lend evidence supporting psychological alteration as well with exercise. These findings have had an impact on existing rehabilitation programs causing them to

attend not only to "the locomotor apparatus but also to (the) mental state" of those recuperating from heart conditions (Kubin, 1978, p. 95).

The following section reviews four articles which attempt to examine the psychological effects of exercise on cardiac patients. Two of these studies were empirical research involving carefully defined populations, measures, and control conditions (Kavanaugh, Shephard, Tuck, & Qureshi, 1977; Mallaghan & Pemberton, 1977). Although the study completed by Birkui, Gianfrancesco, and Lesigne (1976) was empirical in nature, the researchers failed to use measures with established validity and reliability. Vaisrub's (1978) study represents a nonempirical theoretical discussion based on his informal observations.

One of the best studies reviewed on the psychological response to exercise following myocardial infarction was completed by Kavanagh, Shephard, Tuck and Qureshi (1977). Patients were evaluated on physiological and psychological measures 16 to 18 months after detection of their heart problem. Forty-four subjects agreed to participate in a four year exercise rehabilitation program which utilized "personally prescribed and progressive long slow distance jogging" as the major treatment modality (Kavanagh, et al., 1977, p. 1029). Initial psychological testing with the Minnesota Multiphasic Personality Inventory (MMPI) produced valid results which indicated the subjects were severely depressed, with elevations on Hysteria, Psychasthenia, and Hypochondriasis. Physiological measures

were taken at regular intervals including: weight, height, aerobic power, skinfold readings, resting and exercising blood pressure, and an exercise electrocardiogram. In post-testing statistically significant decreases in standardized depression scores were evidenced, however, one-half of the subjects continued to score more than two standard deviations above the mean. Those subjects who did experience a decrease in depression scores also displayed significant lowering of schizophrenia and social introversion scores. In closer scrutiny of the data the researchers note that a lessening of depression scores "were related to compliance with the prescribed exercise, compliance being defined as attendance at a minimum of 60% of available exercise sessions" (Kavanagh, et al., 1977, p. 1030). Subjects who did not meet this criteria displayed little change on this measure of depression. High scores on the masculinity/femininity dimension were obtained for all subjects. Physiological changes revealed a substantial increase in weight which the investigators attributed to gains in lean body mass. Gains seen in aerobic power were evidenced which approximated levels seen in the normal sedentary population. Researchers concluded that although many cardiac patients deny depression this does appear to be a significant problem associated with this particular group. They indicate that "the main reasons for depression are almost certainly the patient's own anxiety, lack of confidence and fear of sudden death" (Kavanagh, et al, 1977, p. 1034). As there were few differences in physiological measures noted between those who experienced



a decrease in depression and those who did not, although as mentioned previously compliance differed, the investigators deduced that the act of participating in the program (rather than physiological changes experienced) proved ameliorative in treating depression. It was felt that the decrease in schizoid traits and social introversion was a function of group involvement.

A study completed by Mallaghan and Pemberton (1977) of behavioral changes seen in 493 subjects after an acute myocardial infarction provides evidence which underscores the importance of taking into account one's psychological makeup when attempting to treat heart problems. Subjects were evaluated 12 to 18 months after discharge from hospitalization. A comparison was made of subjects on changes in smoking, weight loss, and physical activity, with measures taken from hospital records and home interviews. Psychological measures of neuroticism and extroversion were completed at the time of the interview using the Eysenck Personality Inventory. The majority of subjects followed their physician's advice to curtail or stop smoking as well as lose weight. This did not hold true, however, in increasing physical activity as was also recommended by treating physicians. Although there was no relationship between changes in behavior and extroversion scores, or the neuroticism scores and alteration of weight and smoking, neuroticism was found to be related to those who had either increased or decreased their physical activity. The increase in anxiety seen in those who altered their physical activity level was concluded by researchers to

indicate the importance of providing emotional support and encouragement for compliance with rehabilitation efforts so as to gain psychological benefit from an exercise program. Subjects revealed in the course of the interviews "that there was no sustained encouragement available to them once they had returned to normal life" even though they felt this could have assisted them in resuming "at least their precoronary levels of activity with confidence" (Mallaghan & Pemberton, 1977, p. 90). This study supports the findings shown in the previous investigation, that physical activity alone will not bring about improved psychological changes. The cardiac patient must believe he is gaining positive benefit from exercise for positive mental changes to occur.

An investigation completed by Birkui, Gianfrancesco, and Lesigne (1976) evaluated changes in heart patients' attitudes after a three month rehabilitation program. The 32 subjects who entered this medically supervised exercise program had experienced a myocardial infarction approximately three months prior to acceptance. All but one of the subjects were males, with mean age of 47 years. The participants exercised for 45 minute periods, two times a week, performing mass muscle movements which progressed in effort and speed depending on the individual's ability to tolerate stress. Physiological improvement in the subjects was demonstrated on pre- and post-treatment measures utilizing: chest x-ray, ergometric testing, electrocardiogram, blood pressure and heart rate. A questionnaire was completed at the end of the treatment. Patients were

overwhelmingly positive in their responses to the program, so much so that 88% indicated they would like to continue in supervised exercise indefinitely. Researchers stated that patient participation was "enthusiastic" due to their being able to achieve "rapid social reinsertion by the development of new relationships whether personal, familial, or professional" (Birkui, et al., 1976, p. 2294). The investigators concluded that for the majority the program served to be "indispensable" as they were able to learn a new style of living which assisted them in achieving the best state of physical health possible. Also noted was that as most subjects were able to return to their former occupations, their family life also improved. The researchers felt that the "psychological comfort given through physical training" allowed "patients to overcome distress from coronary attack" (Birkui, et al., 1976, p. 2291). The small sample size and lack of standardized psychological evaluations limit the strength of this study.

In clinical observations of cardiac patients one cardiologist notes that jogging "restores self-confidence" by improving "exercise tolerance, physical performance, and, most important, the quality of life" (Baisrub, 1978, p. 1385). Another physician suggests that "the emotional relief, provided by re-employment as well as the neurovegetative improvement of the 'coronary reserve' through general exercise practices' account for the improvement seen in cardiac patients' psychological functioning" (Kraus, 1961, p. 118). Several researchers caution that medical supervision is mandatory while the

heart patient exercises (Birkui, et al., 1976; Kraus, 1961; Carruthers, et al., 1976). They also note that the sooner the patient can be involved in exercise, the more assured his chances will be for rehabilitation (Kraus, 1961; Birkui, et al., 1976). Kraus (1961) urges, further, that exercise should be carried out in homogeneous groups as practice with healthy individuals would be detrimental to psychological readjustment (p. 127).

Summary--The Effects of Exercise on Cardiac Patients. It does appear that a supervised program of exercise has some merit in treating the psychological disturbance which accompanies coronary problems. All the studies reviewed indicate that much more research is needed to study the effect exercise has on psychological processes in recovering heart patients.

Several studies demonstrate that the psychological state of cardiac patients should always be taken into account by cardiologists in the treatment of their patients. Although the exact nature of the relationship between the improvement of psychological outlook and redevelopment of physical function has not been established, evidence does suggest that heart patients can experience improvement in these areas under certain conditions. It is important to attend to the psychological realm when providing rehabilitation programs for cardiac patients. Studies suggest that it is not physiological improvement alone which prompts positive mental change but, rather, the patient's belief that he has gained benefit from the experience.

### Effects of Exercise on Psychiatric Patients

While over the centuries a great many thinkers have suggested that there is a reciprocal relationship between the body and the mind, treatment programs for psychiatric patients have typically ignored the use of exercise in the remediation of emotional difficulties. ] [Until recently there has been "very little systematic study . . . conducted to determine whether there is a relationship between exercise and mental health" (Greist et al., 1979, p. 41). Some psychiatrists are now making claims that physical activity can help in a number of psychiatric ills, although they usually base their comments on subjective observations rather than on scientific data. ] In this section the research on the application of exercise as therapeutic treatment for psychiatric disorders will be examined.

The following section reviews 17 articles which attempt to examine the psychological effects of exercise on psychiatric patients. Four of these studies involved carefully defined populations, measures and control conditions (Rice, Rosenberg, & Radzysinski, 1961; Morgan, 1968; Gary & Guthrie, 1972; Dodson & Mullens, 1969). The study completed by Greist, Klein, Eischens, Faris, Gurman, and Morgan (1979) was empirical in nature but the sample size was small. Linton's study (Morgan, 1968) was also empirical in design but no mention was made as to how the psychiatric diagnosis of subjects was established. Morgan's (1970) study was empirical in nature but could have been improved if he had used control subjects from the normal population for comparison. Jones

and Best's (1975) empirical study fell short of meeting adequate standards because they did not statistically analyze their data. Thus, we have no idea as to whether their findings are indeed significant. Rajewski's (1978) study appears to have been designed empirically, however, as foreign measures have been used it is difficult to estimate the quality of the study. Klein and Deffenbacher's (1977) study, although empirically designed in other matters, failed to use measurements of established reliability and validity to determine the psychiatric diagnosis. The remaining seven studies represent nonempirical theoretical discussions based on informal observation (Martin, 1977; Orwin, 1974; Muller & Armstrong, 1975; Woodruff, 1977; Solomon & Bumpus, 1978; Portuondo & Landry, 1974; Pelosi & Friedman, 1974).

\* Schizophrenia. One psychiatrist, Thaddeus Kostrubala (Martin, 1977), has used running as a treatment for schizophrenia. He began this form of therapy with patients who had made no progress with more traditional forms. Dr. Kostrubala holds hourly running sessions, three times a week with his patients, following each run with group therapy. He states that changes in his patients have been "remarkable" and some were able to discontinue their medication (Martin, 1977). Dr. Kostrubala postulates that running "reawakens a body-mind harmony that man misplaced on his trek through the centuries to modern civilization" (Martin, 1977, p. 85). However, until more controlled studies of such claims become available his theory cannot be accepted as fact.

An investigation completed by Rice, Rosenberg and Radzysinski (1961) studied the relationship between the physical and mental states of schizophrenics to determine if poor physical fitness was a consequence of hospitalization or mental illness. Two groups were compared, the first composed of 59 male patients with diagnosis of schizophrenia, who had been hospitalized for a mean of 29.2 months. The second group was made up of 62 recently admitted males who also carried the diagnosis of schizophrenia. All subjects were administered a battery of tests devised to estimate physical fitness. By comparing muscular performance with lung capacity a Physical Fitness Index (PFI) was obtained. The mean for a normal population on the PFI is 100. Mean PFI for the newly admitted hospital subjects was 59.56. The long-term hospitalized patients obtained a mean PFI of 54.70. This difference was not significant. The investigators concluded that "there is a direct relationship between severe mental illness, schizophrenia, and a below normal level of physical fitness" independent of the effects of long-term hospitalization (Rice, et al., 1961, p. 144). One cannot imply a cause and effect relationship, either positively or negatively, but this does provide some supportive evidence of a link between mental and physical states.

The Schneider test of cardiovascular function was administered to a group of 99 schizophrenics by Linton (Morgan, 1968). He compared schizophrenic mean scores with that of 25 hospital staff members. A significant difference was found between the two groups.

The patients' scores fell 19% below that of the staff. It was concluded that "the Schneider score indicates a significant lowering of physiologic fitness in the schizophrenic patient" (Morgan, 1968, p. 124). Once again these results suggest that individuals who require hospitalization because of behavioral abnormalities labeled schizophrenic are typically less physically fit than "normals" while it appears that poor psychological function and poor physical functioning coexist, whether this is a causative relationship must be determined by further study.

Depression. Application of exercise programs in the treatment of depression has been studied by a number of researchers. [Greist, et al. (1977) compared the effects of running with psychotherapy when attempting to alleviate depressive symptoms in 15 female and 13 male patients. Subjects were randomly assigned to programs of either running ( $n = 10$ ) or psychotherapy ( $n = 18$ ). The Symptom Checklist--90 was administered to all subjects to measure the degree of depression.] Subjects assigned to the running group were evaluated with a maximal stress exercise treadmill test and a resting electrocardiogram, to see if they would be able to tolerate exercise.] The two treatments were provided to both groups for a period of 10 weeks. Members of the running group met in individual sessions with a leader who taught them running techniques but did not focus the discussion on psychological problems. Runners met, initially, three times a week. Sessions were cut to two per week at the fifth week, and one session for the seventh and eighth weeks. The last two weeks



subjects ran independently and averaged three hours a week of running during the entire 10 week period. The therapy group participated in weekly sessions of individual psychotherapy. Dropout rates were similar for both groups. Investigators found that "the running treatment was as effective in alleviating depressive symptoms and target complaints as . . . psychotherapy" (Greist, et al., 1979, p. 46). The cost of treatment differed significantly, the running program costing "a quarter as much to administer" than psychotherapy (Greist, et al., 1978, p. 259). Several possible hypotheses were offered to explain the improvement noted with running. It was felt that subjects gained "a sense of success and mastery," learning that they could "change themselves for the better" which generalized to other areas of their lives (Greist, et al., 1979, p. 48). Investigators postulated further that physical activity seemed to dissolve "symptoms of anger and anxiety as well as depression" (Greist, et al., 1979, p. 49). Running appeared to enable subjects to develop a tolerance for frustration. Some cautions were noted by the investigators. As the study had concentrated on those with moderate depression, results should not be applied, without further study, to those suffering from more severe depression. The importance of building running programs tailored to the individual was stressed to minimize failure and thus prevent reinforcement of "hopeless, helpless, and worthless" feelings (Greist, et al., 1979, p. 52).

A group of Polish psychiatrists have used "psychomotor exercises" to treat patients diagnosed with endogenous depression (Rajewski, 1978, p. 382). Their results indicated a reduction in symptoms and "improvement of the general state of mind" (Rajewski, 1978, p. 382). Vegetative behavior decreased and patients reacted more readily to stimulation. The investigators concluded that exercise could serve an important function in treating those with endogenous depression, especially during the early phase of rehabilitation.

Morgan (1968) studied a group of 69 male psychiatric patients with mean age of 36 years. He had observed that an overwhelming number of medical patients were plagued with "illnesses that are primarily emotional in nature" most of these being "depressive disorders" (Morgan, 1968, p. 1037). Morgan measured an assortment of psychologic variables in hopes of finding some way to differentiate depressed patients through their physical state. The Depression scale of the Minnesota Multiphasic Personality Inventory along with Zung's Self-Rating Depression Scale were administered to all subjects. Although no other measures of physical endurance when comparing depressed and nondepressed patients correlated with high depression scores, the finger ergometer endurance scores did. Morgan concluded that the significantly lower scores were a reflection of the depressed patient's affective state rather than an estimation of physical competence (Morgan, 1968, p. 1042). The similarity of physical measures indicates that although the depressed patient feels

less physically able, his tolerance for exercise is equivalent to those in the normal population.

More recently, Morgan (1970) evaluated 15 female patients to investigate further the relationship between physical state and depression. Subjects were volunteers, nominated by their psychiatrists based on the stipulation that they had no physical impairments. The subjects had a mean age of 31. Physical working capacity was measured by means of strength of grip and heart rate response to a five-minute bicycle ergometer test. The patients were administered Zung's Self-Rating Depression Scale. Significant depression was found in nine of the 15 females on this measure. When comparing the nondepressed with the depressed subjects, physical work capacity was not significantly different. Morgan suggests that although many depressed patients complain of inability to work and feelings of weakness, this does not mean they actually lack the muscular strength to do so. He concludes that the "psychomotor retardation found in the depressed patient" was a consequence of psychological rather than physical states. For some reason Morgan did not compare the physiological measures of his depressed patients with the normal population. As other studies have noted a general decline in the physical ability of psychiatric patients it might be of more value to study depressed patients in contrast to those without psychiatric problems. Not having this data available serves to confuse rather than clarify this issue. In any event, it seems that the investigator's claims are premature and until such time that further

evaluation can be carried out, using the normal population as control group, Morgan's findings should not be applied as fact.

Anxiety States. Researchers are now using running as means by which to treat phobic states. Orwin (1974), in a recent journal article, relates the case of a woman with an unusual situational phobia which was successfully eliminated by utilizing "the autonomic excitation caused by the vigorous physical exertion of running, to compete with the anxiety response" (Orwin, p. 95). This 24 year-old woman had been restricted by her fear of high level lavatory cisterns since the age of two. In five sessions the phobia was removed. The patient exercised vigorously, running until she was out of breath. The feared object was then presented in successively closer proximity until the patient could tolerate it without anxiety. Orwin proposes that the treatment was effective as a remedy for the phobia because, as the anxiety provoking stimulus is presented, the usual response of fear is being inhibited by fatigue. The physiological system places metabolic demands on the body as a consequence of exertion. At the cognitive level the patient is unable to detect anxiety "in the prevailing autonomic excitation" (Orwin, 1974, p. 97). According to Orwin "muscular activity is equated with an autonomic nervous system in a post anxiety" state (Orwin, 1974, p. 97). This form of treatment is relatively inexpensive to administer according to the author. He does call, though, for further research as he has applied this method to only a small number of patients thus far.

Muller and Armstrong (1975) report the use of running therapy with one phobic patient they had treated. The patient was able to gain control over the internal events which occurred when he became fearful, with the running method described by Orwin. To augment the running therapy the investigators also assisted the patient in gaining control over the external events associated with her fear by teaching her how to better handle the feared situation when it occurs. The investigators explained their patient's reinterpretation of her aroused physiological system according to Festinger's cognitive dissonance theory. The patient, instead of connecting her state of arousal to panic, attributed it to the running experience. They concluded that if "an individual can perceive and interpret some outer 'reality' differently, he may be able to adjust the interpretation of his inner reality (emotional experience) accordingly" (Muller & Armstrong, 1975, p. 387).

Woodruff (1977) has outlined a variety of physical exercises which he employs in the treatment of hospitalized psychiatric patients who were "tense, nervous, and apprehensive" (Woodruff, 1977, p. 113). In his clinical observations of patients he had noted the deleterious effects of the patients' separation from their families and the disruption of living patterns which accompanied hospitalization. Woodruff sought to find ways to encourage social interaction so that patients would not deteriorate further. These patients had had little opportunity to engage in "experiences leading to increased self-esteem and social skills" (Woodruff, 1977, p. 115)

because of low treatment budgets. Woodruff found that a large number of patients could be "treated" at the same time with exercise and he describes a variety of positive consequences. Communication was increased between the staff and patients. Anxious patients were able to relax through fatigue of muscles. Woodruff noted more integration between body movements and emotional expressions stating that feelings "generate impulses to movement; conversely movement can induce changes in feeling" (Woodruff, 1977, p. 117). He observed a reduction in excessive activity as well. Patients were given a chance to gain positive feedback and could experience a feeling of success uncommon to hospital life. Woodruff cautioned that as he had not yet been able to perform a scientific study of the effects of exercise with anxious hospital patients and his observations should not be applied as fact. They do present evidence to prompt further research, however.

Solomon and Bumpus (1978) describe a therapy combining meditation with running as a treatment for patients who suffer from anxiety attacks. They utilize a long, slow, distance approach to running so as to enable their patients to maintain the activity for at least one hour at a time. Meditation was used "for activating the relaxation response" (Solomon & Bumpus, 1978, p. 586). The patient exerts himself until he reaches an altered state of consciousness which the investigators claim brings about "a beneficial catharsis of anger, tension, stress, frustration" (Solomon & Bumpus, 1978, p. 588). They have observed a concomitant decrease in resistance to

therapy. The investigators conclude that running assists the patient in gaining a sense of self-mastery of psychological states as a consequence of developing control over their physiological systems. Once again the authors have employed no objective measures to support their statements of positive gain and their conclusions should be given the weight of an interesting theory until data can be collected to support them.

Alcoholism. Gary and Guthrie (1972) employed jogging in the treatment of alcoholics after noting the poor bodily state of their alcoholic patients. It is their contention that inadequate physical fitness both produces and is a product of alcoholic behavior. With this in mind, the investigators decided to employ a method by which they could assist their alcoholic patients in building up their physical states with the expectation that self-concept would improve, thus reducing the need to drink. Twenty male volunteers were equally divided into a control and an experimental group. Electrocardiograms were used to determine capability for exercise. Before beginning training, all subjects were administered the Jourard Body-Cathexis and Self-Cathexis Scales, the Gough Adjective Check List and the Schneider Physical Test. Logs were kept on drinking and sleeping behavior through the course of the study. Patients in the experimental group ran one mile a day, five days a week for four weeks, while the control group continued their usual activities. The investigators found a significant improvement in the physical fitness of the experimental group after completion of the training program,

when comparing them to the control group. Prior to initiation of training both groups scored in the "poor" range of fitness; after training the experimental subjects brought their level of fitness into the "average" range. Experimental subjects improved significantly over the controls in their self-evaluation. This did not, however, affect their drinking patterns which showed no change in pattern as was the case with controls. Sleep disturbance in the experimental group significantly dropped, with no change in the control group. Although jogging appeared to have little impact on the experimental group's intake of alcohol the investigators did feel that this form of exercise has value in treatment. They concluded that participation in such a program could "prove to the alcoholic with low self-esteem that he can show dramatic improvement in one month in an important area of his life" (Gary & Guthrie, 1972, p. 1077). This form of treatment should be given further consideration based on the evidence presented. Longitudinal studies could provide further information as to the effects of jogging in alcoholics over time. The time scope of this study may have been too small to reveal any impact on drinking behavior. Conversely, jogging may serve to further solidify the alcoholic's habit and discourage change due to the improvement in his self-view irrespective of alcoholic intake. One such conceivable possibility is that an alcoholic may feel less guilty about drinking if he or she exercises.



Children's Disorders. Some researchers have noted that exercise, when applied to children, has an impact on aggressive behavior. Portuondo and Landry (1974) utilized instruction in judo as means of treating a group of 50 "emotionally disturbed" girls and boys in a state psychiatric hospital. It was their feeling that as judo is a highly structured, ritualized sport it could be used with aggressive children "to control their hostility and to channel it in a constructive, socially acceptable way" (Portuondo & Landry, 1974, p. 651). Children were selected by referral from their primary therapist. The group, composed of 14 females and 36 males were studied for one month's time by way of clinical observation. Their general behavior, adaptation to groups, and performance while in judo class were noted. The investigators observed an improvement in the behavior of the 40 children studied; the record of fights instigated by the subjects clearly showed a decrease.

Pelosi and Friedman (1974) also examined the use of exercise as a valuable adjunct in the treatment of aggression in children. Seven males between the ages of 11 and 13 were studied to see if a 40 minute period of structured activity would affect their behavior in a group therapy session which immediately followed. Clinical observation was the dependent measure. On the basis of their impressions Pelosi and Friedman concluded that organized activity can serve as "an outlet for physiologic energy" thus providing a "more useful route and a more comprehensive approach" to deal with aggressive impulses (Pelosi & Friedman, 1974, p. 288). The investigators also

observed facilitation of group solidarity and cohesion. Subjects appeared to display their feelings more freely following exercise which greatly improved communication during group sessions.

These two informal studies offer suggestive evidence that physical activity might have merit in the reduction of aggression for a child psychiatric population. Such data, although subjective, should prompt further study.

Hyperactive children were chosen for study by Klein and Deffenbacher (1977). Their purpose was to determine the efficacy of relaxation training and exercise in the reduction of purposeless movement and in the improvement of cognitive function. Twenty-four hyperactive boys were assigned to one of four treatment groups: large muscle exercise, muscle relaxation, attention-placebo control, and no-treatment control. A fifth control group, made up of eight nonhyperactive males, was given no treatment. The treatment groups participated in five 20 minute, individual sessions in a period of three weeks. The exercise group was given instruction in strenuous physical training and the relaxation group provided directions in relaxation, as devised by Wolpe and Lazarus. The final treatment group worked individually with clay. No treatment was provided the two control groups. Upon completion of training subjects were administered the Continuous Performance Task and Matching Familiar Figures Test. Prior to testing, the relaxation and exercise subjects employed methods learned during training. Significant differences were found when comparing errors made on Matching Familiar Figures.

Investigators note that the nonhyperactive control, relaxation, and exercise groups were significantly more accurate than both the attention-placebo and untreated hyperactive groups. They conclude that both exercise and relaxation can be employed to improve cognitive function in hyperactive males. However, as no pretraining testing was performed these results may be affected by pre-existing differences in ability rather than solely an effect of training.

Four autistic children, ranging in age from two to ten years, were studied by Jones and Best (1975) "to establish the value of a physical activity programme in the treatment of autism" (Jones & Best, 1975, p. 15). Prior to initiating treatment subjects were evaluated with the Merrill-Palmer Mental Test, Frostig Developmental Test of Visual Perception, Peabody Picture Vocabulary Test, Fels Behavior Rating Scale, Gunzburg Progress Assessment Chart of Social Development, and the Purdue Motor Development Scale. Videotape recordings of fine and gross motor tasks were made to determine performance level. The subjects were also examined to evaluate their ability in the physical activities to be taught. Subjects were given swimming and movement sessions, an hour and one half a week, for a period of 10 weeks. Upon completion of training the children were retested with all measures administered before initiating the treatment. Subjective appraisals of each child's behavior were obtained from parents, and an occupational therapist not involved in the experimental procedures. After comparing data obtained in both testing sessions investigators found that every "subject improved his

performance on the social, cognitive, motor and behavioural development tests and showed an increase in his repertoire of motor skills" (Jones & Best, 1975, p. 29). Subjects appeared to benefit most in body imagery, form perception and motor coordination. However, because the number of subjects sampled was small the findings, while encouraging, cannot be applied as fact without further validation using larger groups and comparisons made with controls.

Hospitalized Patients. A study completed by Dodson and Mullens (1969) evaluated the effect of two different types of exercise programs on psychiatric patients hospitalized for a variety of mental problems. Eighteen patients, four women and 14 men, were referred by Veterans Administration Hospital staff based on the criteria that they "could tolerate jogging, and would benefit if they had increased endurance" (Dodson & Mullens, 1969, p. 130). The investigators had observed that many of their patients returned to the hospital because they felt they could no longer continue working because of lack of stamina. In their review of treatment programs which were purported to build strength, they determined that jogging was the most efficacious means of achieving this goal. Prior to initiating a treatment program both physical and psychological measures were taken which included blood pressure, respiration and pulse rate, along with the Minnesota Multiphasic Personality Inventory, Draw-A-Person Test, Personality Orientation Inventory, Semantic Differential Scale and the Autokinetic Index. Each subject was exposed to a variety of treatment programs which lasted three weeks each. Patients first

occupied themselves in usual activities while going through the control stage. Two following stages provided subjects the opportunity to participate in light exercise which did not elevate their pulse rate to significant levels. Subjects were given individualized programs, each with a different sequence of light exercise stages and jogging stages. The patients exercised five days a week while involved in treatment phases. After completion of a stage the subjects were readministered psychological measures. Physical evaluations were completed on a weekly basis. Investigators found that physical fitness improved after jogging and had varying effects with light exercise, which failed to maintain the levels achieved with jogging. The MMPI results indicated a reduction in body tension and concern for bodily processes during the jogging phase, as evidenced by significant decreases on Hypochondriasis and Psychasthenia scales. Decreased "hostility and increased manifest anxiety" was noted with light exercise as well as "the elimination of thoughts that draw attention away from the present" (Dodson & Mullens, 1969, p. 132). Jogging, on the other hand, brought about a change in focus of attention to the present. No other significant changes were found on the psychological instruments. In observing patients six months after completion of the study these investigators found that 44% had left the hospital, even though their average length of hospitalization had been 5.7 years. These findings do indicate that physical activity can have important social impact on the behavior and psychological functioning of hospitalized patients. However, since changes

may also be due to factors unrelated to the actual physiological process of exercise, further research applying a variety of treatment methods with different groups could serve to substantiate the claim of palliative benefits to psychiatric patients from exercise and running.

Summary--Effects of Exercise on Psychiatric Patients. Based on the studies reviewed, it appears that exercise may have some value in the treatment of psychiatric illness. ] Although claims of great improvement have been made, not enough carefully completed studies have yet been done to state that physical activity is a proven helpful treatment for schizophrenia. ] [ For depressed patients, improvement has been seen in the mental state of some patients studied following exercise programs. ] Although few formal investigations have been completed with anxious patients there is evidence that they, too, show a reduction in symptoms as consequence of physical activity. ) Applying short-term exercise programs researchers have found improved ability to deal with aggressive impulses, sociability, cognitive function, and motor coordination in autistic and hyperactive children. Changes noted in alcoholic patients after participation in an exercise program call for careful study and further replication so that a determination can be made as to whether findings are consistent.

Application of exercise treatment to alcoholics should proceed slowly as the response observed so far may, in improving the patient's affective functioning, further entrench his drinking habit. Longitudinal studies could be invaluable in providing information on the

impact of treatment which might not have been observable in a short period of time. Future research with children should focus on the possible value of exercise as means by which to reduce aggressive impulses and improve concentration and self-regulation. At present a small number of autistic children appear to have made gains in their developmental growth through activity; this finding demands the further attention of researchers. Studies focusing on the physical fitness of mental patients consistently show a relationship between lowered physical fitness and psychological malfunctioning (Gary & Guthrie, 1972; Morgan, 1968; Murphy, Bennett, Martin, & Hagan, 1972; Dodson & Mullens, 1969; Rice, et al., 1961; Greist, et al., 1978; Morgan, 1969). This finding warrants further clarification.

Given the present state of the art it is premature at this time to begin applying exercise as a newfound "cure-all" for mental and emotional dysfunction. Even now the promoters of exercise and running are making extravagant claims for the psychological value of this activity. However, scientific restraint is called for to prevent an overeager application of preliminary findings which suggest certain types of exercise programs produce certain kinds of positive consequences in certain kinds of emotional disturbance. Lack of such objectiveness could hinder the proper utilization of a treatment modality which has the potential to be a primary and/or adjunct treatment for psychological problems.

### Effects of Exercise on Normals

Studies reviewed thus far have reported on the impact of exercise on specific groups, with responses related idiosyncratically to each. More recently efforts have been made to view the reaction of a normal population to physical activity. Many popular books have been written lately, touting the value of consistent exercise in improving one's life, health, mood, sexual function and self-esteem. The philosopher of long-distance running, George Sheehan, claims to have discovered in this pursuit "my body, my play, my vision and eventually a new life. I found my truth" (Sheehan, 1978, p. 99). Mildred Cooper discusses the more practical consequences of running urging women to participate in the sport not only to improve their physical system but also to fight off "psychological trauma" (Cooper, p. 35). Joel Henning discusses the "therapeutic effects" of "holistic running" which are accomplished when one gets "beyond ordinary consciousness" (Henning, 1978, p. 10). William Glasser (1976) urges people to develop their character with his method, designated in contradictory terms as "positive addiction."

In response to the running-exercise boom people across the country are eagerly jogging without looking at the claims of benefit in an objective fashion. Few stop to question how "a compulsive physiological need" (Webster, 1979, p. 13) can be positive. Fortunately, some researchers are reviewing such assertions in hope of sorting fact from fiction, sensationalism from rational truth.



The Effects of Exercise on State Measures in the Normal Population.

In our increasingly mechanized society with its accompanying frustrations and pressures, many people try to adjust their systems to the heavy stress load without attending to the external causes of problems. They attempt to force their physiological systems to absorb the stress created by modern daily life much as one might fit into the proverbial procrustean bed. Following this mode of thinking, investigators have approached exercise as a means of helping "normal" people cope. When speaking of the "normal" population reference is being made to the majority of "individuals who often appear to function 'normally' in major life roles and may or may not manifest symptoms and signs of emotional distress" (Greist, et al., 1979, p. 42).

Any increase in emotional stress can be observed clearly; it is expressed by a variety of physiological changes (Benjamin, 1978; Ulrich, 1960; Spreads, 1977). Not only are immediate changes apparent, involving the circulatory and cardio-respiratory systems with metabolic, body chemistry, and temperature alterations, but under long periods of exposure to stress permanent physical destructive effects can be seen (Ulrich, 1960) which can "result in extensive malfunctioning of the body" (Spreads, 1977, p. 21). Seeing the effect of mental processes on the physical system investigators are now striving to determine if the converse is true. Researchers have, as a consequence, focused on the use of exercise as a possible intervention technique with the more transitory aspects of anxiety.

In general, stress reactions fluctuate as time passes and are "characterized by subjective, consciously perceived feelings of apprehension and tension, accompanied by or associated with activation or arousal of the autonomic nervous system" (Layman, 1974, p. 53).

Estimations have been made that general practice physicians and internists currently treat stress-related disorders which make up from 30 to 70% of their total patient load (Morgan, 1979, p. 2). A survey of 439 physicians revealed that 98% of the doctors "believe that moderate exercise helps to give relief from tension" (Byrd, 1965, p. 238). However, this response was supported in only a few cases by actual clinical observations made by the physicians. Without support from more objective measures, an astounding 93% actually had prescribed physical activity as treatment for tension. Application of this intuitive "knowledge" has prompted the development of a more responsible attitude such that investigators are now beginning to use scientific methods to estimate the value of exercise in reduction of anxiety related symptoms.

The following section reviews 13 articles which attempt to examine the effect of exercise on state measures taken on normal subjects. Eight of these studies were empirical research involving carefully defined populations, measures, and control conditions (Massie & Shephard, 1971; Bahrke & Morgan, 1978; Morgan, Roberts, Brand, & Feinerman, 1970; Morgan, Roberts, & Feinerman, 1971; Wood, 1977; Driscoll, 1976; Folkins, Lynch, & Gardner, 1972; Folkins, 1976). The bulk of the studies, however, cannot be truthfully said

to represent the normal population as subjects consist of professors (Morgan, Roberts, Brand, & Feinerman, 1970; Morgan, Roberts, & Feinerman, 1971), college students (Wood, 1977; Driscoll, 1976; Folkins, Lynch, & Gardner, 1972) and those identified as high-risk for the development of coronary problems (Folkins, 1976). Two of these studies were empirical in nature but failed to use measures with established validity and reliability (Girodo & Pellegrini, 1976; Roberts, 1978). Morgan's (1979) study did not adequately define the population studied nor did he provide adequate controls. Although at first glance it appears that Carter (1977) may have made an attempt at empirical research, he does not complete a random sampling, use physiological measures to validate subject's claims of fitness, nor use objective measurements. Spread's (1977) article represents a nonempirical theoretical discussion based on informal observation.

Morgan (1979) studied the response of 40 males to a 45 minute physical workout. Subjects were administered the State-Trait Anxiety Inventory prior to exercise, immediately following, and 20 to 30 minutes after termination of exercise. Results showed a slight increase in anxiety immediately following exercise but a significant and substantial decrease in anxiety after 30 minutes. Especially noteworthy was the finding that "high-anxious individuals experienced a significant reduction in state anxiety" (Morgan, 1979, p. 4). Similar findings were obtained in a second study by Morgan (1979) of 15 adult males. Morgan concludes that anxiety reducing effects of

vigorous exercise warrants further evaluation to determine the nature of the relationship.

Another study (Wood, 1977) evaluated the response of 62 college males and 44 females to a 12 minute run. The State-Trait Anxiety Inventory was administered prior to and after completion of running. The subjects were representative of a normal population on the anxiety dimension measured. Results revealed a statistically significant reduction in state anxiety for males (Wood, 1977). Both high anxious males and females evidenced a significant reduction in anxiety after the run. However, low anxious male and female subjects became significantly more anxious. Wood (1977) concluded that this differential response could be seen as the consequence of aggression catharsis. With the occurrence of aggression while anger is absent, the tendency is for increased aggression. However, when "aggression occurs in the presence of anger, there is a cathartic effect, that is, a decrease in the tendency to aggress" (Wood, 1977, p. 69). This variable response to exercise points to the need for careful screening before prescribing physical activity as a palliative measure.

Bahrke and Morgan (1978) studied a variety of treatments as possible means of bringing about a reduction in anxiety with 75 adult male volunteers who exercised regularly. Subjects were randomly assigned to one of three groups: meditation, exercise, or a quiet rest (control) treatment. Anxiety was evaluated both before and after treatment with the State-Trait Anxiety Inventory. The exercise

group spent three minutes in warm-up exercises prior to walking at 70% of their self-imposed maximal heart rate on a motor-driven treadmill. Psychological measures were taken immediately upon termination of exercise as well as 10 minutes later. The meditation group was instructed in the Relaxation Response, practicing the technique in a recliner. The controls rested in a quiet room for 20 minutes. The results showed a significant decrease in state anxiety for all three treatment groups. In combining the three groups and reclassifying them as high and low-anxiety based on initial testing, investigators found that "mean state anxiety values decreased significantly in both the high trait anxious and in the low trait anxious subjects" (Bahrke & Morgan, 1978, p. 327). State anxiety in the two groups showed a significant reduction in the high-anxious group, however, there was little change in the low-anxious group. Physiological measures taken on the meditation and control groups while in treatment displayed identical responses. The investigators conclude that this "evidence suggests that acute physical activity, noncultic meditation, and a quiet rest are equally effective in reducing state anxiety" (Bahrke & Morgan, p. 331). These results suggest that all three treatments could be used with normal persons as well as highly anxious subjects to reduce anxiety.

Girodo and Pellegrini (1976) studied 20 high-anxious and 20 low-anxious subjects, as differentiated by the Manifest Anxiety Scale, to determine if physical activity might have an impact on the perception of anxiety. One-half the subjects were randomly assigned to the

exercise treatment group and the rest to an inactive control group. Both groups were shown a film of industrial accidents while being monitored for respiration rates. The exercise group subjects pedalled a stationary bicycle, while the inactive group sat in a chair. After viewing the film subjects were evaluated regarding the level of anxiety they developed while watching the film, as well as questioned to determine if they had attended to the information presented in the film. Results indicated that the high-anxious subjects reported more anxiety than the low-anxious ones. Those in the inactive group admitted to greater feelings of anxiety than those who had exercised. There was no significant difference revealed between groups in recall of information. The researchers concluded that "physical activity has the effect of decreasing the subjects attending to their internal bodily state" and thereby prevented them from sensing their internal reaction to the anxiety-provoking incidents viewed (Girodo & Pellegrini, 1976, p. 934). This study offers some theoretical explanation as to why physical activity appears to bring about a change in anxiety level, however, further investigation needs to be carried out before these observations can be viewed as fact.

Driscoll (1976) utilized a combination of physical activity in conjunction with the presentation of positive images to determine if a reduction of anxiety could be achieved by this method. Four treatment conditions were evaluated using exertion plus the positive image procedure, exertion alone, positive images alone, as well as minimal

treatment. Two other groups of subjects were placed in either a desensitization or control group. Subjects were volunteer college students who were evaluated by questionnaire assessing apprehension, debilitation and physiological components of anxiety. Subjects were asked to estimate their enjoyment of physical activities as well. The questionnaire was completed prior to treatment, and again shortly after treatment and after mid-term examinations. During the final testing, subjects were questioned as to their anxiety during the mid-term exams. Sixteen highly test-anxious subjects were assigned to each of six treatment groups. The method used to elicit anxiety was presentation of the most anxiety-arousing scenes the subjects had rated during the pre-testing. Positive images were ones chosen individually, involving situations in which the subject felt relaxed and confident. The physical activity was a vigorous run in place until the subject began to tire, at which time anxiety-arousing and positive scenes were presented in alternation. Subjects would then rate the level of anxiety felt and the realism of scenes. The minimal treatment had subjects tense and relax shoulder muscles twice, so as to provide some believability to this intervention. Subjects involved in these four treatment conditions were given two sessions each. The systematic desensitization group listened to two tapes in each of two sessions and were taught relaxation techniques. Test-related scenes were presented to the subjects arranged in hierarchical order with relaxation interspersed. The control subjects completed all testing without intervention. Results showed

significant differences from pre-treatment, with exertion in combination with positive images being equivalent to taped desensitization, and these two treatment groups "substantially more improved than even the minimal treatment control or the untreated control group" (Driscoll, 1976, p. 92). Scores received by both exertion groups demonstrated a more significant reduction in anxiety than the equivalent group not involved in exercise. When comparing grade point averages of subjects for the semester prior to treatment with those obtained during the semester of treatment, corresponding improvements were observed with the more effective anxiety treatments. In analyzing the physical enjoyment scale it was found that exertion, when combined with positive images, brought about improvement of enjoyment scores. However, when exertion was carried out alone this caused enjoyment of physical activity scores to decrease. Results of this study indicate the effectiveness of exercise in the reduction of anxiety, especially when done in concert with positive conditioning. This treatment, equivalent in effectiveness to a program of systematic desensitization, takes about one-fourth the time to complete. Driscoll advises that further study is needed to determine if this method can be applied to the treatment of other anxiety-related disorders.

Spreads (1977) discusses the importance of "Physical Re-Education" as a procedure by which to break the "vicious circle" caused by anxiety and consequent disturbances in body function. She advises that poor body habits (stiff muscles, shallow breathing, and



flabbiness), accompanying anxiety established as a result of physiological changes produced to meet emergencies, create more tension thus reinforcing the cycle. Spreads compares Physical Re-Education to psychoanalysis stating that it "strives to bring forward into consciousness an awareness of habits and functioning which are now unconscious" (p. 23). This method teaches how to focus one's attention on the body and learn to use the physical system in more natural ways, devoid of interference from the habits developed when anxious. The author provides data collected in observations of a variety of people discussing the importance of breathing and experimentation with movement. In the article reviewed, however, no objective data was provided and the method only crudely presented, Spreads noting it is extremely difficult to explain in words.

A number of studies have been completed whose focus extends beyond anxiety, encompassing a wide range of mood states, and looks at the effect of physical activity on a particular mood. Folkins, Lynch, and Gardner (1972) studied college students enrolled in two physical education classes. The groups were evenly divided between sexes and classes. The control group was composed of 42 archery and golf students who were not involved in strenuous physical activity. The 42 subjects who made up the experimental group had not been involved in exercise prior to enrolling in this running/jogging course. All subjects were administered psychological measures before and after treatment including two scales from the Adjective Check List, anxiety and depression scales of the Multiple Affect Adjective

List, as well as two self-rating scales of work efficiency and sleep. The experimental group subjects were evaluated on physical measures prior to treatment and afterwards as well, by means of their time to complete running a 1.75 mile course and resting heart rate. The experimental group met twice a week for 32 sessions. The first three sessions involved lectures explaining aerobics and were used to "instill a positive attitude toward the running experience" (Folkins, et al., 1972, p. 504). Running and jogging abilities were developed gradually in a systematic, progress program, with an average distance of three miles being completed each session. The control group subjects met twice a week and were led in archery and golf training by the same instructor who led the experimental group. One weakness of the study is that no physiological measures were taken on this group. The results of treatment showed significant improvement on physiological measures for women with a general improvement for men, the total group moving from a poor to fair-to-good category of physical fitness. Psychological testing revealed that the experimental and control groups were different from the outset, with those who had enrolled in the experimental group admitting to more psychological disturbance. Female experimental subjects were significantly more depressed, anxious, less well adjusted, and less self-confident than control subjects. Male experimental subjects were less self-confident than controls at the outset. No change was evidenced in pre- and post-testing on psychological variables of control subjects. Experimental males also did not display significant changes on

psychological measures, however, females significantly improved on measures of depression, self-confidence, adjustment, and work efficiency. Also noted was that as the subject's heart rate decreased, so, too, did the measure of anxiety. As male subjects displayed a much higher level of physical fitness from the outset, the authors concluded that "those who are in poorest physical and/or psychological condition will show the greatest improvement, both physiologically and psychologically" (Folkins, et al., 1972, p. 507).

A study of 36 males (Folkins, 1976), identified as high risk by police and fire departments for the development of heart problems, was carried out to determine the impact of thrice-weekly exercise sessions on physiological and psychological functioning. Two groups were randomly formed with 18 participating in the 12 week exercise program, and the 18 control subjects refraining from changing previously established exercise habits for the duration. All subjects were evaluated as to blood pressure, lipid measurements, and cardiovascular capacity prior to initiating treatment and again afterwards. Psychological measures were also administered according to this schedule. Measurements included the anxiety and depression scales from the Multiple Affect Adjective Check List, the self-confidence and personal adjustment scales of the Adjective Check List, and the Secord and Jourard Body Cathexis Scale. A significant improvement in fitness was observed in the treatment subjects. No pre-post changes were observed on the Check List or on psychological variables in the control group. The exercise subjects, after

treatment, decreased significantly on depression and anxiety measures with no change on other variables. The investigator concluded that findings were in line with those of previous studies, showing that changes occurred on state but not trait variables of psychological function.

A study (Morgan, Roberts, Brand, & Feinerman, 1970) of male college professors was recently carried out in an effort to determine if a link exists between physical characteristics and depression, as well as to evaluate the use of physical activity in treating depressive states. This group of 101 men was tested on a variety of physiological measures, along with the Zung Self-Rating Depression Scale. Four groups were formed, with subjects having the option of exercising by way of jogging, swimming, circuit training, and treadmill running. A fifth group of control subjects was made up of those who were unable to exercise because of conflicts in scheduling. All treatment subjects exercised three times a week for six weeks, in approximately half-hour sessions. Subjects attempted to maintain a level of physical activity in which they reached 85% of predicted maximum heart rate. Results of the study show that "depression was not significantly related to age, height, weight, percent body fat, strength of grip, or physical working capacity" (Morgan, et al., 1970, p. 216). The exercise program failed to bring about significant changes in depression when viewing the entire treatment group. However, scores of those who were depressed on initial testing did show a significant decrease. In clinical observation of subjects the

investigators noted that many nondepressed subjects made statements indicating they felt better as a consequence of exercise. This study supports the theory that improvement on state measures is seen in those who display a greater amount of psychological disturbance.

Two experiments were carried out by researchers (Morgan, Roberts, & Feinerman, 1971) to determine if acute physical activity would have an impact on anxiety or depression levels. In the first study, 120 college professors were randomly assigned to treadmill or bicycle ergometer tasks. Within groups, subjects were assigned to one of four levels of exercise conditions leading to terminal heart rates in exercise of 150, 160, 170, and 180 beats per minute. Upon reaching the level randomly assigned, the subject rested five minutes, then electrocardiogram measures were made. The Depression Adjective Check List was administered afterwards. Results did not demonstrate any significant differences for exercise on depression as "the four work loads were not associated with differing levels of depression" (Morgan et al., 1971, p. 423). The second experiment viewed the impact of two levels of exercise on 36 male and female students, randomly assigned. A treadmill was used for treatment groups; the control subjects rested for equivalent period of 17 minutes. Upon termination of treatment pulse was taken and the IPAT Anxiety Battery as well as Depression Adjective Check List were completed. No significant differences between groups or sexes were noted. Investigators observed that many treatment subjects stated they felt better after exercise. They concluded that although data

collected disputed the common belief that "acute" exercise improves psychological states "perhaps psychometric instruments were not sensitive enough to measure psychologic changes" (Morgan, et al., 1971, p. 425). This study might have been improved with pre-exercise testing to determine, if, as in previous studies, more change is achieved with those displaying more anxious and depressive symptoms.

Massie and Shephard (1971) compared the effectiveness of two types of exercise programs in bringing about physiological and psychological changes. The first group was made up of 38 volunteers recruited through advertisement by means of the Ontario Heart Foundation. These subjects participated individually, following suggestions from a book on aerobics distributed to all members, and logged their activities. The second group was composed of 11 members, enlisted from a beginning gymnasium exercise program. Subjects met three times weekly for 40-45 minute sessions, also keeping logs of their activities. Extensive physiological testing was performed prior to initiating treatment, at the mid-point, and upon completion of 28 weeks of participation. Psychological testing included a measure developed to estimate attitude toward physical activity and body image. The Taylor Manifest Anxiety Scale, McPherson Semantic Differential and Maudsley Personality Inventory were also administered. Both groups displayed expected improvements in physiological functioning. The independent exercisers changed significantly on only one variable, developing a more positive attitude toward sport as a thrill with risk. The group exercisers

became significantly more extroverted and less neurotic. Their attitudes toward games of chance as well as mood states also improved. The investigators concluded that the change in extroversion and neuroticism, not supported by previous research, was a function of increased social contact. Although the Taylor Manifest Anxiety Scale did not indicate parallel changes in mood as did the other measure used, alteration in mood was supported by questioning, and a reduction in absenteeism, according to the researchers. They attributed the greater impact of group exercise over individual exercise on psychological states as reflective of the social process, indicating this should be given consideration when improved psychological functioning is the objective for exercising.

A study was completed by Carter (1977) to estimate the effect of physical activity on happiness. The researcher developed a questionnaire which collected information on: physical activities engaged in, length of time spent on them per month, physical characteristics, an estimate of health, along with questions regarding the informant's level of happiness. While respondents from a variety of backgrounds were included, they were not randomly chosen. Questionnaires were received from 216 out of 222 adults. Aerobic values were assigned to activities each individual regularly engaged in. After analyzing the data Carter indicates that there is a definite relationship between those who exercise regularly and happiness, "72.1% of those rated very happy were individuals maintaining an optimum level of physical fitness" (Carter, p. 311). He suggests that greater happiness is a

consequence of physiological changes which occur during exercise. Carter postulates that an increase in oxygen consumption may "stimulate the limbic area of the brain which has a central role in the generation of affective feelings" (Carter, p. 312). He also points to the possibility that one feels happy when one has a greater sense of self-control. Physiological measures of subjects were not made and exercise programs were not monitored, hence, whether those who claimed to be regular exercise participants were actually physically fit can only be assumed, thus weakening the study. The importance of taking objective measures of physical fitness is brought out in the next investigation.

Roberts (1978) gathered information regarding physical activity in relation to mood states, in an effort to explain the contradictory findings observed in studies previously mentioned. A sample of 41 subjects was evaluated, made up of 21 males and 20 females recruited through churches. The investigator carried out personal interviews which gathered demographic data as well as "inquiries into the degree of physical fitness, physical activity, and the effects of these factors on mood and self-concept" (Roberts, 1978, p. 28). A personal history of parents' activities, participation in sports, and motivational methods was completed. A measure of percentage of body fat was also made. Subjects attributed a wide variety of positive responses to exercise and admitted to a direct relationship between their own physical fitness and moods. Many subjects made a variety of claims as to how exercise was an important activity for them, and



that it had a good deal of impact on their psychological and physical health. However, the data indicates that "although 92 percent of the subjects reported that physical activity was extremely important to them, only about 60 percent" participated in sufficient exercise to have impact on their physical health (Roberts, 1978, p. 65). The subjects' beliefs that their moods were tied to being in shape was not borne out by the measure of physical fitness. Positive moods were related to reports of being active and in shape. However, this was not related to the objective body fat percentage measurement. Roberts concludes that if exercise is to effect a change in mood, it is not mediated through physiological channels but rather through psychological ones. It is the "decision to make a change" and one's "perception of fitness" which determines whether a person's moods are changed. Roberts also points to the importance of the placebo effect in whether one makes psychological gains with exercise stating it is due to "the activity associated with getting into shape . . . social interaction . . . and cognitive rewards" in achieving a socially approved goal which has perhaps as much influence as the actual physical changes (Roberts, 1978, p. 68).

Summary--Effects of Exercise on State Measures in the Normal Population. Studies reviewed regarding the effect of physical activity on normals generally support the theory that participation in exercise changes one's state of mind. It is not clear, however, just how this mechanism operates and the consequent changes in mood are not consistent with all subjects studied. Once again, it appears

that it is the subject's perception of the experience, rather than actual fitness, which will determine whether he feels he has achieved psychological benefit. Studies provide evidence for a differential response to acute exercise for high- and low-anxiety subjects. This points to the need for a thorough diagnostic evaluation prior to the institution of an exercise program as means to treat mood states. For those who focus on their internal states, exercise has been demonstrated to be ameliorative in breaking their preoccupation with their inner milieu. Results of one study provide evidence suggesting that the greater impact of group exercise over individual exercise on psychological states may reflect the social process. Further study is needed to determine the effectiveness of exercise as a possible treatment modality. Research indicates the importance of pairing exercise activities with positive mental images in order to produce improved mental states. A number of studies support the notion that those who embark on an exercise program in poorer states of physical and mental health stand to gain the most from exercise. Chronic exercise has been linked with improvements in psychological measures of anxiety and depression. The importance of including physiological measures in studies of psychological changes with exercise has been established. This is especially true if one wishes to demonstrate whether the change is the result of improved physical functioning. It is not always the experience of fitness which precipitates a change in mood, but rather one's perception of the experience which determines improvement. Finally, although

psychological instruments do not always reveal significant variation of mental states with variation in physical states, subjects studied generally reported that they "felt better" after exercising.

The Effects of Exercise on Self-Concept in the Normal Population.

The following section reviews seven articles which attempt to examine the effects of exercise on the self-concepts of normal subjects. One study is empirical research involving carefully defined populations, measures and control conditions (Leonardson & Gargiulo, 1978). This study, however, cannot be said to be representative of a normal population as all subjects were college students at the time of evaluation. Although Duke's (1977) study was empirical in design, because of the nature of the subjects studied no controls could be provided. The remaining studies were all empirical in nature but either lacked controls (Saipe, 1977; Collingwood & Willett, 1971), sampled a small number of subjects (Saipe, 1977; Collingwood & Willett, 1971), did not control for the opportunity to exercise as having influence on findings (McGlenn, 1976), did not include a measure of physiological fitness (Jeffers, 1977), or did not use measures of established reliability or validity (Heinzelmann & Bagley, 1970).

A number of studies have been completed recently which may provide support for the "feeling better" phenomena. This change in mental outlook may be an expression of the subjects' revision of their self-view rather than a product of variation in affective state. Subjects may feel better as a consequence of feeling better

about themselves. Saipe studied 16 female and 3 male college students enrolled in a jogging course to determine whether physical conditioning would affect self-concept. Physiological measures of heart efficiency, percent of body fat, and physical fitness taken before and after treatment demonstrate "that aerobic exercise is directly related to improved physiological responses" (Saipe, 1978, p. 53). Personality variation was measured by the Conceptual Grid. Individualized conditioning programs were developed based on pre-treatment measures of physiologic functioning. Subjects walked and jogged an hour twice-weekly, for a period of six weeks. Psychological measures were taken before, immediately after, and three months after completion of the program. No consistent relationship of psychological change with exercise was discovered, however, those who experienced an increase in self-self-ideal congruence did continue running after the conditioning program had ended. Saipe concluded that a change in one's cognitive structure is not due to the effects of physical conditioning alone but rather the "subject's interpretation of the exercise program is also required to establish a stable new pattern" (Saipe, 1977, p. 54). Due to the limited number of subjects studied and lack of controls results should be interpreted cautiously until further research can validate these claims.

A study of 50 male adolescents was made by McGlenn (1976) to determine if a significant difference in self-image would occur after completion of 10 weeks of activity programs. Subjects were

administered the American Association for Health, Physical Education, and Recreation Youth Fitness Test to evaluate physical fitness.

Psychological measures included the Offer Self-Image Questionnaire for Adolescents and the Eysenck Personality Inventory. Upon completion of treatment results showed that extroversion was not correlated with body image, however, as the extroversion level increased "the subjects' coping abilities increased" (McGlenn, 1976, p. 82). The introverts displayed significant improvements, unlike the extroverts, in self-image when involved in a highly physical activity. Physical fitness was "correlated in a positive direction" with vocational goals, self-image, body image and "total psychological well-being and adjustment" (McGlenn, 1976, p. 80). The researcher concluded that physical activity might serve as a helpful psychological treatment for introverts. It was not demonstrated, however, if the positive changes noted in introverts were a consequence of socialization or the actual increase in fitness.

A limited study of five obese male teenagers was carried out by Collingwood and Willett (1971) to determine if improved physical fitness could bring about a change in self-concept. Subjects were evaluated both before and after treatment with measures of physical fitness, as well as the Body Attitude Scale and Bills' Index of Adjustment and Values. Subjects participated two hours daily, five days a week, for a period of three weeks. The subjects displayed significant improvements in physical fitness measures along with a significant decrease in self- and ideal self-concepts. Significant

increases were demonstrated in "positive body attitude, positive self-attitude, and self-acceptance" (Collingwood & Willett, 1971, p. 412). As the sample size was small and no control subjects used, application of findings should be conservative. The study, once again, supports the theory that those subjects who stand to gain most psychologically from physical activity programs are those in poorer states of physical condition.

A study (Leonardson & Gargiulo, 1978) of 15 college students enrolled in a jogging course adds some weight to the notion that perception of improvement in physical fitness is more important to a positive self-concept than an actual increase in level of fitness. Subjects met twice a week, a minimum of 30 minutes per session, for a 10 week period. Although measures of physical fitness revealed a significant increase in physiological function, the subjects did not perceive a change in their physical state. Measure of self-concept, a semantic differential rating scale, failed to indicate a significant increase although scores did improve after treatment. Because a significant positive correlation was found between self-concept and perceived physical fitness researchers concluded that the perception of physical fitness and its relationship to self-concept was worthy of further investigation (Leonardson & Gargiulo, 1978, p. 338).

A study (Heinzelmann & Bagley, 1970) carried out to evaluate the effectiveness of an exercise program for men, ages 45-58, who had been identified as having an increased risk of coronary disease produced findings which support the theory that self-image changes with

the level of physical fitness. The experimental group was made up of 239 men, randomly assigned, and the control group consisted of 142 members. The experimental subjects exercised for one hour sessions, thrice weekly, in a supervised program lasting 18 months. Data concerning all participants' beliefs, attitudes, and health behavior was collected by survey prior to initiating treatment and at three-month intervals, until completion of the program. "Social-psychological" information was obtained by self-administered questionnaire and interview. All subjects participated in periodic medical evaluations. Subjects in the experimental group displayed significant differences when compared to controls in all three areas evaluated: work performance and attitudes, aspects of personal health, and habits and behavior. Findings based on self-reports showed that those who exercised experienced a variety of changes. Exercise subjects felt better able to handle stress, and enjoyed an improved attitude toward work. General habits reflected more awareness and concern for health. The investigators attributed the changes "to a more positive self-image which served to support the person's thoughts, feelings, and actions" (Heinzelmann & Bagley, 1970, p. 911). The study could have been improved if standardized psychological instruments were used, however these findings are consistent with the majority of similar research on normal populations. This program was carried out for a far longer time than most of the exercise programs reviewed. Psychological improvement may be attributed to this factor, or possibly to the differences in

availability of social contacts for experimental subjects over control subjects as function of the group activity with exercise.

Jeffers (1977) completed an investigation of 200 college students to determine whether a 12-week physical conditioning program would have an effect on locus of control, body attitude, and ability to deal with others. Four equal groups were formed made up of experimental and control, male and female subjects. All subjects were administered the Body Attitude Scale, the Fundamental Interpersonal Orientation Behavior Test and the Rotter Internal-External Locus of Control Scale. No assessment of physical fitness was made either before or after treatment, therefore, changes seen in psychological variables can only be assumed to be related to improved physiological function. Experimental subjects participated in physical conditioning programs, three times a week. Controls attended instructional, nonactivity classes. Both male and female experimental subjects developed significantly greater internal locus of control (i.e., a belief that one has control over his destiny) "or more healthy individual adjustment" (Jeffers, 1977, p. 76). Experimental females and males also significantly improved in body attitude which, according to the investigator, "would likely enhance overall self-concept" and "level of confidence" (Jeffers, 1977, p. 77). Although this study is in agreement with others in showing that improvement in self-concept accompanies an increase in physical fitness, these results should be applied cautiously as data on physiological functioning was not collected.



Children, ages 6 to 14, were studied (Duke, Johnson, & Nowicki, 1977) at a sports fitness camp to see if increased physical fitness affected locus of control. Both physical fitness measures and a psychological instrument were administered before and after the camp experience. Physical fitness significantly increased for the 74 boys and 35 girls studied, following completion of the program. Changes in scores on the Children's Nowicki-Strickland Internal-External Control Scale indicate "the children became more internally controlled as a result of participating in the camp program" (Duke, et al., 1977, p. 282). Observations made by parents indicated that they felt their children became more self-confident and self-directed as a consequence. A cause and effect relationship cannot be established between physical fitness and improved self-concept as no control group was included. However, these findings do provide evidence to warrant further study of physical training and its effect on the self-concepts of children.

Summary--Effects of Exercise on Self-Concept in the Normal Population. The majority of studies reviewed support the theory that positive changes in self-concept do occur, either directly or indirectly, as a consequence of physical fitness programs. Additionally, evidence suggests that in order to experience a positive change in self-concept, it is important that the subject perceive a change in fitness. Studies also support the notion that those who stand to gain the most psychologically and physiologically from exercise are those in poorest physical condition to begin with. Some

evidence exists to suggest that introverts experience greater benefits in changing their self-views with exercise, when compared to extroverts. Future research needs to control for the social-interaction variable in order to better establish the nature of the relationship between exercise programs and improvement in self-concept.

The Effects of Exercise on Personality in the Normal Population. The following section reviews six articles which attempt to examine the effects of exercise on personality in the normal population. Tillman's study (1965) was empirical research of a carefully defined population, employing measurements with established reliability and validity. No control group was used, therefore, it is impossible to say whether the changes noted were a function of treatment or some extraneous variable. The studies reviewed by Ismail and associates (Ismail & Trachtman, 1973; Young & Ismail, 1976; Ismail & Young, 1976; Ismail & Young, 1977) were all empirical in nature involving carefully defined populations and using measurements with established reliability and validity. Subjects studied cannot be said to be representative of the normal population, therefore, findings must be interpreted with caution. Findings might also be affected to some degree by the fact that all subjects were volunteers and no controls were included in the study. Sharp and Reilly's (1975) study, although empirical in design, also studied a distinct group which cannot be said to be representative of the normal population. No mention was made in the journal article as to the length of treatment. The measure of personality was a poor choice in that it was

not devised for use with normals. It is difficult to make comparisons of these studies as a variety of psychological measurements was used.

Studies of subjects from the normal population thus far reviewed have dealt with the impact of exercise on more transient states. Researchers have also attempted to determine whether increased physical fitness leads to enduring changes in the personality traits of normals. A study of 65 male college students (Sharp & Reilly, 1975), ages 18 to 23, evaluated the impact of an aerobic conditioning class to determine the relationship between fitness and personality. Measurements of fitness as well as findings obtained from the Minnesota Multiphasic Personality Inventory were compared on pre- and post-exercise conditions. Subjects met twice-weekly for periods of 45 minutes each session. No mention was made as to the length of treatment. The investigators found a "positive correlation" between aerobic fitness and ego strength and healthy self-regard (MMPT). A negative correlation was seen when comparing fitness and measures of deviant responses, hypochondriasis, depression, hysteria, paranoia, psychasthenia, schizophrenia, social introversion and anxiety (MMPI). A comparison of pre- and post-treatment scores reveals that those subjects "who initially scored highest on the aerobic tests also gained the most psychologically, but the least physically" (Sharp & Reilly, 1975, p. 429). At the same time, subjects who had poorer fitness scores gained the most on physical measures but the least on psychological ones. This differential

response is in opposition to the bulk of findings observed on normals studied thus far. On personality characteristics, the investigators noted a greater psychological response with the more fit group when comparing them to less fit subjects.

Ismail and associates (Ismail & Trachtman, 1973; Young & Ismail, 1976; Ismail & Young, 1976; Ismail & Young, 1977) completed numerous studies on the relationship between personality and physiological factors. Their findings serve to clarify the issue as to whether consistent physical activity has impact on more stable psychological measures of traits in normal populations. The lack of consistency in findings between high-and low-fitness subjects' responses on personality measures was also evaluated. These particular researchers had noticed serendipitously in testing improvement of physiologic measures after completion of four month exercise programs, that subjects studied seemed to undergo personality changes. In order to gain a more objective view a psychological evaluation was done on each subject.

The first study (Ismail & Trachtman, 1973) compared 14 relatively high-fitness subjects with 14 relatively low-fitness subjects, derived from a group of 60 volunteer university staff members. This all male group was described as middle-aged, generally sedentary and unfit. Exercise was carried out thrice-weekly for one and one-half hour sessions. The group maintained approximately a 60% attendance record in this strenuous physical conditioning program which consisted of jogging for a 10 minute period, 25 minutes of calisthenics,

25 minutes progressive running and a final 30 minute period of structured sports. A variety of physical-fitness measures were compared on pre- and post-treatment of physical functioning including the following:

exercise heart rate, percent of lean body mass, maximal oxygen intake corrected by lean body mass, submaximal minute volume of ventilation corrected by body weight, and resting diastolic blood pressure. (Ismail & Trachtman, 1973, p. 81)

Testing of personality was carried out in two sessions through interviews and use of the Cattell 16 Personality Factor Questionnaire. The investigators hypothesized that if the low-fitness group became more like high-fitness subjects in personality measures the change could be attributed to the exercise regimen.

Psychological testing provided evidence linking the high-fitness group with imagination and emotional stability. High-fitness subjects scored significantly higher on these measures than the low-fit subjects when analyzing the scores collectively. Upon termination of treatment, the low-fit group evidenced marked improvement in emotional stability, so much so that a significant difference in groups on this measure no longer existed. The low-fit subjects were also noted to show an increase in scores measuring imaginativeness. However, they did not approximate scores received by their more fit counterparts on this measure. The scores received by the low-fit group also increased on the measures of inclination toward guilt and greater self-sufficiency unlike the scores received by high-fitness

subjects. The factors of greatest association with a high level of fitness after treatment were self-assurance, imagination, emotional stability, and self-sufficiency. The authors claim to have developed a method by which they can distinguish between low- and high-fitness groups by analysis of these four variables apart from any further data. Researchers conclude that subjects who developed greater physical proficiency also demonstrate personality characteristics that indicate less tendency toward neurotic behavior. Speculation was made that the increase in guilt found in initially low-fit subjects after completion of the treatment program may be due to either an increased awareness of their former lack of fitness or feeling that time spent in conditioning has taken them from more important duties.

As a consequence of this investigation two theories were suggested to try to understand why changes in personality measures did occur with improvement in physical functioning. The "physiological-cause" theory interprets change in mental process as being a result of biochemical and physiologic variation. One can also explain this phenomenon from the psychological viewpoint. In adhering to an exercise program a sense of accomplishment can be experienced, perhaps as it has never been before, thus prompting adjustment in the psychological realm. The investigators conclude that, as this study does support the notion of changed mentation with consistent exercise, perhaps "other experiences . . . can change supposedly crystallized personalities" (Ismail & Trachtman, 1973, p. 82).

Prompted by these findings Young and Ismail (1976) selected 28 subjects to study from a group of 90 university staff and business men volunteers who participated in a four-month physical conditioning program as described previously. Four equal groups were identified to compare relatively high-fit old and young men with their low-fit peers. The investigators sought to determine if personality differed with the level of physical condition, as well as to discover if changes in personality variables would occur as a consequence of a change in physical fitness. The subjects participated in a fitness program and were evaluated on physiological measures as described in the previous study. Assessment and psychological variables were expanded including, not only the Cattell 16 PF Questionnaire, but also scales from the Eysenck Personality Inventory as well as the Multiple Affect Adjective Check List.

Results showed that the total (young and old) high-fit group was "more unconventional, composed, secure, easygoing, emotionally stable, adventurous, and higher on crystallized intelligence than the unfit group" on both pre- and post-testing (Young & Ismail, 1976, p. 515). When comparing the young group with the old group, measures of extroversion were found to be higher in the former subjects on both pre- and post-testing. Young fit subjects were more aggressive and dominant than the old-fit subjects on both pre- and post-testing. The young low-fit subjects scored higher in superego strength on both pre- and post-testing than their older low-fit counterparts, this difference being even more pronounced after conditioning. The fit group became

more self-sufficient after treatment and all subjects evidenced an increase in social precision, persistence and control on post-test measures. The investigators found the greatest differences between fit and low-fit subjects on variables of emotional stability and security. Although all subjects increased on measures listed previously, low-fit subjects did not evidence dramatic changes when compared to the high-fit group in psychologic measures after four months of physical training. The authors concluded that as it took many years for low-fit subjects to reach their state of poor physical condition it would appear that longer periods of physical training would be required to have an impact on seemingly more static psychological characteristics.

Ismail and Young (1976) went on to study 56 university staff volunteers who participated in the physical conditioning program discussed previously. Subjects were evaluated on physiological measures identical to those taken in preceding studies. Form A of the Cattell 16 PF Questionnaire was administered before and after training to study the relationship between personality and physiologic variables at different hierarchical levels. Results showed that deficient physical fitness (relative to the group studied) was related to emotional instability and "that participation in a physical fitness program of sufficient duration and intensity has a stabilizing effect upon the factors that affect personality" (Ismail & Young, 1976, p. 272).

Ismail and Young (Ismail and Young, 1977), after researching the association of biochemical changes with behavioral alterations, chose



to focus their attention on the effect of physical conditioning on these variables (serum glucose, serum cholesterol, serum testosterone, and free catecholamines). The 58 men studied were taken from a group of 90 business men and university staff members who participated in the same type of volunteer exercise program established for previous studies. Physiological measures included those mentioned before as well as evaluation of serum cholesterol, serum glucose, serum testosterone and free catecholamines. Psychological evaluation utilized the Cattell 16 PF Questionnaire, Eysenck Personality Inventory, and the Anxiety Scale of the Multiple Affect Check List. Although the subjects did evidence a significant improvement in fitness levels as measured by the physiological instruments outlined in the previous studies, biochemical makeup was not demonstrably altered within the time frame measured. Certain biochemical levels, however, were linked with differing psychological characteristics. For example, individuals with both high levels of glucose concentrations and high serum testosterone were found to be more aggressive and neurotic as compared to those with levels in the average range. High cholesterol and glucose levels were positively and significantly correlated with low superego strength and self-indulgence. A high rate of catecholamine excretion was significantly related to tension and neuroticism. Once again, Ismail and Young conclude that a lack of significant change in biochemical makeup might be a function of the length of treatment. Slight alterations observed in the relationships between personality and biochemical

measures led them to "speculate that a considerably longer and intensified period of regular (habitual) exercise is necessary to cause a dramatic change in personality parameters" (Ismail & Young, 1977, p. 64). The final conclusions based on their most recent study is that changes in psychological characteristics which accompany physical conditioning come about as a function of alteration in body chemistry, as definite relationships between these three domains have been found to exist. This theory has been echoed by other researchers in the field (Layman, 1955, p. 150; Kraus, p. 9; Eliot, et al., p. 239).

Tillman (1965) evaluated differences in personality and physical fitness variables in 386 high school males. All subjects were evaluated with two measures taken from the AAHPER Youth Fitness Test, as well as personality measures utilizing the A-S Reaction Study of Allport, the Cattell 16 PF Questionnaire, and the Kuder Preference Record. On initial fitness testing two groups were identified, consisting of the upper and lower 15 percent. In comparing these groups, significant differences were found in personality variables. The more physically fit group was observed to be more dominant, extroverted, and socially oriented. The less fit group had a greater propensity for accuracy and precision and appeared to be more tense. This latter group was then separated into two groups to evaluate the effect of physical conditioning on personality and physical fitness measures. The experimental group participated in hour-long sessions of strenuous exercise five days a week, while the control group

continued in regular physical education classes for the nine month period. On post-testing the experimental group significantly improved on fitness measures over the control group. Change in personality characteristics between groups occurred in only one variable. The experimental group displayed a significantly lower clerical interest than controls after treatment. As the experimental group subjects brought fitness measures up to the average range, as compared to the high-fit subjects who scored at the 92 percentile, the investigator concluded that perhaps achievement of a greater level of physical proficiency would be necessary before changes in personality characteristics could occur.

Summary--Effects of Exercise on Personality of the Normal Population.

Studies completed on personality and exercise support the belief that definite differences do exist between high-fit and low-fit persons. The effect of physical conditioning on personality characteristics, however, is not as conclusive. Those subjects studied who were classified as being physically fit were evaluated as emotionally stable, easygoing, composed, and secure. These people were seen as more socially oriented, dominant, and extroverted. They were further characterized as unconventional, imaginative and possessing higher crystallized intelligence than their inactive peers. In contrast, the low-fit subjects studied were preoccupied with their physical state and were socially withdrawn. Emotional instability was expressed in their hypersensitivity, tenseness, and mental suffering. When low-fit subjects were exposed to a regular exercise program

emotional stability improved. Experimental subjects became more self-assured and able to provide for their own needs. These subjects developed an increase in persistence, self-control and imagination. Also their ability to deal with others improved along with an accompanying decrease in desire for solitary tasks. All in all, a great change did not occur in the personalities of low-fit subjects treated with exercise. Researchers generally concurred that as the two groups do differ in basic personality variables, perhaps more extensive physical conditioning would be necessary to bring about more dramatic personality revisions. While it is clear that changes in personality, mood or transient mental states occur as a result of exercise, whether this change is best explained physiologically or psychologically is still open to debate. Studies linking biochemical levels with personality characteristics support the physiological cause for psychological change theory.

General Effects of Exercise on the Normal Population. The most recent reviews of the literature regarding the effects of physical conditioning on intellectual achievement provide evidence suggesting improved cognitive functioning is related to increased fitness. However, "this relationship is far from firmly established" (Shaw & Cordts, 1960, p. 626; Layman, 1960, p. 568). Studies discussed previously show higher "crystallized intelligence" in physically fit than inactive peers (Young & Ismail, 1976, p. 515). Improved grade point averages in college students were seen as one consequence of

physical training in Driscoll's (1976) study which was reviewed earlier.

An empirical study involving carefully defined populations, measures, and control conditions completed by Greenberg (1975) further supports the notion that intellectual achievement can be enhanced with participation in a physical conditioning program. College students were selected and randomly assigned to either a control group, physical as well as interpersonal skills training, and interpersonal skills training alone. All 60 subjects were evaluated before and after treatment with Carkhuff's Standardized Communication and Discrimination Indices, along with an assessment of physical fitness using Cooper's Twelve Minute Walk/Run test. Subjects who participated in the second group were trained in systematic, individual exercise programs developed by Cooper to increase aerobic functioning. The latter two groups received training in interpersonal skills modeled after Carkhuff's methods. Results showed a significant increase in physical functioning of those subjects participating in the fitness conditioning group. The group trained in Carkhuff's methods only made a significant gain in both communication and discrimination functions. There were no changes seen in interpersonal or physical functioning of control subjects. Subjects who had both physical and interpersonal training scored significantly higher on discrimination ability (ability to grasp the intent of another person's verbal message) than those with interpersonal training alone. Communication scores of both groups were

similar, both significantly higher in post-test measures than in pre-test evaluation. Greenberg attributes this phenomenon to improved cognitive functioning. These findings in the normal population are consistent with those seen in the geriatric population. Findings should be interpreted cautiously, however, as the group studied cannot be said to be representative of the normal population. This study might have been improved if an additional exercise-only group were included.

A number of studies have been completed which explore the effect of physical activity on a variety of behaviors and psychological measures. One empirical study of 135 males found a significant relationship between the level of physical activity and fulfillment in sexual life (Katzman, p. 76). One researcher theorizes that this is due to "the autonomic nervous response to the whole central glandular axis" as being stimulated by physical training, resulting in "relatively strong sex tendencies of athletically fit men and women" (Cureton, 1963, p. 17). An empirical study completed by Morris and Husman (1978) evaluated the effect of physical conditioning on "life quality" changes. Life quality is defined as "the degree to which an individual or a society is able to satisfy its perceived psychophysiological needs" (Morris & Husman, 1978, p. 3). The 51 subjects evaluated were college students who voluntarily participated. The experimental group was made up of 10 males and 10 females who met twice a week for two hour sessions. During these meetings they trained in long distance running for a period of 15

weeks. The 31 control subjects attended a sport history class for the same time period and were not involved in a fitness program. All subjects were evaluated both before and after treatment with the short form of the Pflaum Life Quality Inventory. Results showed a significant increase in Life Quality scores obtained by experimental subjects. No significant change was observed in the scores of control group members. Experimental subjects also significantly improved in physiological measures. Control subjects were not evaluated on this parameter. Investigators concluded that positive life quality changes were a result of "this new self-determining attitude" which "appears to elevate one's total life outlook and hence one's life quality" (Morris & Husman, 1978, p. 6). This group cannot be said to be representative of the normal population, therefore, findings should be interpreted relative to population parameters.

Summary--Effects of Exercise on the Normal Population. Recent studies on the normal population provide information which supports the intuitive belief that an improvement in physical condition is associated with improvement of psychological functioning. Most studies reviewed report positive changes in mood states, although a differential response is seen in some types of individuals thus mandating a thorough diagnostic evaluation before initiating treatment via physical channels. The bulk of studies on the self-concept in relation to exercise show improvement in one's self-view as one becomes more physically fit. Some positive changes were noted on

personality variables when one is exposed to a physical training program, however, researchers generally concur that long-term exercise is required to achieve a more substantial impact. They arrive at this conclusion based on differences seen when comparing the personality of high-fit and low-fit groups. There was an indication that those who participated in physical exercise could experience improved cognitive and sexual functioning, as well as gains in life quality. Many researchers emphasized that for one to obtain psychological benefit from improving his physiological state, he must view this activity as being beneficial. Although varied responses to improved physical fitness have been observed the exact nature of the relationship between mental and physical processes has not yet been established. Future studies should pursue this question in greater depth. It is apparent that longitudinal inquiries might best bring forth evidence to illuminate this relationship, as well as to probe whether trait measures of personality could undergo facilitative improvement as a consequence of physical training.

#### Summary and Implications

It appears that exercise can have as much impact on psychological processes as it has been demonstrated to have on physiological measures, based on the information reviewed. A synthesis of findings will follow as well as a discussion of possible theories which might serve to illuminate the relationship between mental and bodily changes. Implications for the field of psychology will also be included.



Exercise and Affective Functioning. The greatest number of studies done thus far on exercise and psychological processes have dealt with the effect of physical activity on affective functioning. Of the 33 studies reviewed, only four noted no significant improvement in affect with exercise (Guraedy, 1978; Morgan, 1971; Gary & Guthrie, 1972; Mallaghan & Pemberton, 1977). All four are empirical in nature and are products of good research practices. Guraedy's (1978) is somewhat weakened because no physiological measures are provided. The athlete, as portrayed in the studies reviewed, was consistently characterized as being freer from emotional disturbance than non-athletes (Snyder & Kivlin, 1975; Morgan & Pollock, 1977; Ibrahim & Morrison, 1976). These three studies are, again, empirical in nature and carefully carried out. Both short-term and chronic exercise were used successfully in treating a variety of anxiety related disturbances (Morgan, 1979; Wood, 1977; Bahrke & Morgan, 1978; Girodo & Pellegrini, 1976; Driscoll, 1976; Spreads, 1977; Folkins et al., 1972; Folkins, 1976; Orwin, 1974; Muller & Armstrong, 1975; Woodruff, 1977; Solomon & Bumpus, 1978; Ismail & Trachtman, 1973; DeVries & Adams, 1972). The bulk of these studies are empirical research. Five of these studies, however, rely solely on observation in reaching findings (Spreads, 1977; Orwin, 1974; Muller & Armstrong, 1975; Woodruff, 1977; Solomon & Bumpus, 1978). A reduction in depression was noted in diverse groups after prolonged exercise programs (Folkins, et al., 1972; Folkins, 1976; Morgan, 1970; Kavanaugh et al., 1977; Greist et al., 1979; Rajewski et al., 1978; Hutterer &

Denes, 1975). Only one of these studies was not empirical research (Hutterer & Denes, 1975), relying instead on observational data. Improvement in a variety of mood states, ranging from estimates of happiness to emotional stability, has been observed (Stamford et al., 1974; Martin, 1977; Massie & Shephard, 1971; Carter, 1977; Roberts, 1978; Ismail & Trachtman, 1973; Ismail & Young, 1977). Four of these studies were carefully executed empirical research. Three others fell short of this standard, however. One relied on data collected through observation (Martin, 1977), one did not include physiological measurements of physical fitness (Carter, 1977), and another relied on measurements of unestablished reliability and validity (Roberts, 1978). The majority of evidence shows that physical activity can be used successfully to treat certain types of affective disturbance. Since severity and type of psychological disorder is an important determining factor in the success of exercise as a treatment modality a careful psychological evaluation is mandatory before prescribing exercise in order to exclude those patients diagnosed as psychotic, alcoholic, or low-anxious as studies suggest these types are least likely to benefit (Solomon & Bumpus, 1978; Gary & Guthrie, 1972; Wood, 1977). Two of these studies are examples of empirical research, however, one (Solomon & Bumpus, 1978) relies on observational data in reaching their conclusions.

Exercise and Self-Concept. The evidence supporting the notion that exercise brings about positive changes in one's self-view is not as strong as that relating to affective function. There is, however, greater substantiation for this theory than the converse. Of 13

studies reviewed two were unable to demonstrate significant improvements in self-concept with exercise (Saipe, 1978; Leonardson & Gargiulo, 1978). One of these is empirical in nature with carefully defined population, measures and control conditions, however, the other study (Saipe, 1978) lacks controls and reaches conclusions based on a small sample size. Two studies characterized the athlete as having a poor sense of himself and lacking self-confidence (Ibrahim & Morrison, 1976; Daus & Templer, 1976). These findings were obtained through empirical research. Three other studies provide evidence in opposition to these findings, stating that the athletes evaluated were generally self-confident with feelings of high self-esteem (Balazs, 1975; Snyder & Kivlin, 1975; Vincent, 1976). Snyder and Kivlin's (1975) findings were reached through carefully executed, empirical study. The remaining two studies, although empirical in nature, are relatively weak. One is unclear as to the definition of the populations studied (Vincent, 1976). The findings obtained by Balazs (1975) are no doubt influenced by the fact that subjects were volunteers. Improved self-image after an exercise program was noted in a number of groups including normals, obese, and introverts (Folkins, 1976; McGlenn, 1976; Collingwood & Willett, 1971; Heinzelmann & Bagley, 1970; Jeffers, 1977; Duke, 1977). All are examples of empirical research. Some are faulty in execution as they lack controls (Duke, 1977; Collingwood & Willett, 1971), do not use measures of established reliability and validity

(Heinzelmann & Bagley, 1970), or do not take physiological measures of physical fitness (Jeffers, 1977).

As the evidence for positive change in self-concept with exercise is contradictory it is apparent that further studies will be needed to resolve this issue. One researcher, after empirical study, suggests that to succeed as an athlete one must possess generally higher self-esteem and a greater resistance to criticism, prior to involvement in competition (Vincent, 1976). Studies of athletes should be applied to other populations only with great caution, as the high self-concept observed by some researchers may have existed prior to sport involvement rather than being a product of exercise. Two investigators caution that should exercise be utilized to bring about improvement in self-concept, great care should be taken both to tailor exercise programs to the individual and place people in homogeneous physical activity groups (Kraus, 1961; Greist et al., 1978). Without such care in program development exercise might serve to reinforce negative self-views rather than improve them.

Exercise and Personality. Findings related to the effect of physical activity on personality fail to demonstrate that people who exercise share a common personality. Exercise seems to appeal to a diverse variety of people. Personality attributes considered helpful for success in one type of event or sport may not be so for another. Empirical studies of athletes report that the athlete could be distinguished from the nonathlete on a variety of different measures, however, these observations do not lend themselves to any consistent

formulation (Widdop & Widdop, 1975; O'Connor & Webb, 1976; Stoner & Bandy, 1977; Hartung & Farge, 1977; Balazs, 1975; Kukla & Pargman, 1976). Two of these studies are weakened, one because they reached their conclusions based on a small sample size with no controls (Kukla & Pargman, 1976) and the other because the subjects studied were volunteers (Balazs, 1975). The athlete was characterized as: more outgoing, warmhearted, gay, conscientious, spontaneous, worldly, shrewd, ambitious, aggressive, more experimenting, reserved, aloof, sober, serious, resourceful, and "almost completely lacking in deviant or abnormal attributes" (Balazs, p. 271). These contradictory findings point to the need for careful study of individual athletic subgroups, rather than studying athletes as one group.

The majority of studies carried out on normals who exercise demonstrate significant changes in personality. Of seven studies, only one study (which is empirical in nature) failed to show positive changes in personality as a result of exercise (Buccola & Stone, 1975). Several studies (which were, again, empirical research) noted generally favorable improvements in personality with exercise programs of long duration and intensity (Sharp & Reilly, 1975; Ismail et al., 1977; Ismail & Trachtman, 1973; Ismail & Young, 1977; Tillman, 1965; Morris & Husman, 1978). As a variety of personality measures have been used by various researchers it is impossible to compare these studies. Although these studies found differing personality types in those who exercised, there is enough suggestive evidence to

conclude that exercise has an influence on personality, although the nature of that influence is yet to be determined.

Exercise and Interpersonal Relationships. A look at studies addressing the question as to whether exercise has impact on one's ability to function in social situations provides overwhelmingly positive support for this view. Of 11 studies, only one observed a negative consequence of physical activity on interpersonal relationships (Widdop & Widdop, 1975). This empirical study is somewhat weakened because no physiological measures of physical fitness were included. The remaining 10 studies characterized those who became regular exercisers as much more attentive to others and more socially oriented (Massie & Shephard, 1971; Kavanaugh et al., 1977; Birkui et al., 1976; Woodruff, 1977; Portuondo & Landry, 1974; Pelosi & Friedman, 1974; Jones & Best, 1975; Dodson & Mullens, 1969; Young & Ismail, 1976; Tillman, 1965). Seven of the studies were empirical in design. The remaining studies relied on observational data in reaching their conclusions (Woodruff, 1977; Portuondo & Landry, 1974; Pelosi & Friedman, 1974). Some researchers attribute this increased sociability to the group experience of exercising with others. This is an important consideration deserving further study as the positive changes noted may be a function of the group process rather than physical activity alone. Until such time as this question can be better clarified a group exercise program should be utilized for those desirous of becoming more socially facile.

Exercise and Cognitive Ability. Present research indicates that when people exercise their cognitive functioning improves. Of the 11 studies reviewed which were concerned with this issue only one (which was empirical research) provided evidence contrary to this position; the athletes studied were found to have a "lower organizational ability" (Widdop & Widdop, p. 17). Two other empirically designed studies of athletes demonstrate that athletes had greater mental capabilities than the normal population (O'Connor & Webb, 1976; Hartung & Farge, 1977). Improvements in cognitive ability with exercise were observed in such diverse groups as hyperactive boys, autistic children, normals, college students, and the geriatric population (Klein & Deffenbacher, 1977; Jones & Best, 1975; Ismail & Trachtman, 1973; Driscoll, 1976; Greenberg, 1976; Rodstein, 1975; Powell, 1974; Crooks, 1977). The majority of these studies were empirical in nature with carefully defined populations, measures and control conditions. One did not use measures of established reliability and validity and did not take pre-treatment measures (Klein & Deffenbacher, 1977). Another was generally poor, conclusions arrived at through observation with no details provided regarding treatment or controls (Rodstein, 1975). Previously inactive persons who embarked on a regimen of exercise demonstrated significant improvements in reality orientation, logical thinking, and memory.

Although more research is needed before recommending exercise to improve cognitive function in other groups, the efficacy of this

modality in increasing mental function in the elderly has been well supported. After the aged person's physical condition has been determined suitable for the rigors of exercise by medical examination, exercise should be given consideration as an aid in the rejuvenation of mental faculties.

Implications. In light of the studies reviewed it seems apparent that exercise might serve as a valuable adjunct in the treatment of a variety of psychological disturbances. Further studies are in order to better understand the limitations of exercise as treatment, as well as to examine the relationship between mental and physical processes in greater depth. Presently most of the research done on the relationship between exercise and mental functioning comes from the fields of physical education or medicine. Consequently the psychological factors are neglected or their level of analysis is superficial. It is now timely for serious students of psychology to more carefully consider the role of exercise and physical activity on the promotion and maintenance of a state of psychological health.

Moreover, future research should be guided by some theoretical notions in order to organize the present store of knowledge and serve to guide the development of further research. Indeed there are a number of areas which need more systematic study. For instance, longitudinal studies of the athlete are needed which look at males separately from females, and team athletes separately from individual sport participants. Furthermore, there is a need to break the athletic population down further into sub groups, such as basketball



players, football players, etc. Standard measures should be utilized with a variety of groups so that comparisons can be made.

Researchers should not rely on one psychological measure alone but should use a number of standardized instruments. Studies carried out in such a prescribed manner would enlarge our understanding of exercise's applicability as a psychological treatment and allow comparison of exercise programs.

Some studies have demonstrated that exercise is more cost efficient in treating affective disorders than more traditional forms of treatment (Greist et al., 1978; Orwin, 1974; Woodruff, 1977). Reduction in anxiety has been shown to take less time with exercise than psychotherapy (Driscoll, 1976). Based on these findings serious consideration should be given to viewing exercise as a potential therapeutic modality for anxiety.

Certain groups have been identified by researchers as demonstrating significant improvements in psychological functioning with exercise. Generally, consideration should be given to the use of physical activity as a treatment for those in extremely poor states of both mental and physical health (Folkins et al., 1972; Morgan, 1971; Collingwood & Willett, 1971). In treating anxiety in the elderly, exercise would be the preferred treatment over the use of medication due to the hypotensive side-effects some drugs produce (DeVries & Adams, 1972). Contrary to popular thought, rather than suffer, the preponderance of evidence suggests that females benefit psychologically from sports involvement (Balazs, 1975; Snyder &

Kivlin, 1975; Vincent, 1976; Kukla & Pargman, 1976; Widdop & Widdop, 1975; Ibrahim & Morrison, 1976; Folkins et al., 1972).

In order to increase the likelihood that one might achieve positive consequences from exercise, great care should be given in developing exercise programs. The best psychological gains have been seen in those persons who exercise for durations of three months or more (Kavanaugh et al., 1977; Ismail & Young, 1977; Ismail & Trachtman, 1973; Heinzelmann & Bagley, 1970). Certain steps should be taken, therefore, to insure compliance, to minimize the chance of failure and to prevent reinforcement of a poor self-concept. Slowly progressive programs tailored to the individual's physical and mental capacity are necessary to increase the likelihood of success. Great attention should be given to the exerciser's psychological state as the studies reviewed have established that it is not the physical activity alone which brings about psychological improvement (Roberts, 1978; Saipe, 1978; Kavanaugh, 1977; Leonardson & Gargiulo, 1978). The exercise leader should assist the exerciser in interpreting his exercise experience so as to allow him to gain maximum benefit from it. Emotional support should be provided wherever it is needed. Homogenous groups are preferable wherever feasible to prevent the exerciser from comparing himself negatively with someone of superior ability. Group exercise would be preferable to individual exercise when a goal of therapy is to enlarge the patient's repertoire of social skills. To further insure that exercise has positive psychological consequences, the conditioning techniques outlined by

Driscoll might be considered for application. A thorough medical examination is mandatory prior to admission in an exercise program. Some groups, such as cardiac rehabilitation patients and the elderly, require constant medical supervision.

### Conclusions

After reviewing the available literature on exercise and its effect on psychological functioning one can state with certainty that generally exercise is beneficial to physical health but that the relationship to psychological health is less clear. However, the studies completed up to this time have been guided by a shotgun approach, lacking any theoretical basis. Enough information now exists for researchers to look to theory to guide further research. In the absence of any present theorizing it is the intent of this paper to try to organize the data around two major theoretical notions.

One school of thought attempts to explain the changes in psychological states on a strictly biological/physiological basis. Several researchers believe that observed mental alterations are an isomorphic consequence of improvements in body function (Layman, 1955; Kraus, 1961; Eliot et al., 1976). Some state, more specifically, that it is the stimulation of brain tissue associated with physical activity which accounts for change in psychological processes (Carter, 1977; Katzman, 1977; Powell, 1974; Crooks, 1977; Rodstein, 1975). Other researchers believe biochemical alterations are responsible for the mental changes observed (Ismail & Young, 1977).

These biological-cause theorists view psychological improvement as being solely a product of increased physiological efficiency.

The opposing school of thought proposes that a change in physiological functioning alone will not necessarily bring about psychological improvement. Several studies dispute the biological-cause for mental change theorists by showing that increased physical fitness does not insure that psychological change will necessarily follow (Carter, 1977; Roberts, 1978; Saipe, 1978; Leonardson & Gargiulo, 1978; Kavanaugh et al., 1977; Mallaghan & Pemberton, 1977). Some individuals become physically fit and exhibit no positive change in psychological function; conversely, others display improved psychological function even without actual improvement or change in physiological measures.

A more likely explanation of this phenomenon of positive mental change following exercise is the following: Since at first exercise is inherently physically punishing, in order to overcome one's initial exercise resistance it becomes important for an individual to perceive a positive change in himself in order to reinforce his motivation to continue exercising. In this regard there are a variety of possible changes a person may look for to urge himself on. These include the following--improved appearance, increased stamina, improved health, increased longevity, improved self-concept, heightened esthetic experiences, ascetic self-denial, etc. While exercise goals vary and are peculiar to the individual, in order for psychological change to accompany increased fitness an idiosyncratic

perception of positive alteration is mandatory. It is the contention of this paper that positive psychological changes occur as a rationale to reduce the cognitive dissonance associated with the negative physical aspects of exercise. Thus the self-motivating ideology of the exerciser is crucial to the kind of psychological benefits which are derived from the exercise experience.

If the preceding contention is true a study is needed to evaluate it. One suggestion is that three equal groups be formed,  $N = 90$ . Sexes would be equally represented. Groups A & B would participate in the exercise regimen established by Ismail and his associates. Group A would receive additional training to aid them in noticing the changes that might be expected as a result of exercise. Group C would participate as a group in non-strenuous, social activities (card-playing, discussion groups, etc.). A variety of psychological measures would be administered to all subjects to evaluate: self-concept, social skills, affective functioning, personality and life satisfaction. Physiological measures would be made as well, including as a minimum, percentage of body fat, and heart rate. Measurements would be taken at 3-month intervals for one year. The group interaction effect could be partialled out by the control subjects. Thus one could accurately measure both: (a) the effect of physical activity on psychological functioning independent of the opportunity to gather as a group, (b) as well as the impact of teaching subjects to focus on perception of improvement in a variety of ways suggested by this writer. A study of this type would go a

long way toward clarifying the relationship between exercise and feelings of psychological benefit.

Based on the findings of the researchers reviewed, one can safely say that positive psychological changes can be achieved through somatic channels. It does not appear, however, that physiological alteration alone can, in and of itself, produce psychological change. The mental changes observed are, more likely, due to a combination of psychological and physiological alterations. What seems to be a necessary condition for mental improvement is a subject's awareness that he has experienced some positive change as a result of physical activity. These perceived positive changes are individual and varied, with each person looking to a different part of the experience as a reinforcer. Those who continue to exercise do so, it seems, as a consequence of these idiosyncratically determined positive changes which serve as motivators to overcome the negative aspects of exercise.

The importance of these findings, in conclusion, is not that one theory better explains the phenomenon of psychological change with exercise, but that potential changes in mental processes can be initiated by non-psychological means. To better understand this relationship further study is needed. It is time for psychology to recognize the importance of physical health and take a more active role in clarifying this important relationship between physical and psychological well-being.

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