Effects of Aerobic Fitness Training on Psychological Functioning

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EFFECTS OF AEROBIC FITNESS TRAINING ON PSYCHOLOGICAL FUNCTIONING

BY

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B.A., University of Central Florida, 1981

THESIS

Submitted in partial fulfillment of the requirements for the Master of Science degree in Clinical Psychology in the Graduate Studies Program of the College of Arts and Sciences University of Central Florida Orlando, Florida

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DEDICATION

This thesis is dedicated with deepest gratitude and appreciation to Jack McGuire PhD who over the years of our acquaintanceship has provided the fulcrum for personal and professional growth and the impetus for realization of a lifelong dream. Anyone who has tried to buck tradition and/or cultural or ethnic values soon realizes the considerable amount of resistance and rejection with which they are confronted. Without the support of special people during times when equilibrium and perspective are lost, attainment of goals appears to be an insurmountable task.

Dr. McGuire has been a special person and has played many roles in my life. He has been a friend, advocate, teacher and role model. As a therapist, Dr. McGuire has provided me with a model of sensitivity, honesty, personal concern and integrity, enhanced by courage that have reinforced and made me staunch in my endeavors as a professional.

However, Dr. McGuire's greatest impact has been on my growth as a person. First, because what he is as a person is worthy of respect and admiration. Second, his continuing
encouragement, reassurance, suggestions and confrontations at critical moments have provided me with the foundation for risk taking and independent action which precipitate personal growth. His profound impact on my life will be remembered and appreciated forever.
ABSTRACT

An attempt was made to assess the effects of aerobic fitness training on the psychological functioning of college females. The experimental group, comprised of students enrolled in an aerobic dance class, was compared with a control group comprised of students enrolled in a jazz class.

All subjects received a battery of physical and psychological tests before and after the respective 12-week exercise course. The psychological tests included state and trait measures of depression, hostility (MAACL) and anxiety (STAI). A retrospective questionnaire was also included. Physical measures of fitness included: 1) Cooper's 12-Minute run (analyzed by fitness category and distance covered), 2) resting heart rate and 3) systolic and diastolic blood pressure.

ANCOVA analysis revealed one significant finding. The experimental group had a significant increase in fitness category, $F(1, 26) = 4.058, p < .05$ when compared with the control group. Results on the other measures did not support the hypothesis of decrease in negative mood (depression, hostility and anxiety) as a function of increased physical fitness. Consistent trends are discussed.
TABLE OF CONTENTS

LIST OF TABLES ...................................................... viii

INTRODUCTION ....................................................... 1
  Effects of Exercise on the General Population ................. 3
    Sense of Competence ......................................... 3
    Changes in Feelings About Self ............................. 5
    Personality .................................................. 10
    Affect ....................................................... 15
    General Psychological Assessment .......................... 28
    Increased Intellectual Functioning ........................ 32
  Exercise Resulting in Behavior Change in the General Population ........................................ 37
    Sleep ......................................................... 37
    Work .......................................................... 38
    Type A Behavior .............................................. 41
    Sexual Behavior .............................................. 42
    Interpersonal Skills ........................................ 43
  Effects of Exercise on Clinical Populations .................. 46
    Institutionalized Geriatric Populations .................... 49
    Depression .................................................. 54
    Anxiety (Phobia) ............................................. 59
    A Psychodynamic Analysis ................................... 61
    Delinquents .................................................. 63
    Alcoholics ................................................... 65
  Summary ......................................................... 68
  Rationale and Hypotheses ...................................... 69

METHODS ............................................................... 76
  Subjects ......................................................... 76
  Rationale for Aerobic Dance ................................... 77
  Exercise Program ............................................... 83
  Instruments ..................................................... 93
  Procedure ....................................................... 96

RESULTS .................................................................... 100

DISCUSSION ............................................................ 106
  Conclusions and Limitations ................................... 112

APPENDICES ............................................................ 116
  I. Behavioral Description of Flexibility, Warm-up, and Stretch Exercises .......................... 116
  II. Summary of Section Times ................................... 123
  III. Detailed Description of Each Class ........................ 125
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV.</td>
<td>Oral Presentation To Subjects</td>
<td>131</td>
</tr>
<tr>
<td>V.</td>
<td>Log</td>
<td>137</td>
</tr>
<tr>
<td>VI.</td>
<td>Consent Form</td>
<td>139</td>
</tr>
<tr>
<td>VII.</td>
<td>Demographic and Health Questionnaire</td>
<td>141</td>
</tr>
<tr>
<td>VIII.</td>
<td>Multiple Affect Adjective Checklist</td>
<td>143</td>
</tr>
<tr>
<td>IX.</td>
<td>Spielberger Trait-State Anxiety Inventory</td>
<td>147</td>
</tr>
<tr>
<td>X.</td>
<td>Post Exercise Questionnaire</td>
<td>150</td>
</tr>
<tr>
<td>XI.</td>
<td>Letter to J. H. Blumenthal</td>
<td>152</td>
</tr>
</tbody>
</table>

REFERENCES                                             154
LIST OF TABLES

1. Results of ANCOVA for Physiological Tests . . . . . 102
2. Results of ANCOVA for Psychological Tests . . . . . 103
3. Results of Post Questionnaire . . . . . . . . . . . . 104
INTRODUCTION

The proliferation of information on exercise suggests there are many benefits to engaging in cardiovascular fitness training (aerobic exercise). This led the author to believe that fitness training would be an important therapeutic tool. Additionally, a review of four textbooks on clinical psychology and psychotherapy found no suggestion of exercise as an adjunct to therapy. In a master's thesis, Coe (1980) states, "Most writers who attempt to treat psychological ills give passing notice to the importance of physical health in the maintenance of psychological adjustment" (p. 1).

In light of the need to search for ways to increase the effectiveness of therapy and the lack of professional suggestion to use exercise as a therapeutic tool, a review of current literature to ascertain if the proposal of fitness training as a general therapeutic tool, and as an adjunct to other treatment modalities, is justified.

Although there is much research to consider, the conclusions of researchers, after completing several major reviews, have been that the research in this field is generally poorly designed and lacks validity (Layman, 1960; Hammett, 1968; Folkins and Sime, 1981). Folkins and Sime
(1981) suggested that one possible reason for poor results in outcome research might be its attempt to measure global changes rather than target variables. This suggestion seemed most appropriate given the fact that outcome research for psychotherapy effects has been plagued with disappointing results using this approach. Additionally, there are multiple goals to be achieved through therapy. The main goals of the therapist are to help the client achieve: (a) a sense of competence (White, 1971); (b) a change in his feelings about himself, his self-concept and self esteem (Corey, 1977; Goldenberg, 1973; Martin, 1971); (c) changes in emotional states of anxiety, depression, guilt and hostility; (d) increases in functional intelligence (e.g., increased problem solving ability); (e) ability to accept more responsibility for who he or she is; (f) changes in his/her behavior, external or internal, public or private, individual or social (Egan, 1975).

The following review of the literature attempts to evaluate changes in sense of competence, locus of control, feelings about self, personality, affect, intellectual functioning, behavior and interpersonal skill which have resulted from physical exercise. Additionally, research dealing with clinical populations will be presented. However, it should be noted that these studies are plagued by small sample size, lack of statistical analysis and
control groups, and use of subject-defined independent variables which limit establishing a causal relationship.

With few exceptions, the research was chosen on the basis of being experimental or quasi-experimental. As Folkins and Sime (1981) suggested, these are the criteria that must be met if we are to be secure in our conclusions. There are some correlational data which only show that a relationship exists and the direction of the relationship, but not the cause and effect. Since cardiovascular efficiency has become the most widely accepted indicator of overall fitness, selection emphasized those studies which employ cardiovascular models of fitness rather than muscle or motor models.

Effects of Exercise on the General Population

Sense of Competence

Two studies were reviewed. Ismail and Trachtman (1973) studied initial fitness and the effects of training on 48 "middle-aged" males. Two extreme groups were formed (high and low fit) on the basis of pretest physiological factors (e.g., exercise heart rate, percentage of body fat, maximal oxygen intake, etc.). Psychological functioning was measured by 16 Personality Factors Questionnaire (16 PF). This test was administered before and after a four-month fitness program which included running and calisthenics three times per week for 1 1/2 hours.
Pre-experimental comparison of personality variables showed higher scores on the factors of emotional stability and imagination for the high-fit group. A comparison of post data showed the low-fit group had a significant increase in emotional stability, in fact, there were now no differences between the groups. In addition, those initially lacking fitness were higher in self-sufficiency.

Jasnoski, Holmes, Solomon and Aguiar (1981), did an experimental study to investigate the relationship between changes in aerobic capacity, self-perceived ability and confidence in judgement about ability, before and after a 10-week aerobic training program. This program required attainment of 30·Cooper aerobic points. This was achieved by two classes which required 30 minutes of strenuous rope-jumping, dancing or running and exercise outside of class. Twenty women (under age 30) initially in Cooper's fair category of fitness, completed the program. The experimental, waiting list control and independent (had not applied for training program) control completed Cooper's 12-minute run to test fitness changes. Psychological change was measured by an original questionnaire, designed to test self perceived abilities and confidence in judgement.

Post-program physiological measurement showed the experimental group was significantly better than either control group. There was no difference between control groups. Analysis of variance demonstrated a significant
(p < .01) increase in perception of ability in all areas. A significant (p < .05) increase in confidence in perceptions was noted in all areas except study confidence.

A correlation of residualized aerobic capacity scores, and ability and confidence scores, showed they were inconsistent in direction and not reliable. This led Jasnoski et al., to conclude: "The fact that changes in self-perception were related to participation in the physical fitness training program but were not related to changes in physical fitness suggests that the changes in self-perception that were observed in this experiment were due to personal or social factors associated with the training program (e.g., group participation, expectancies)" (p. 466).

Changes in Feelings About Self

Eight studies were reviewed. Research on the effects of fitness training in eight sedentary females, ages 20-44, was done by Hanson and Nedde (1974). It was long-term and consisted of participation five days a week for eight months. Physiological effects, as measured by the bicycle ergometer, resulted in a significant increase in work capacity at four months. These results were accentuated at eight months.

Psychological changes, as measured by the Tennessee Self Concept Scale (TSCS), showed no significant change
during the first four months; however, at eight months significant changes were seen in six out of seven areas. Only "self criticism" remained the same. "Self satisfaction" increased ($p < .01$), "physical" and "personal self" increased ($p < .05$), "overall self-esteem" increased ($p < .01$) and "conflict" decreased ($p < .05$). The subjects also expressed that they felt less fatigue, had a better work capacity, a calmer attitude, and a general sense of well-being.

In another study of self concept, McGowan, Harman and Pederson (1974) studied the effect of competitive endurance training on 37 seventh-grade boys. The psychological instruments used were a sociogram and the TSCS. The sociogram was used to assess an increase in peer approval with an increase in fitness. The physical measuring instrument was Cooper's 12-Minute Run, which tests cardiovascular fitness. A $t$-test on pre-experimental measurement revealed equality between groups. Statistical analysis with $t$-tests for paired data revealed the experimental group had a significant increase in fitness ($p < .05$). The control group showed no significant difference between pre and post measures on any variable.

Collingwood (1972), using a quasi-experimental design, studied the effects of fitness training on behavior and self attitudes. The physiological testing measures were a step test to measure cardiovascular fitness, sit-ups and push-ups
(dynamic strength), and the Kraus Weber Series (overall fitness). The psychological measures included subjective counselor ratings, the Bill's Index of Adjustment and Values (IAV) which yields a self concept, self acceptance and ideal self scores, and a self versus ideal discrepancy score. The results showed significant increases in fitness on all fitness measures. Results on the psychological tests led the researchers to conclude there was a significant increase in positive attitude, body attitude, self acceptance, and positive intellectual and emotional interpersonal behaviors. Fitness measures were not taken on the control subjects. Psychological measures showed no significant differences post experiment.

Collingwood and Willet (1971) studied the effects of a training program on five obese boys ages 13-16. The three-week program consisted of a daily two-hour workout, which included one hour of running or swimming. Eight measures of physical fitness were administered, which included aerobic fitness measures (pulse rate, lung capacity and overall fitness). Psychological tests included the Body Attitude Scale and the IAV. Statistical analysis of mean difference scores revealed a significant ($p=.05$) increase in potency (e.g., weak vs. strong) and ($p=.01$) evaluative (good/bad, awkward/graceful). The IAV revealed a significant increase ($p=.05$) in self concept and a decrease ($p=.05$) in discrepancy between self concept and ideal self.
A correlational study (Goldberg and Folkins, 1974) attempted to clarify the relationship between negative body image and negative emotional attitudes in a normal population. The instrument used was a revision of the Schwab and Harmeling (1968), Body Cathexis Scale. A significant negative (Pearson) was found between body image and anxiety, depression and hostility.

Utilizing a different approach to the study of the effects of an endurance program, Morris and Husman (1978) suggest that instead of determining specific personality change, that there should be a more general assessment of life quality. They cite Pflaum's hypothesis of life quality which he organized into four components. One of these components "...the self component refers to the individual awareness of self, his self image, self expression, growth and development, and other personality traits..." (p. 4). Using the Pflaum Life Quality Inventory as a measure of change, they did a study to assess the effects of an endurance training program on changes of life quality. They found a significant ($p < .01$) increase in mean life quality scores from 145.5 to 155.7 in the experimental group. There was an insignificant decrease (155.0-154.2) in life quality scores for the control group.

The only experimental research that combined fitness training with counseling was a study by Hilyer and Mitchell (1979). It measured the effects of a running program alone
or combined with counseling, on the self-concept of college students. The psychological testing instrument was the TSCS. The physiological measure was Cooper's 12-Minute Run. Control subjects were only measured on psychological variables.

For statistical analysis the groups were divided into high and low self-concept on the basis of pretest scores. All students in the experimental groups demonstrated an increase in self-concept. However, analysis of variance revealed only students with low self-concept who received running and counseling had a significant (p < .05) increase in self-concept.

The only study with no significant increase in self-concept was the result of a 10-week physical training program was Leonardson and Garguilo (1978). The self-concept of 15 college freshmen was assessed with a four-item semantic differential scale (test-retest reliability was .82; internal consistency .96) before and after training. Fitness as measured by Cooper's 12-Minute Run was significantly (p < .05) increased. An increase in self-concept occurred, however, it was not statistically significant. They attributed the lack of change to the small sample size and/or the assessment instrument.
Personality

Seven studies were reviewed. Jasnoski and Holmes (1981) studied initial fitness and the effects of training on 103 female college students aged 17-31 (mean age 20.27 years). They administered the 16 Personality Factors Questionnaire (16 PF), Zung's Self Rating Depression Scale (SDS), and the Type A Personality Survey. Cooper's 12-Minute Run tested overall fitness. These tests were administered before and after a 15-week exercise program. The program required attainment of 30 Cooper aerobic points per week. This was achieved by two classes and one outside session of exercise.

Correlations done on initial levels of fitness and results showed that high aerobic performance was related to emotional stability (p=.03), self assurance (p=.025), less depression (p=.025) and pretentiousness (p=.03).

Post-program, there was a significant (p < .001) physiological improvement. Jasnoski and Holmes believe that changes can be due to participating in a program or changes in fitness. Therefore, an analysis of co-variance pre and post was done. It showed that these changes occurred because of program participation; there was a significant increase in self-assurance, imagination and easygoingness; there was a significant decrease in inhibition and Type A behaviors. An "all-with-all" regression analysis of residualized scores resulted in attributing changes in
fitness to more assurance, liberalness and less tension.

("A residualized score consists of the difference between
the observed post-training score and the post-training score
that would be predicted by linear regression from the
observed pre-training score. Scores of this type are
independent of the law of initial values.") (p. 554).

Tillman (1965) studied males in junior and senior high
school. In the first phase of the study he measured the
fitness level of 386 boys with the AAPHER Youth Fitness Test
battery (AAPHER). He also administered Allport's AS
Reaction, Sixteen Personality Factors Questionnaire (16 PF),
and Kuder's Personal Preference Record. On the basis of
fitness scores, 30% of the subjects who scored highest and
lowest were put into a high- and low-fit group. High-fit
subjects had significantly higher ascendance ratings, were
more surgent, were less tense, exhibited greater social
service interests and a greater preference for outdoor
activity. The high-fit group ranked higher on mechanical
and scientific interests. The low-fit group ranked higher
on musical, clerical and computational interests.

Tillman then took the low-fit group and randomly
assigned them to an experimental or control group. After
nine months of "strenuous" fitness training, they were again
measured on the AAPHER. The experimental group was
significantly more fit than the control group. The only
significant change on the 28 personality factors measured
was a change in clerical score. They had less need for precision and accuracy. Tillman notes that the experimental subjects fell far short of the 44th percentile.

Mayo (1975) did a study of seventh- and eighth-grade girls. Pre and post measures included Cooper's 12-Minute Run, Cattell's Jr-Sr High School Personality Questionnaire, and Personal Contact Scale. On the basis of distance run, the 20 who ran the farthest were designated high-fit and put into an experimental and control group. Likewise, the 20 who obtained the lowest score were designated low-fit and put into the experimental or control group. No statistical differences between the high- and low-fit group, experimental or control, before or after treatment on any measure were found.

Duke, Johnson and Nowicki (1977) studied initial fitness and the effects of training on 74 males and 35 females, ages 6-14. They measured change in locus of control with the Childrens Nowicki-Strickland Internal External Control Scale (CNS-IE). Physical fitness was measured by a battery of tests which included: 12-minute run, standing broad jump, 50 yard dash, one minute situps and grip strength.

Physiological and psychological tests were administered before and after an eight-week fitness program. The program consisted of daily 30 minute sessions of running, swimming, interval training, tumbling and gymnastics.
Analysis of covariance revealed significant ($p < .01$) increase in physical fitness and a significant ($p < .01$) change from an external to internal locus of control.

McPherson, Paivio, Yuhasz, Rechnitzer, Pickard and Lefcoe (1967), in a study of the effects of a fitness program on post infarct patients and normals, demonstrated that the cardiac exercises were significantly higher in personality characteristics such as happiness, confidence, optimism, hopefulness, social adventurousness, pleasantness, elatedness and cheerfulness than cardiac controls, normal exercisers, normal controls and experienced exercisers.

Young and Ismail (1976) studied the relationship of age, fitness and a physical exercise program. Fifty-eight men were divided into four groups: high-fit, young and old; low-fit, young and old. They were measured by the 16PF, three scales of the Eysenck Personality Inventory and the "In General" form of the Multiple Affect Adjective Checklist (MAACL) to assess trait anxiety. An analysis of variance showed these results: the high-fit group was more unconventional, emotionally stable, composed, secure, easygoing and adventurous than the low-fit group; the old group was less extroverted than the young group; the high-fit young were more dominant and aggressive than the high-fit old; the low-fit young had more supergo strength than the old low-fit group, especially after the program; the high-fit group at post test was significantly more
Bucolla and Stone (1975) studied the effects of an endurance program (jogging or cycling) on males 60-79 years of age. They exercised three days per week for 14 weeks. There was a significant improvement in fitness for both the jogging and cycling groups as demonstrated by decreased weight and diastolic and systolic blood pressure. The VO\textsubscript{2}max was increased. Personality change as measured by the 16PF was not significant for the cyclers. The joggers became less surgent and more self sufficient. An analysis of variance comparing the two groups showed the cyclers were more tough-minded.

In summary, overall fitness training has not produced dramatic change in personality variables. Inconsistent small changes in young and old groups have been demonstrated. Middle-aged individuals appear to have more change. Additionally, three of the seven studies were lacking control groups (Duke et al., 1977; Young & Ismail, 1976; Buccolla & Stone, 1975), which further limits conclusions to be drawn because it is impossible to identify what was responsible for the change. Extraneous variables such as history, maturation and being part of a group are some of the possibilities.
Affect

Anxiety and depression are the most common psychological problems with which general practitioners, psychologists and psychiatrists deal. These problems are manifested by somatic and psychological complaints.

Exercise and Diazepam are commonly prescribed to relieve tension and anxiety. Calhoun (1977) estimated that Diazepam was used by 15% of the population in the United States. The addictive properties of this drug are a cause of serious concern because they could precipitate a need for more treatment (Ledwidge, 1980).

Byrd (1965), in a survey of 439 general practitioners, found 98% believed exercise relieved tension and anxiety. Of these, 93% had advised or prescribed this treatment and 92% advocated one of the following activities: bowling (24%), golf (51%), walking (89%), or swimming (66%). Similar results from another study of psychiatrists found that 9 out of 10 believed moderate exercise provides relief of tension.

Seven studies which specifically focused on anxiety were reviewed. de Vries (1968) did two experiments dealing with the effects of acute and long term exercise on muscle tension. To measure the effects of short-term activity on muscular tension, 12 females and 17 males, 19-39 years of age (mean, 22.2), were tested twice. One occasion was an experimental day, which consisted of electromyography (EMG)
of muscle tension five minutes before acute exercise (five minutes of bench stepping). One hour after exercise another EMG measurement was taken. On the control day EMG readings were taken the same time period but 15 minutes rest was substituted for exercise. A 58% reduction of muscular tension was found on exercise days while on the control days there was no change.

The second experiment involved 18 males, 26-53 years of age. Eleven were in the experimental group, seven in a control group. The experimental subjects went through a conditioning program including endurance and heavy resistance exercises. They had a total of 17 work-outs. Pre and post measures of muscular activity were conducted in the same manner as the first experiment. Difference scores subjected to a t-test revealed a statistically significant (p < .02) decrease in muscular tension in the experimental group.

Wood (1977) studied the effects of acute physical exercise on state anxiety. Sixty-two male and 44 female subjects were administered Spielberger's State Trait Anxiety Inventory (STAI) Form I (state anxiety) before and after a 12-minute run. Males had a significant (p < .05) decrease while females did not. When subjects were divided into high- and low-anxiety groups (based on pre STAI scores) for statistical purposes, those with low anxiety had a significant (p < .05) increase in anxiety, but were still
within normal range. Those with high anxiety had a significant decrease in anxiety. Woods concluded that physical activity can raise or lower anxiety; the direction is probably dependent on state of arousal before exercise.

Wilson, Berger and Bird (1981) compared the effects of running, an aerobic exercise class and lunch on state anxiety. STAI form I was administered to males and females, ages 21-27, before and after each activity. There was a significant decrease in anxiety in all groups who were in the normal range of anxiety, which supports the idea that any diversion will relieve anxiety.

Additional statistical analysis provided the following information: For male and female runners, initial level of anxiety was positively related to decreased anxiety following activity. Correlational data on runner's pre-activity anxiety showed frequency of running each week, as opposed to previous running history, and was the most important factor in decrements of anxiety level.

Bahrke and Morgan (1978) tested 75 regularly exercising male volunteers, 22-27 years of age. Subjects were assigned to one of three groups: (a) exercise, (b) meditation, and (c) quiet rest (control). Diastolic and systolic blood pressure, and the STAI (both forms) were administered before, immediately following and 10 minutes after treatment. The exercise group (n=25) walked 20 minutes on a treadmill at 70% of self-imposed maximum heart rate. The
meditation (n=25) group received tape-recorded instructions. The control (n=25) group rested 20 minutes. A significant (p < .05) decrease in anxiety occurred in all groups across time. When groups were combined and divided into high- and low-trait anxiety, a significant (p < .05) decrease occurred in both groups. When high-trait anxious subjects (n=4) from each group were compared, a significant decrease in state anxiety across groups occurred. When groups were separated into high- and low-state anxiety, they found significant decreases for high- but not low-state anxiety people. The authors concluded that anxiety reduction may be the same for each treatment but research has to be done on length of reduction.

Bahrke (1979) cited a study by Gillett, Morgan and Balke (1973) of 40 males. The STAI (form I) was administered before and after 40 minutes of vigorous activity. Both high- and low-anxiety subjects had a significant decrease in anxiety.

Mitchum, also cited by Bahrke, achieved a significant reduction of anxiety in males and females with 15 minutes of meditation. Bahrke concludes that even though the treatments are at different ends of the arousal continuum, both result in anxiety reduction.

Driscoll (1976) took a different approach in testing the effects of physical exertion on anxiety. Physical exercise was engaged in before and during presentation of
anxiety scenes. He also did this procedure coupled with presentation of positive images after anxiety scenes.

Ninety-six subjects with severe test anxiety (as determined by interview and the Alpert-Haber, 1960 anxiety scale) were placed in one of six conditions: (a) Physical exercise was engaged in before and during presentation of anxiety scenes (anxiety scenes were subject rated); (b) Positive scenes were imagined after presentation of anxiety scenes; (c) Both of the above treatments were combined, which resulted in exertion before and during presentation of anxiety scenes. Positive scenes were imagined after anxiety scenes; (d) Presentation of anxiety scenes alone; (e) Systematic desensitization with tapes; (f) No treatment control.

The four parallel groups participated in two treatment sessions with the first session lasting 30 minutes. Two to nine days later, a second session lasting 10 minutes was held. The systematic desensitization group listened to four tapes lasting 45 to 50 minutes in each of two sessions. Control subjects were given the anxiety measure at the same time as the experimental subjects. No other procedure was carried out with these subjects.

Analysis of variance on adjusted posttreatment scores indicated all experimental groups were significantly improved (p < .001). Exertion plus positive images were
equal in results to desensitization, which were significantly \( (p < .001) \) better than other treatments. Each of the exertion groups improved more than equivalent groups without exertion \( (p < .002) \). There was significant \( (p < .05) \) improvement in GPA with positive images and exertion.

The importance of positive images following threatening events was supported by anxiety deconditioning effects of positive images; the direct relationship between enjoyment and anxiety deconditioning in the exertion condition and overcoming of negative effects of physical exercise.

Another approach to measure the effects of physical exercise was taken by Cox, Evans and Jamieson (1979). They measured tonic heart rate response to psychosocial stressors. Twenty-nine female students and 41 male students, ages 19-26, were given feedback that they had done poorly on two I. Q. tests (WAIS, comprehension, arithmetic and information and Stroop (1935) color word task). Initially, aerobic power was determined, then the subject's heart rate was monitored before, during and after the experimentally created stress situation. Correlations were made and the results indicated significant differences between aerobically fit and unfit individuals and resting and recovery heart rate. A significant \( (p < .001) \) negative relationship between aerobic power and recovery heart rate and between resting heart rate and aerobic power.
Zimmerman and Fulton (1981), in an experimental replication of Cox et al., changed statistical analyses to adjust for initial basic differences in heart rate. The magnitude of baseline was adjusted. They found that aerobically fit individuals did not have statistically significant lower levels of arousal before, during or after the psychosocial stressor. State anxiety measured by STAI (form I) in conditioned subjects was significantly lower in absence of psychosocial stressors.

Dienstbier, Crabbe, Johnson, Thorland, Jorgensen, Sadar and La Velle (1981) tested changes that resulted from running. Eighteen males and five females were pre and post tested with the Mood Affect Adjective Checklist (MACL, Nowlis and Green, 1959) which measures anxiety, skepticism, aggression, fatigue and sadness. The Buss and Plomin EASI 1975) was also administered. It measures emotionality, activity, sociability and impulsivity. Additionally, a questionnaire measuring reduction in fear and the GSR was monitored. For the Lo RSC there was no difference on anger, but a significant difference in fear. When comparing Mar R to Sh R, anxiety, skepticism, aggression and disgust did not change. Fatigue, sadness, guilt and sick increased at a significant (p < .01) level. Elation was increased. Sociability and activity were decreased. The expectation of benefits was higher in the Hi RSC and results showed they received more benefits. Dienstbier et al. concluded that a
short and long run influenced future stress tolerance. They had expected that the long run would increase stress and eliminate possible benefits, but this was not confirmed.

Four studies measuring depression alone were reviewed. Kavanaugh, Shepard and Tuck (1975) administered the MMPI to 101 subjects, 16-18 months post myocardial infarction. Fifty-six of the individuals were designated severe depression on the basis of Scale 2 scores. These individuals were engaged in a "regular" running program. They were followed for two to four years and improvement on the MMPI Scale 2 was noted; this was attributed to increased fitness.

Morgan, Roberts, Brand and Feinerman (1970) did a correlational study to measure the interrelationships between height, weight, percent body fat, strength of grip and physical working capacity (PWC) on the bicycle ergometer. Sixty-seven male college professors, males, ages 26-55 (mean age 40), were tested on physiological measures and the Zung Self Rating Depression Scale (SDS). No significant correlations were found. In the second phase of the experiment, 34 males were added. All participated in a physical conditioning program. Subjects were given a choice between swimming, jogging, circuit training or a lab group doing treadmill running and bicycle ergometry. A control group consisted of subjects who could not participate
because of scheduling conflicts. The groups exercised three days per week.

The lab group did 10-20 minutes, other groups did 30-45 minutes. All exercised at a submaximal rate of 85%. As heart rate decreased in response to exercise, the intensity of training was increased. All completed the SDS post training. Overall no significant changes in depression were found. However, for 11 of the 101 subjects who were clinically depressed, a significant decrease in depression was noted.

Brown, Ramirez and Taub (1978) did a two-phase experiment; phase one was a general focus on the psychological correlates of exercise in normal and depressed subjects, and phase two focused on clinically depressed subjects. In phase one, 96 female and 71 male subjects participated in a 10-week exercise program. Softball, wrestling, mixed exercise, jogging and tennis were the exercises offered; choice was left to the individual. Pre and post the exercise program, Zung SDS, Human Figure Drawings and the Eysenck Personality Inventory were administered. Resting pulse rate was also taken. A journal of mood variation in relationship to sleep and dream experience, exercise and emotional trauma was kept by all subjects.

The only result Brown et al. reported on was a significant decrease in depression for subjects
participating in the wrestling, mixed exercises, jogging and tennis activities. The softball and control subjects demonstrated no change. Phase two of the experiment will be reviewed in the section dealing with depression in a clinical population.

McCann and Holmes (1984) compared the effects of fitness training on depressed college women. Initially, the Beck Depression Inventory was administered to 250 students in a general psychology course. Forty-three women who scored higher than 11 (cut-off for mild depression) were randomly assigned to one of three groups: (a) aerobic exercise condition (n=15); (b) placebo (meditation n=14); (c) no treatment control (n=14). All subjects were tested pre and post on Cooper's 12-Minute Run. Beck's Depression Inventory was administered at mid-treatment (5 weeks) and posttreatment (10 weeks).

Subjects in the aerobic program participated in a rhythmic dance class two times per week (class included jogging, strenuous dancing and running). They were also required to engage in exercise outside of class to reach 30 Cooper aerobic points. The placebo condition subjects were given verbal and written instructions for use of progressive muscle relaxation and told to practice this 20 minutes, four days per week. Additionally, they were instructed to precede the relaxation session with a five-minute walk.
ANOVA on prescreening and pretreatment scores did not reveal significant differences between groups. A 3x2 (trails by conditions) ANOVA revealed all subjects showed a reliable and substantial reduction in depression that was independent of any specific treatment. ANCOVA of fitness scores revealed a significant increase \( (p < .001) \) in fitness for the aerobic group when compared with the placebo and no treatment groups. Additionally, ANCOVA revealed a significantly \( (p=.005) \) greater decrease in depression for the aerobic group when compared with the other groups. It was also noted that the change occurred in the first five weeks.

McCann and Holmes conclude, "Although these findings provide controlled evidence for a relationship between exercise and reductions in depression...[it]...also documented a reduction of depression that was independent of treatment...this raises questions concerning the results of previous investigations that did not use a no treatment control" (p. 1146).

The rest of the studies reviewed measured more than one mood variable in the same individuals. A quasi-experimental study by Folkins (1976) of 40 men who were high risk for coronary heart disease were matched by age, occupation and risk factors and then assigned to an exercise or control group. The pre and post measures of psychological function were the MAACL (general form) as well as the self confidence
and personal adjustment scales of the Adjective Check List (ACL). The revised form of the Secourd and Jourard Body Cathexis Scale was also used. Physical fitness measures were maximal oxygen uptake, blood pressure and lipid measure. $t$-tests for difference between means of two correlated samples revealed significant increase in cardiovascular fitness for the exercise group. On the psychological measures, the exercise group only, showed significant ($p < .01$) lowering on anxiety and depression scales. No changes were observed on the other scales. The control group showed no significant change on any variable in the post test.

Nowlis and Greenberg (1979) measured mood variables in experienced runners. The MACL and the STAI (both forms) were used. Five females and 13 males were measured before and after a 12.5 mile run. Results showed a significant ($p < .01$) increase in pleasantness. Sadness, depression and anxiety, present at low levels before the race, were not present after the race. There was a decrease, although not significant, in state and trait anxiety.

Lynch, Folkins & Wilmore (1973) investigated the relationship between jogging and the stress emotions. Thirty-six experimental males with a mean age of 46.5 and 34 controls with a mean age of 43.5 were measured pre and post a 19-session exercise program. The MAACL was used to measure anxiety, depression and hostility. The joggers
showed significantly greater reduction in all three measures. Lynch et al. concluded that exercise can provide considerable relief from stress emotions in middle-aged men (Folkins & Amsterdam 1977).

Blumenthal, Williams, Needles and Wallace (1982) measured the psychological changes that accompany aerobic exercise in healthy middle-aged adults. Eleven women and five men, ages 25-61 (mean age 45.1 years), engaged in a 10-week program. Community volunteers, matched on age, sex, education and health status served as controls.

Physiological changes in the experimental group were significantly better. Changes in mood state were measured by the Profile of Mood States (POMS), which measures tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia and confusion-bewilderment. Additionally, the STAI (both forms) were administered. Results showed significant changes in four of the six affective scales: Tension (p < .04), fatigue (p < .05), depression (p < .01), vigor (p < .08) and confusion (p < .05). Furthermore, STAI state was significantly (p < .05) reduced, and trait anxiety was reduced significantly (p < .02).

In summary, research supports the contention that endurance training has been shown to reduce stress emotions (anxiety, depression and hostility).
General Psychological Assessment

This section includes the studies which measured change on several psychological variables in the same individuals. The variables included changes in mood, personality and general adjustment. Six studies were reviewed. In a correlational study which compared aerobic fitness with results from the MMPI, Sharp and Reilly (1975) found aerobic fitness correlated with the favorable scales on K (defensiveness) and Es (these people tend to feel they are resilient) and correlated negatively with the psychotic and neurotic measures.

In a before and after, quasi-experimental design, Kowal, Patton and Vogel (1978) attempted to find out the psychological and aerobic fitness of U.S. Army recruits before and after basic training. Using a variety of psychological and physical measures, they concluded that male recruits had significantly less body fat and weight after training. Aerobic fitness was significantly better for males than females, which might be attributed to differences in the training program the females underwent. The psychological measures did not show change in the personality traits of extroversion, anxiety or emotionality. There were, however, significant improvements in male post-training measures of mood state, tension, state anxiety and physical self-concept. There were no significant changes on any factor for females.
In a study that related physical fitness to psychological fitness, Folkins, Lynch and Gardner (1972) operationally defined psychological fitness as "...present functioning: personality, for example, present view of self, mood variables, and work related ratings" (p. 504). To measure personality variables, the Adjective Checklist (ACL) confidence and personal adjustment subscales were used. To measure mood variables, the MAACL scales of anxiety and depression were used. The physical fitness measure was the amount of time it took a subject to run one and three-fourths miles and resting heart rate. The fitness program resulted in significant physiological improvement in both men and women. Psychological improvement occurred only in women. Statistical analysis showed that women were initially less psychologically fit than men. Women had a significant decrease in anxiety and depression and a significant increase in self confidence and adjustment.

Massie and Shepard (1971) investigated the physiological and psychological changes that occurred as a result of fitness training. Two groups participated in the study; a running group and a group in an organized program at the YMCA. Both groups were administered physiological and psychological tests before, during and after the program, and the participants also kept exercise logs.

All participants had the following significant physical changes: loss of subcutaneous fat ($p < .01$); decrease in
resting pulse rate ($p < .001$); a gain in aerobic power ($p < .001$); increased ventilation ($p < .01$); and increased lactate ($p < .02$). Psychological changes included a change in attitude about physical activity and body image. There was a nonsignificant improvement in mood states. Anxiety measures did not change. The personality scales showed an increase in extroversion and a decrease in neuroticism and defensiveness. A limitation of this study is lack of a control group.

A study by Naughton, Bruhn and Lategola (1968) in post-infarct patients resulted in significant physiological but not psychological changes. Results of an MMPI showed changes in the depression and hypochondriacal scales in the desired direction, but they were not significant. Sociological interview revealed that subjects in the exercise program had longer, more restful sleep, greater ease handling conflicts, a more relaxed pace and more stable eating patterns. Information related to the physician by the subject was discussed so that discrepancies in the information could be clarified. Upon entry into the program the sedentary cardiac controls differed significantly ($p < .05$) from healthy controls. The healthy controls were more defensive, suspicious, oversensitive and socially extroverted.

Stern and Cleary (1981) did an extensive study of psycho-social changes in post-infarct (eight weeks to three
years) males, 30-64 years of age, following a six-week low level exercise program. The study involved participants at several centers around the United States. It is the first phase of a two-year longitudinal study of the effects of exercise in a post-infarct rehabilitation program.

Of the 781 original participants, data were collected on 651, who completed this phase of the program. Participation in the study required the subjects to attend 14 out of 18 sessions in six consecutive weeks. Each exercise session included a five minute warm-up followed by four-minute intervals at 72% maximum capacity on a bicycle ergometer, shoulder wheel, treadmill, steps and rowing machine. These intervals were interspersed with two-minute rest periods.

Before and after psychosocial measures included: two subscales of MMPI (anxiety, depression), Taylor Manifest Anxiety Scale (TMAS), Katz Adjustment Scale (KAS) which is a spouse-rated index of social and psychological adjustment. Self-rating questionnaires were administered to measure domestic, social, work and sexual activity.

Results showed significant cardiovascular fitness changes. There was a statistically significant ($p < .05$) decrease in the percentage of depressed men and level of depression post exercise. Changes in anxiety were in the opposite direction. A significant ($p < .05$) increase in the level of anxiety and number of men reporting anxiety
occurred. When subjects were stratified by time post-infarct there were no significant differences, although mean increase was greater for those 24-months post-infarct. The subjects who were initially more anxious, showed more change in depression and several KAS scores than did the non-anxious subjects. There was no differential change for those more depressed at the onset of the program. Exercise was clearly beneficial but not specifically as an antidepressant agent.

KAS ratings by spouses showed significantly improved rating on subscales of verbal expansiveness, negativism, helplessness, suspiciousness, anxiety, withdrawal, psychopathology, nervousness, hyperactivity, and depression. The belligerence subscale showed no change, while the instability scale increased.

In summary, this research raises more questions than it answers. It appears that changes in mood occur with those who are less psychologically and aerobically fit at the onset. However the results of Massie and Shepard, and Stern and Cleary contradict other findings on decrease in anxiety with aerobic exercise.

Increased Intellectual Functioning

Nine studies were reviewed. In a study on the effects of physical exertion on mental performance, Davey (1973) did
two experiments. In the first experiment, he had three groups: rest, control and experimental (physical exertion). The mental task for the experimental group was the Brown and Poulton Test. This test assesses attention and relies heavily on short-term memory. The physical task was constant torque bicycle ergometer. The results showed that the physical exertion group did significantly better on the Brown and Poulton Test than did the rest or control groups. The second experiment used the same measuring instruments but varied the amount of physical exercise. The conclusion he reached was that differing the amount of exercise had a significant effect on mental performance. Improvement in performance of mental tasks occurred when moderate amounts of exercise were engaged in. Severe exertion resulted in a deterioration effect on mental performance. Intermediate amount of exercise led to different results in different subjects.

Gutin (1966) did an experimental study on the effects of general fitness training on mental performance following physical and mental stress. The fitness training included isometrics, calisthenics and circuit training. The subjects were male college students. He found no significant difference on any variable between the control and experimental groups.

Weingarten (1973) did three studies to test the relationship between fitness and performance under stress.
conditions. One experiment tested psychomotor performance between physically fit and unfit subjects under stressful physical conditions. A group of soldiers shot at a target 10 times after a 1 kilometer run. They were then divided into two groups. One group remained sedentary, while the other ran 1 kilometer daily for three weeks. During this time neither group did any target shooting. The two groups then repeated the target shooting after a 1 kilometer run. The control group shooting ability remained the same, while the experimental group improved considerably. The following day both groups did target shooting under relaxed conditions. There was no difference between groups. The relaxed and stress scores of the running group were the same, while the non-running group had different scores under the stress and non-stress situations.

Weingarten and Alexander (1970) tested mental performance under stress and non-stress situations. They administered maximal aerobic capacity tests to 22 male college students. They then tested the students on 30 odd-numbered Raven's matrices while walking a treadmill at 0% grade. One week later they answered the 30 even-numbered matrices under severe physiological stress produced by increasing the grade on the treadmill to 15%. At the 15% grade they answered the questions. Comparisons were made between the 13 fit and 9 less-fit subjects. In the pre-mental test the fit group did slightly better than the
unfit group. During the stress test the fit group did significantly \( (p < .01) \) better than the unfit group. When the matrices were divided according to degree of difficulty, mental scores were better with difficulty in the fit group.

Weingarten (1970) tested 30 males with the odd-numbered Raven's matrices during treadmill exercise requiring exertion at 75% of maximal capacity. Based on test scores and fitness level the subjects were divided into two equal groups of 15. The experimental group ran 2-3.5 kilometers daily and did other fitness exercise. Results showed no differences between the groups on the pretest. Post training, the experimental group had significantly \( (p < .001) \) higher aerobic capacity. The post mental test of the experimental group was significantly \( (p < .01) \) better than the control group (Weingarten, 1973).

Hammett (1967), in his review of psychological changes occurring with fitness training, cites Petrushevski's (1966) experiment of the "before and after" type. Radiotelegraph operators who were given two months of fitness training improved performance at their jobs and improved general psychological functioning as measured by the digit span and numerical problem solving tests.

Ismail and El Naggar (1981) studied the effects of endurance training on successive and simultaneous cognitive processing. Simultaneous processing was described as "...grouping of separate elements into integrated wholes"
It was measured by Cattell's Series, Classification, Matrices and Conditions tests. In addition, Bennett, Seashore and Wessman's Space Relations test was used. Successive processing was described as "...processing information in a serially dependent, temporal order" (p. 85). The tests used were Bennet et al. Verbal Reasoning Test; Vernon, Ryba and Lang's Successive Numbers Task; Weschler's Digit Span and Armitage's Trail Making Test, parts A and B.

Forty-eight men, ages 24-68 with a mean age of 42, were divided into an experimental group (n=35) and control (n=13) group matched for age and health. The fitness tests included: resting pulse pressure, submaximal oxygen uptake l/min., maximal oxygen uptake l/min., maximal oxygen uptake ml/kg lean body weight/min. The four-month fitness program consisted of exercise three days per week for 90 minutes. It included progressive jogging or walking for 25 minutes maximum. Results of the t-test pre and post for the exercise group showed significant improvement on all the physiological measures. A discriminant function analysis showed "four physiological, three successive and three simultaneous cognitive processing variables were successful in discriminating between the pre and post results... in this respective order" (p. 88,89). t-test results on the control group showed no significant difference in any variable.
A correlational study by Cooper (1982) on Air Force officers found an almost perfect correlation between fitness level and academic grades.

Pradusov (Donoghue, 1977) presented evidence of several studies of the effects of fitness on intellectual performance. Work capacity and creativity in scientists was directly related to fitness levels. Exercise breaks in textile mills reduced errors made by female workers.

Except for one study, the results of the other studies seem to indicate there is improved mental performance with increased physical fitness.

Exercise Resulting in Behavior Change in the General Population

Changes in sleep, work, type A, sexual and interpersonal skills behavior will be examined.

Sleep

Two studies were reviewed. Baekland (1970) examined the effects of exercise on psychological and sleep reactions. The sleep patterns of 14 college students who were accustomed to regular exercise and free from psychiatric or medical problems were studied over a one-month period. Exercise nights when compared with non-exercise nights resulted in greater deep sleep. Wakefulness, first REM (rapid eye movement) latencies and
REM sleep increased during the exercise deprivation period. These signs are viewed as indices of increased arousal or anxiety. The subjects reported they felt an increased need to be with others, impaired sleep and increased sexual tension. It was concluded that physical confinement is a stressful experience.

In a study of four males and four females, Griffen and Trinder (1978) measured slow wave sleep (SWS), which is restorative sleep, after a day of exercise and no exercise. For statistical purposes, subjects were divided on the basis of a fitness test, into fit and unfit groups. There was an increase in slow wave sleep for fit people after exercise. For unfit people, exercise had a negative effect on sleep. There was a higher amount of restlessness. The results suggest that the level of exercise appropriate to the level of fitness may be an important factor influencing the positive benefits of exercise on sleep.

Work

Six studies were reviewed. Heinzelman and Bagley (1970) did a longitudinal study of 18 months duration. Men with a high potential for coronary heart disease enrolled in an exercise program. Results of a self-report questionnaire showed 60% of the 108 participants said exercise had a positive effect on work performance and on their attitudes toward work.
Heinzelman and Durbeck (1970) studied the results of a two-year physical activity program at NASA headquarters in Washington, D.C. They administered a questionnaire to 239 executives, ages 35-55. Fifty percent of those who attended the program reported improvement in work performance and less stress and tension. Forty-nine percent reported improved attitudes toward work. Objective tests of fitness corresponded very well with their perception of fitness (Donoghue, 1977). Donoghue cites several studies in Canada that had the same results as Heinzelman and Durbeck.

A study of 534 males and females by Cox, Shepard and Corey (1981) examined the changes in fitness (as measured by body mass and fat, sit and reach test, handgrip force and maximum O₂ uptake), absenteeism, and productivity after a company exercise program. Of the 534 subjects, 331 participated in the program, 203 were controls. They found those who were high adherents to the program had a significant increase in aerobic fitness and flexibility, and decrease in percent body fat. Job turnover was reduced 15% in a 10-month period. In high adherence absenteeism was reduced 22%. Productivity was up 7.04% in the experimental company, while the control company had a 4.3% increase.

Donoghue, in a review of literature of changes in work behavior that occur as a result of exercise, states that much of the research comes from the USSR because fitness programs have existed there since 1930. Pradusov (1976),
summarizing the results of many studies in the USSR, enumerated several outcomes that resulted from participation in physical activity. There is less absenteeism among those who are fit, and when they get sick the duration of illness is less than among unfit people. Inactive people consult physicians four times more than active people and their illnesses result in absenteeism 60% of the time compared to 22.5% in the active group. Inactive people have 2-3 more accidents than active people. The output of active people is 2-5% higher. In a study of teletype operators, productivity increased significantly after an exercise break (Donoghue, 1977).

Stern and Cleary (1981), previously cited, studied post-infarct males. A self report questionnaire was administered to measure vocational performance pre and post an exercise program. They found a significant \( p < .001 \) increase in the number working after the program. Twenty-two percent reported an increase in income, 16% reported increased responsibility at work. Exercise work capacity also increased significantly. When subjects were stratified by time, there was a significant \( p < .05 \) differential increase. Thus, those less than six months post-infarct had the greatest increase in work capacity.

A correlational study of 51 customs officers in Britain, done by Linden (1969), demonstrated an inverse relationship between absenteeism and maximal oxygen uptake
(Donoghue, 1977). Donoghue also reports on a pilot study in an Ottawa post office which resulted in two days less absenteeism among exercisers as compared to non-exercisers. The research on changes in work performance are highly suggestive that exercise is beneficial.

Type A Behavior

One study was reviewed. Blumenthal, Williams, Williams and Wallace (1980) studied changes in physiology and behavior that resulted from an exercise program. Forty-six subjects, males (n=20), females (n=26), ages 25-61, walk/jogged for 30-45 minutes three times per week for 10 weeks. It was suggested to participants to change their diet. They were asked to limit salt, cholesterol, saturated fats and total calorie intake. No further manipulation or monitoring of diet was attempted.

Pre and post physical testing included these fitness measures. Blood pressure, diastolic and systolic, body weight, treadmill heart rate at 75% of initial treadmill workload (V 75). Total serum and high density lipoprotein (HDL) cholesterol, plasma triglycerides and plasminogen activator release were also determined.

Psychological testing measured type A and B behavior using the Jenkins Activity Survey for Health Prediction (JAS). This is a 54-item behavior questionnaire which differentiates between type A (competitive, aggressive,
hard-driving and a chronic sense of time urgency) and type B (the opposite of type A) individuals. It also categorizes type A behavior into three factors: (a) Speed and impatience; (b) Job involvement; (c) Hard-driving and competitive. Results of the pretest categorized 21 type A and 25 type B individuals.

MANOVA analysis indicated there was a significant positive change for all subjects in treadmill performance, blood pressure, weight, HDL and plasminogen activator release. There was a significant reduction in the magnitude of type A behavior in those designated as type A. Type B individuals had no significant change in A scores. Analysis of factor scores on the JAS revealed no significant change on any one factor.

Blumenthal et al. concluded that results were encouraging although lack of a control group limited attributing the mechanism of change.

Sexual Behavior

A self-report questionnaire administered by Stern and Cleary (1981) to post-infarct males pre and post a six-week exercise program found a significant (p < .01) increase in those reporting sexual activity. Of all the sexually active participants, 24% reported better quality sex. When subjects were stratified by time, all groups, except those
24 months or more post-infarct reported an increase of frequency.

In a study by Harper (1978) measuring the effect of an exercise program on students in a counseling class, students noted in their logs of change that they had an increased appreciation for sex.

**Interpersonal Skills**

The last area to be examined is interpersonal skills.

Four studies will be reviewed.

Collingwood and Holder (1973) did a correlational study of the relationship of fitness to acquisition of interpersonal skills. Twenty subjects, males (n=10) and females (n=10) in an interpersonal skills training class were measured pre and post for fitness and skills levels. Interpersonal functioning was measured by rating subject responses to eight stimulus situations representing various affect and content categories. A five-point scale, the Overall Facilitative Functioning Scale, was used. The inter-rater reliability coefficient was \( r = .75 \). Three fitness measures were employed, resting pulse rate, time to run 600 yards and the number of sit-ups in two minutes.

All subjects had a significant gain in interpersonal functioning post training. There was no relationship between pre and post level of interpersonal function and skill acquisition. There was a significant relationship
between resting pulse rate ($p=0.01$) and run time ($p=0.05$) and interpersonal skill level. Collingwood and Holder concluded, "Fitness level demonstrated enough of a relationship to performance in interpersonal skill training that it (resting pulse rate) warrants consideration as a selection measure for that specific kind of training" (p. 371).

Harper (1978) studied the effects of fitness training on eight students planning careers in the helping professions, enrolled in a fitness/counseling course. The program included jogging five times per week for 14 weeks. In addition, a two-hour group discussion weekly dealt with physical and personal problems, and topics on health and fitness. Logs and group discussion indicated the students experienced improvements in attitudes, friendships, sense of accomplishment, feelings of well being, confidence, capacity for work and value for health. Increased muscle tone, ability to cope with stress and relax, sleep, physical and mental alertness and appreciation for sex were also noted.

State and trait measures of anxiety (STAI) and the Tennessee Self Concept Scale showed improvements which were significant only on state anxiety. Physical measures demonstrated a significant decrease in weight, but a non-significant reduction in measurements. Subjective evaluation of the course was that "...it was the most meaningful course that they had ever taken" (p. 75). Small
sample size, lack of a control group and weekly discussion of changes experienced are serious limitations of this study.

Students enrolled in a course which was designed to get them involved with a fitness program and to use the fitness program in counseling, were studied by Hilyer, Jenkins, Deaton, Dillon, Meadows and Wilson (1980). Fifteen students from this course were selected because they were not involved in any fitness program. Controls were students enrolled in other courses, matched on these variables: age, sex, curriculum major and lack of participation in a fitness program.

Pre and post physiological measures were: Cooper's 12-Minute Run; the 5-Minute Step Test; maximum weight supine press (muscular endurance); skinfold (body fat); chin-ups (muscular endurance). Pre and post psychological measures included: Tennessee Self Concept Scale (TSCS) total P (self esteem) and the Physical Self sub scale; Neuroticism Scale Questionnaire (NSQ) factor "depressiveness versus cheerfulness"; Profile of Mood States (POMS), tension-anxiety and inertia-fatigue scales; the Fear Survey Questionnaire; Cattell's 16 Personality Factors (16PF), factor C (feelings versus emotionally stable) and factor Q4 (relaxed versus tense; MMPI scale 1 (hypochondriases), scale 2 (depression) and scale 7 (anxiety, obsessive compulsive). Statistically at pretesting the groups were psychologically
and physiologically similar except for the MMPI, scale 7. The experimental group had a mean of 24.4 while the control group had a mean of 21.4. Discriminate analysis and post-hoc univariate t-tests scores revealed the experimental subjects had significantly more positive scores ($p < .05$) on all psychological measures except for the MMPI scale 7. They did significantly better on all physiological measures except for bench press and percent body fat. A severe limitation of this study is that many variables other than fitness change could have influenced the outcome. Some of the possible confounding variables listed by the authors included: focus on changes made by physical training, frequent assessment of fitness and its effect on behavior, the fact that they (subjects in this study) administered the program to another group and observed changes, natural motivation shown by enrolling in the course, knowing it was very demanding.

Hilyer et al. concluded that, "Intense, systematic physical fitness programs, when delivered in a helping relationship, help improve self-concept; reduce depression, anxiety, somatic complaints, tension and fatigue; reduce the effect of fear; and improve emotional stability" (p. 113).

Greenberg (1975) studied the relationship of physical conditioning on the acquisition of interpersonal skills. Sixty volunteer students, enrolled in a course that offered interpersonal skills and fitness training, were randomly
assigned to one of three groups. Group 1 treatment included running and interpersonal skills training. Group 2 received interpersonal skills training only. The control group received no training, but was offered the same training the following semester. No rewards were offered for participation in this non-required course.

Subjects were pre and post tested on Cooper's 12-Minute Test, and communication and discrimination skills from Carkhuff's model. To test communication skills the subject was given a lead ostensibly from someone seeking help, to which he/she responds. These responses were rated on a 5-point scale as being facilitative (5) or non-facilitative (1). Discrimination ability was tested by providing four responses to a lead form which he/she chooses the most appropriate response for facilitating movement in therapy.

The endurance program provided was an individual adaption of Cooper's progressive training based on fitness level at pretesting. A variety of endurance activities were offered.

The training resulted in significantly ($p < .01$) improved mean levels of fitness for the subjects in this group. All subjects who received interpersonal skills training had significant ($p < .05$) improvement in communication skills; they also showed significant ($p < .001$) gains in discrimination ability. The controls demonstrated no change in physical or interpersonal
functioning. Statistical testing of differences between groups revealed those receiving both skills training and running did significantly \( (p < .05) \) better on discrimination skills than those receiving skills training only.

The overall results show that acquisition of interpersonal skills is enhanced by fitness training. It suggests fitness training not only improves client behavior but may also enhance therapist functioning.

**Effects of Exercise on Clinical Populations**

A limited review of research done with clinical populations will be presented. These studies are plagued by small sample size, lack of statistical analysis and control groups, and use subject-defined independent variables which limits establishing a causal relationship. A correlational study comparing broad levels of mental adjustment and fitness, studies on geriatric clinical populations, psychodynamic application of running, treatment of the specific syndromes of anxiety and depression, and treatment of alcoholic and delinquent populations will be reviewed.

A correlational study by Murphy, Bennett, Martin and Hagen (1972) compared fitness and mental adjustment in males, age 18-70. Fitness measures used were weight and girth (chest and abdomen dimensions). Three levels of mental adjustment were designated by: control group \( (n=144) \) non-hospitalized males in the community; experimentals
(n=259) two groups; (a) Newly admitted patients (hospitalized less than six months) and (b) long term (hospitalized more than six months). A significant (p < .01) positive relationship between girth and mental adjustment was noted. Controls had a significantly better difference between chest and relaxed abdomen measurements than newly admitted patients who were significantly better than long-term patients. There were no significant differences in weight between groups.

Institutionalized Geriatric Populations

Powell (1974) studied changes in cognition and behavior of institutionalized (average 24.3 years) and geriatric (mean age 69.5) patients that resulted from 12 weeks of mild exercise (brisk walking, calisthenics and rhythmical movements). Social therapy (arts, crafts, music and game therapy) was a treatment designed to control for attention or change of routine effects. Using a randomized block design to account for age, sex and ward residence, 30 subjects were assigned to exercise, social therapy or control condition. Both treatment groups met one hour, five days a week.

The Weschler Memory Scale, Ravens Progressive Matrices and Graham and Kendall's Memory For Designs, were used to test cognition. Behavioral changes were measured by the Nurses Observation Scale for Inpatient Evaluation (NOSIE)
and the Geriatric Assessment Scale. All subjects were measured at 0, 8 and 12 weeks.

At eight weeks significant differences were found between groups. At 12 weeks significant positive changes on Weschler Memory Scale, and Ravens Progressive Matrices were noted for the exercise group. No changes on the Memory For Designs was noted for any group. There were negative changes on the behavioral scales for the exercise group (decline in personal appearance, increased irritability), which Powell felt might be an expression of self independence or antagonism toward hospitalization or routine and therefore not necessarily negative. A limitation of this study is the lack of measurement of physical changes.

In a study of changes occurring as a result of jogging, Lion (1978) measured trait anxiety and body image in six middle-aged, chronic psychiatric patients living in a half-way house. Experimental subjects exercised three times per week for one hour, while controls were taken to the exercise area and left on their own. Treatment was carried out for two months.

Pretest results showed no differences on Spielberger's, State Trait Anxiety Inventory (STAI) trait form or on the Body Image and Personality (Fisher and Cleveland, 1958). Post testing revealed a significant ($p < .05$) difference between groups. There was a reduction in anxiety for the exercise group while the control group had a slight
increase. Changes in body image were not significant. This study is limited by lack of fitness measures and small sample size.

Dodson and Mullens (1969) studied physiological and psychological changes in psychiatric patients that resulted from a four-phase experimental program. Four females and 14 males, rotated through a no exercise, light exercise (two periods, one before and one after the jogging phase), and jogging program with each regime lasting three weeks. The light exercise and jogging involved participation five days per week.

Psychological changes were measured after each phase. The measures included: MMPI, Shostrom's Personality Orientation Inventory (POI, measures self-actualization), Fisher and Cleveland's Body Image and Personality (measures body image), Osgoods' Measurement of Meaning (a specially constructed semantic differential scale), and the Autokinetic index (Voth).

Blood pressure, pulse and respiration rate and resting lung capacity were the physiological measurements taken on a weekly basis. The results indicated a significant \((p < .01)\) change in pulse rate and lung capacity. They also found that light exercise, before jogging, improved fitness, but could not maintain the high level indices reached during the jogging phase.
Psychological indices showed increased anxiety, acceptance of aggressive feelings and less hostility with light exercise. Jogging resulted in alertness to here and now, less concern about body function and less tension. There was a trend toward better body image during the jogging phase. A six-month follow-up revealed that eight of the subjects had been discharged compared with average hospitalization of 5.7 years.

A study by Stamford, Hambacher and Fallica (1974) demonstrated significant physiological and psychological changes that occurred after participation in a physical exercise program. Seventeen males were randomly assigned to an experimental ($n=9$) or a control group ($n=8$). The mean age of the experimental group was 71.5 with an average continuous hospitalization of 21 years. The control group had an average hospitalization of 22 years and a mean age of 62.5. Those patients receiving medication continued to receive it regardless of which condition they were in.

The physiological measurements were heart rate and blood pressure after work on a treadmill and bicycle ergometer. Psychological changes were measured by Draw a Person Test (DAP), Weschler Adult Intelligence Scale (WAIS) digit span and information subtests. A fourth measure was a questionnaire designed to measure patient's knowledge of hospital activities and well-publicized current events.
Testing was done pre and post the 12-week program. All testing and scoring was done by PhD psychologists who were blind to assignment of subjects to the experimental or control group.

Both the experimental and control groups walked on a treadmill five days per week. Differences between groups were manipulated by intensity and duration of exercise. Experimental subjects worked at 70% of maximal heart rate, progressing from 4 to 12 minutes daily. The control group spent 30 minutes in the exercise room, but walked on the treadmill for only one minute.

ANCOVA of physiological tests revealed a significant decrease in heart rate and systolic blood pressure for the experimental group. There was no change in the control group. A non parametric statistical analysis utilizing the Mann Whitney U test demonstrated that experimental subjects did significantly better (p < .05) than control subjects on the WAIS information and general questionnaire. Statistical analysis of the DAP and digit span revealed no significant changes for either the control or experimental groups.

Informal observation of subjects provided additional information. Initially, no social interaction occurred among patients, nor between patients and researchers. As the study progressed, experimental subjects spontaneously initiated conversation as well as greetings and farewells.
Stamford et al. felt that this was particularly significant as this did not occur with control subjects.

Clark, Wade, Massey and Van Dyke (1975) studied changes in institutionalized psychiatric patients of varied diagnoses who participated in an exercise or social group or maintained usual activities. Several physiological measures were used to ascertain fitness and neuromuscular changes. Changes in behavior were measured by an objective measure of activity level (formula devised by Clark et al.) and NOSIE (nurses' ratings of self care). The social interaction group did arts, crafts and other activities excluding exercise. The exercise group did varied exercises, but not to bring the heart rate above 120 beats per minute. The physiological measures showed no significant change. The activity levels increased but were not significantly greater for the exercise group. There were no significant changes on any of the measures.

Overall fitness training appears to have a beneficial effect on institutionalized patients, and although one study showed no changes, this could have been the result of not achieving endurance training intensity levels during exercise.

Depression

Brown et al. (1976), previously cited, in the second phase of their experiment, collected data from 561
university students. One hundred and one were clinically depressed, 91 of the depressed subjects participated in the running program. Ten were non-exercising controls. Of the remaining students, 406 served as running controls, while 54 did not exercise. The exercisers jogged three or five days per week for 10 weeks.

The psychological measuring instruments were expanded. In addition to Zung's Self Rating Depression Scale (SDS), the MMPI scale 2 (depression), Activation-Deactivation Checklist, and a multifactor adjective checklist of mood states and two questionnaires on sleep and health were utilized.

$t$-tests for correlated means revealed that all joggers (three or five days) whether clinically depressed or not, showed significantly ($p < .02$) less depression at post-testing. A significant ($p < .01$) decrease in the negative affect states of fatigue/inertia, and tense/anxious occurred in all joggers. No change was noted for non-joggers. A significant decrease in anger/hostility occurred in the depressed joggers, no change on this measure was noted for other subjects. The subscales of cheerfulness, energetic and general activation, the positive affect states, were significantly ($p < .01$) increased for depressed joggers. For non-depressed joggers there was a significant ($p < .05$) increase on general activation only.
Limitations of this study were non-concealment of purpose and lack of a fitness measurement. Additionally, change in depressed patients could have resulted from praise given by attending physician for improved health or the patient taking other potentially uncontrolled therapeutic steps on their own behalf.

In two pilot studies, Griest, Klein, Eichens, Faris, Furman and Morgan (1978a, 1978b, 1979), compared running to time-limited and time-unlimited therapy for treatment of depressed patients. Stringent entrance criteria included being between 18 and 30; scoring at 50% or above on Symptom Checklist-90 (SCL-90); depression had to be the target symptom and had to be minor in accordance with Research Diagnostic Criteria (RDC) of the National Institute of Mental Health. Subjects also had to have an absence of psychosis, have no significant suicide risk or need for antidepressant medication.

In the first study, 13 men and 15 women were randomly assigned to time-limited (10 weeks, n=6), time-unlimited (n=12) or running (10 weeks, n=10). Dropouts resulted in data being collected on eight runners, five time-limited and three time-unlimited subjects.

Running treatment progressed in this manner: A running therapist (not a psychotherapist) taught subjects how to run (stance, gait, posture, etc.) to prevent injury, and to focus on body feedback. No discussion of problems occurred.
If the subject initiated conversation in that direction, he was distracted by the leader, who got him to focus on body feedback. The subjects ran progressively longer distances and were weaned from running with the therapist by the eighth week.

Results showed two women had little improvement, one had improvement later. The rest of the runners were improved (as measured by the SCL-90).

A second study was done because of problems with the therapy condition in the first study. Combined data showed that running was as effective as either of the other treatment modalities. SCL-90 data one year later showed running subjects to be in the no depression category, while the time-limited subjects were a little bit depressed and the time-unlimited individuals moderately depressed. Serious limitations of these studies is a lack of statistical analysis, fitness measures and the large number of dropouts.

Griest, Eichens, Klein and Linn (1981) attempted to compare running, meditation and group psychotherapy for depression. Sixty subjects were recruited by newspaper. Entry criteria were the same as the previous study. Significant dropout in the running group resulted in too few data for statistical analysis. Group psychotherapy clients had a significant ($p < .05$) decrease, while the meditation group had a non-significant decrease ($p < .065$). A second
attempt at comparison yielded data for running. There was a significant decrease ($p < .005$) in depression. All subjects were measured on the SCL-90.

Limitations of this study included data collated from two different time periods, lack of fitness measures and lack of a control group.

Eischens and Griest (1984) suggest that to use running as a treatment for depression it is necessary to determine if the depression is the type amenable to running. They believe that mild to moderate reactive depression are likely to respond. There is no evidence that in major depressions (endogenous-psychotic) that running is helpful. They state, "... our limited attempts at using running for patients with major depression have produced no beneficial effects" (p. 75). They believe it is contraindicated unless it is used as an adjunct to medication and/or electroconvulsive therapy.

Rinskoff and Gratch (1980) studied the changes in mild or moderately depressed college students, that resulted from running alone or running plus psychotherapy. After six weeks both groups had a significant decrease in anxiety and depression. There was an improvement in interpersonal sensitivity. A five-month follow-up revealed the therapy/running subjects had returned to their pre-treatment condition, while the running only group continued to improve
(Griest et al., 1982b) A limitation of this study is lack of a control group.

Anxiety (Phobia)

Two studies are reviewed. Orwin (1981), used acute physical exertion as a treatment for agoraphobics. The procedure was to create a hierarchy of situations and distance. When a situation that provoked an anxiety response was isolated, the subject would withdraw to a certain point so he/she could run and arrive breathless at the anxiety provoking point or run through it. He would repeat this at a gradually slowing pace.

Orwin tested eight clinical cases ranging from severe to mild symptoms of agoraphobia. Four cases were described with severe agoraphobia which was defined as, "where even if accompanied they would be unable to leave home or similarly, unable to wait in street, shop, etc. unless heavily sedated" (p. 34). Moderate (n=3) symptoms were described "...if, although unable to approach a feared situation alone, they would suffer minor anxiety when accompanied, but this did not preclude occasional anxiety attacks" (p. 34). Finally, mild (n=1) signified "...occasional panic feelings, but mainly apprehension, always present if alone, and absent when accompanied" (p. 34).

The treatment was carried out by nurses with the exception of one case. For the severe cases, 34-90 sessions
were needed. For moderate, 16-28 sessions were needed. For the mild case, 12 sessions were needed. All had alleviation of anxiety symptoms and were able to engage in the previously phobic activity. One case had three relapses which occurred when marital problems arose, when these problems were dealt with, she was still symptom-free three months later.

Orwin feels the response to this treatment may be the result of cognitive relabeling of somatic symptoms or anxiety inhibition because of competing metabolic needs of vigorous physical activity. He also postulated that an instinctive response to anxiety (running) helped to control it.

A case study by Muller and Armstrong (1975) involved the use of acute physical activity and information to treat elevator phobia. The phobia existed for 22 years. The woman ran to the elevator, felt calm about it and rode up and down one floor. She gradually became aware of fear and would not take a second ride. She jogged the second time and was able to go up 28 floors. They then increased the clients' knowledge of danger and how to escape from the elevator. She practiced and easily mastered escape. Four months later she was still using elevators.
A Psychodynamic Analysis

Berger and Machenzie (1981) presented an analysis of the dynamics of running, from data collected on one of their therapy patients. The case involved a 35 year-old, college-educated female, with divorced parents and a younger male sibling who had died one year earlier. After seven months of therapy the study began.

Data were collected from a diary and recordings made directly after or during the run. The patient reported her thoughts, feelings and experiences during the run. Three interviews were conducted by the researchers immediately after a run, the last month of the study. During the interviews, she was encouraged to fantasize so she would by-pass defenses. In all, 33 pieces of data were analyzed.

The authors proposed four dynamic benefits of sports participation: (a) Participation allows the patient to experience a broad spectrum of emotions, ranging from agony to ecstasy. Fright, hostility, hopelessness, loneliness, pleasure, power, resentment, aliveness, anger, competency, control, fear of death and guilt were some of the emotions reported by their client. (b) Sports, such as jogging, are conducive to thinking in general and introspection. Their client planned things, reviewed conversations with friends, problem-solved and reflected on people, events and scenery. She also found jogging to be an affirmation of self, because she devoted an hour to self. It also provided a form of
escape, some days there were thoughts, "Fun, today I was running away from it all" (p. 60). (c) Engagement in sport satisfied inner dynamic needs. The patient was obsessive compulsive. She was intense, rigid, had a driven preoccupation with technical detail, intellectualized, overconcern for moral and professional responsibility. The obsessive compulsive behaviors were manifested and reinforced by jogging. Requirements for jogging (completion of a routine, focusing on a particular time and distance, little variability, repetitiveness, and solitary performance) helped her to cope with anxiety. Compulsive style was also evidenced by repression of pleasant and unpleasant feelings. The client hurt herself during a run and denied the pain. She was concerned about wearing shorts and provoking sexual thoughts. Running exacerbated her style but had the beneficial effects of control over helplessness and sense of power. Dynamically, for her, running provided the opportunity to compete with father and brother who were both runners. (d) Awareness of private phenomenological experiences with sport can be useful for gaining self understanding. She became aware of her competitiveness, aware of self-criticism and its contribution to denial of obvious capability.

Berger and Machenzie stated, "As a result of the findings of this study, it is responsible to postulate that
Two studies were reviewed. Collingwood and Engelsgjerd (1977) in a study of 1,000 juvenile offenders, 264 of whom finished a five-week fitness program, averaged a 12% increase in fitness. About half who were in the program (exercise done three times a week) followed the routine after the completion of the formal program. There was an increase of participation in sports and recreation programs of 49%. Recidivism dropped from 35% to 2.7%.

The authors concluded, "...a systematic effort to raise the fitness levels of delinquents and to involve them in recreation and sports can help decrease the eventual involvement in crime" (p. 23).

Physical fitness training and counseling as an adjunct to treatment of male delinquents were studied by Hilyer, Wilson, Dillon, Caro, Jenkins, Spencer and Booker (1982). Male students (ranging in age from 15.6 to 18.6) at a state industrial school were randomly assigned to a control or experimental treatment group. Twenty-three experimental and 20 controls completed the program.

Control subjects participated in the regular treatment program provided by the institution. The experimental group had the added treatment of physical fitness and counseling.
The experimental subjects met one and one-half hours, three times a week, for 20 weeks. One hour and fifteen minutes was devoted to fitness training, which included muscle strength, endurance and flexibility plus progressively longer running distances. The 15-minute counseling period time was spent relating problems subjects were having in the fitness program to problems in other areas. Success in running goals was reinforced and it was pointed out that goal attainment was accomplished by their efforts. A major goal was to motivate students to continue in the program.

Physiological measures included Cooper's 1 1/2 Mile Run, heart rate response to submaximal work on the bicycle ergometer and tests to measure muscle strength and endurance, flexibility and percent body fat. Psychological measures included: A Self-Esteem Inventory, Form A, which gives an overall rating and five subscale ratings, General Self, Social self-Peers, Home-Parents, Lie and School-Academic; Profile of Mood States (POMS) which measures tension/anxiety, fatigue/inertia, anger/hostility, confusion/bewilderment, vigor/activity, depression/dejection; Spielberger's State Trait Anxiety Inventory for Children (STAI) and Beck's Inventory of Depression.

Pretest results showed controls were slightly better on all physiological and psychological indices. Post exercise group comparison showed the fitness levels of the experimental group was significantly \( p < .001 \) superior.
Within group differences showed the experimental were significantly \((p < .05)\) improved on all measures except weight and skinfold. Comparison of groups on psychological measures showed the experimental group to be significantly better than the control group. Within group change of experimentals showed improvement on every variable except tension and vigor. Within group analysis of the control group revealed significant changes in a negative direction on 12 of the variables, four at the .01 level and eight at the .05 level.

Hilyer et al. concluded "...this particular treatment could be used effectively on this particular population" (p. 301). In addition, "Physical fitness training appears to elevate low self esteem, reduce anxiety and depression and in general promote a healthier psychological state" (p. 302).

Alcoholics

Two studies were reviewed. In a study of the effects of a fitness program on self-concept, Gary and Guthrie (1972) compared changes of 10 experimental subjects, 25-55 years old (mean age 38.9) and 10 controls 39-55 years of age (mean age 45.1). Eighteen years of problem drinking was the average for both groups. The experimental group engaged in exercise (one mile jog) five days a week for four weeks. They were encouraged to reduce the time necessary to
complete the mile. The controls participated in the usual treatment program.

The physiological measure was Schnieders Physical Test. It is a protocol that gives an overall cardiovascular fitness score. The psychological measures were Gough's Adjective Checklist (ACL), Jourard Body and Self Cathexis Scales. A log of drinking and sleep disruption was also kept.

There was a significant ($p < .05$) increase in fitness for the exercise group, while the control group demonstrated no fitness changes. The effect of jogging on self concept showed trends in a positive direction on all scores except heterosexuality and aggression. There was a significant ($p < .005$) increase on the self cathexis scale for the exercise group but not for the control group. This score, plus the body cathexis score, demonstrated improved self-evaluation. A significant negative correlation between fitness and masculinity scores was noted. It was hypothesized that increased fitness would maintain a masculine self-concept and thereby reduce drinking; this did not occur. The only behavior change that occurred was a change in sleep. After the subjects' restless sleep due to muscle soreness abated, there was significantly less sleep disturbance for the experimental subjects, which the authors felt should not be overlooked since sleep problems are a common complaint of alcoholics.
Sinyor, Brown, Rostant, and Seraganian (1982) studied the effects of a fitness program on abstinence rates of alcoholics. Fifty-eight residents at a six-week inpatient alcohol treatment center were assigned to a complete or partial exercise program, on the basis of physical condition. Subjects who had surgery or medical complications were restricted to a lower intensity of exercise. Full participation included daily exercise for 60 minutes. This included a warm-up, stretching and muscle strengthening exercises and a 12-minute walk/run. Subjects were encouraged to increase distances in the time span and level of participation was geared to initial performance tests. Two control groups were derived, one of subjects in another center and those who took the regular treatment without exercise at the same center.

Physiological measures were VO$_2$max, percent body fat and resting heart rate. Family or associate corroborated abstinence was the other measure.

The participants in the full exercise program had significantly ($p < .01$) less body fat, significantly ($p < .001$) increased oxygen uptake and a nonsignificant decrease in heart rate. Comparison was made with partial participants and controls to see if the increase in fitness was related to abstinence from alcohol. No significant changes in fitness were noted in either group.
All subjects were abstinent at the end of treatment. A three-month follow-up showed: (a) of those who received treatment, but no exercise at the same center, 38% remained abstinent; (b) 69% of those in treatment plus exercise were still abstinent; (c) 39.6% of those controls at other centers were still abstinent. Eighteen-month follow-up corroborated these findings.

Sinyor et al. concluded that the data give empirical support to the effects of fitness on abstinence, but caution is warranted because other aspects of the multidimensional program may have changed over time, for example, a change in the general treatment program, a change in personnel or atmosphere in the center.

Summary

The research reviewed appears to support the contention that exercise can be an important therapeutic tool. The two almost universal problems clients present are malfunction in mood states and low self-esteem (Martin, 1971). Mood states and low self-esteem or self-concept are the two areas that have had the most attention in the research. Except for one study on self-concept (Leonardson and Garguilo, 1978), the research reported positive results. Increase in self concept and a favorable change in mood states were noted.
However, there are many reasons to use restraint in drawing conclusions from this literature. Limited review of effects on clinical populations or entities suggest fitness training has great potential. But, the quality of available research in some areas was very inadequate. The design of experiments needs to be improved. The selection of "normal" randomly assigned subjects needs to be met, and more accurate testing procedures have to be devised. To test this hypothesis, more experimental research designed like that of Hilyer et al. (1978, 1982), Blumenthal et al. (1982) and Greenberg (1976) is needed. In these studies, hypotheses were made, there was a control group, and many measures both psychological and physiological were used to test the dependent variable. There is also a need for longitudinal research to test the long-term effects of aerobic exercise.

Rationale and Hypotheses

An extensive review of the literature on the psychological effects of physical fitness by Layman (1960) suggested that in order to clarify the picture, more studies needed to be done on women and girls. Olgesby (1981) also brought up this point. She suggests that research institutions and labs review ongoing projects with regard to a balance of male and female subjects. Citing a literature review by Griffen (1978) of psychiatric and normal
populations which concluded that psychological benefits are derived from physical exercise, Olgesby points out, that his investigation revealed only three studies with females which utilized jogging. Folkins and Amsterdam's (1978) extensive review of the literature on the control and modification of stress emotions concluded:

Exercise has been associated with improved sense of well being and has been correlated with objective demonstration of reduced psychological and physiological indices of factors such as anxiety, depression and hostility (p. 291).

Those studies that evaluated exercise effects in some detail also demonstrated that those individuals who were most unfit physically and or psychologically initially experienced the most improvement from an exercise program (p. 290).

Most of the research on exercise and its effects on stress emotions (earlier examples of stress emotions were "fear, anxiety, tension, anger and depression" p. 280) support the conclusion that chronic exercise, indeed reduce stress emotion levels. Evidence supporting this conclusion has emerged from studies on children, male and female college students, normal adult men, and men with coronary heart disease (p. 290).

The gap in the literature noted by Layman (1960) has been only partially filled with some studies involving female college students.

This is remarkable when coupled with the well-established fact that women are more prone then men to treatment for mental illness. For example, Gove and Tudor, (1973) after an extensive review of the literature on rates of mental illness from community surveys, studies of first admissions to mental hospital, psychiatric outpatient care
in clinics and private practice, and from studies of general practitioners, came to these conclusions: overall, women are 1 1/2 times more likely to have psychiatric problems than men; they constitute the greatest number of first admissions. Women outnumber men in psychiatric outpatient care in private practice and clinics; in hospital and outpatient clinics more women are treated for transient disorders ("acute symptom response to an overwhelming situation which is followed by disappearance of the symptoms when the stress is withdrawn" p. 824).

In the community surveys and studies of general medical practice, more psychophysiological disorders have been noted in women than men. The medical studies showed psychiatric disorders ranked third for women versus seventh for men as a presenting condition. They point out that this relationship cannot be explained by assuming men go to physicians less than women. They also indicate that there is "considerable evidence that women have a more negative self image of themselves than men have of themselves" (p. 816).

Of major interest to this study is the incidence of depression and anxiety. It is a well-accepted fact that the incidence of depression is higher in women than in men. Poe, Lowell and Fox (1966), investigating the incidence of depression in a general hospital, found the ratio of women to men was 3:1. Two men and 7 out of 15 women seriously impaired their health with a suicide attempt. The symptom
which alerted the physician that there might be an emotional problem was agitation or nervousness. They also observed that depression accompanies a partial or complete loss of self-esteem. Scarf, 1979, (Tinsley, 1979) points out that women are depressed two to five times the rate of men. Gove and Tudor (1973) state "...the available evidence on depression uniformly indicates that women are more likely to become depressed" (p. 816). They also mentioned that suicide attempts in women are more likely, although they do not succeed at the same rate as men. Additionally, the rates of suicide has increased greatly among women while they have not among men (Gove & Tudor, 1973).

Bahrke and Morgan (1978) describe anxiety as a major health problem. Psychological problems involving anxiety are 2-4% in the general population. In the psychiatric population, these figures rise to 16-25%. People seen by general practitioners suffering from unrelieved stress have been estimated to be 30-70% of their practice. Gove and Tudor (1973) reviewing community surveys, found anxiety to be a major factor for help seeking behavior. The incidence of anxiety, psychological and physical, in women was twice that of men. Berger (1984a) suggests that if Dienstbiers (previously cited) model of sympathetic arousal and efficiency occur with exercise, women will tend to be more anxious because, traditionally, they have been less inclined to participate in vigorous physical activity and are more
likely to have lower levels of catecholamines in stressful situations. Additionally, she makes the point that exercise might counteract negative cultural influences. She cites a study by Rossi (1980) that a youthful appearance is more important for women and that exercise provides positive changes in physical appearance.

In summary, a review of the literature on the effects of endurance training and psychological variables suggests many possible benefits. The greatest amount of research with positive results has focused on the stress emotions of hostility, depression and anxiety as dependent variables. Additional research (Jasnoski et al. 1981; Duke et al., 1977; Hanson and Neede, 1974; Hilyer and Mitchell, 1979) has suggested that fitness training may not only relieve anxiety, depression and hostility, it may also help to counteract some of the negative cultural influences on the character of women. Diebel (1980), for example, lists some of these effects: they are less satisfied with themselves; they have a more negative self-concept; lower self-esteem which results in less effectiveness, adjustment and personal satisfaction; low independence, lower levels of self-regard; low internal locus of control; low ability to take initiative; fewer experiences of competence and success, lower in goal orientation and lower in achievement. Additionally, Berger (1984a) suggests that women are appreciated more for helplessness than for competence and
strength. Many researchers have concluded that the incidence of mental illness is greater for women than for men. For example, the ratio of depression in women was demonstrated to be anywhere from 2:1 to 5:1, as compared to men. Anxiety was also demonstrated to be a prevalent symptom in the general population and more so in women. Those who are the least fit physically or psychologically initially will gain the most benefits from an endurance program. It was pointed out that very little research investigating the psychological effects of systematic aerobic exercise has been done on the population that needs and would potentially benefit the most from it, women.

The present study will investigate the effects of endurance training on depression, anxiety and hostility in college women.

The general expectation is that endurance training will lower "state and trait" levels of anxiety, depression and hostility.

Based on the review of the literature, the following hypotheses are proposed;

1. There will be a significant decrease (.05 level) in the "state" measure of depression, post-fitness training.

2. There will be a significant increase (.05 level) on the "trait" measure of depression post-fitness training.

3. There will be a significant decrease (.05 level) in the "state" level of hostility, post-fitness training.
4. There will be a significant decrease (.05 level) on the "trait" measure of hostility, post-fitness training.

5. There will be a significant decrease (.05) on the "state" measure of anxiety, post-fitness training.

6. There will be a significant decrease (.05 level) on the "trait" measure of anxiety, post-fitness training.

7. The level of physical functioning will be significantly increased (.05) following endurance training.
METHODS

Subjects

Experimental subjects were 41 volunteer female subjects enrolled in an aerobic dance class at Rollins College. This class was one of the elective classes offered to students to fulfill required physical education credits. From this pool of subjects, 20 complete sets of data were obtained. The subjects' ages ranged from 16-21 years, with a mean of 18.55. Twenty percent (n=4) of the subjects had never engaged in aerobic exercise, 25% (n=5) had not engaged in aerobic exercise the previous year, 20% (n=4) of the subjects had not engaged in exercise for three months prior to the class, and 35% (n=5) were currently maintaining or had just suspended an exercise program. One subject was under the care of a physician for gynecological problems. One subject had obtained psychological help described as "biofeedback training."

Control subjects were 21 volunteer female subjects enrolled in a jazz class at Rollins College. This class was one of the elective classes offered to students to fulfill required physical education credits. From this pool of subjects nine complete sets of data were collected. The subjects' ages ranged from 18-20 with a mean of 18.33. Seventy-seven percent (n=7) had engaged in aerobic exercise
the last year, but not the last three months, 22% (n=2) had not engaged in aerobic exercise for more than one year. None of these subjects were under a physician's care, nor any had psychological care at the time of the study.

Rationale for Aerobic Dance

After consideration of motivational, psychological and physiological aspects of exercise, an aerobic dance program was chosen as the method of endurance training. The following is a presentation of research on these variables.

A recent Harris survey (Keefe and Blumenthal, 1980) conducted nationwide, revealed that only 37% of the population engages in regular exercise. Those who do start programs do not stay in them. Epstein, Wing, Thompson and Griffin (1980), in reviewing studies, cite dropout rates from 25%-58%. Massie and Shepard (1970), in their study comparing the dropout rate of a running group versus an exercise program, had attrition rates of 53% and 12%, respectively. Getting people to join and stay in an exercise program is a difficult task. Franklin (1978), after reviewing the literature, lists some of the negative forces of exercise programs as inadequate leadership, time inconvenience, musculo-skeletal problems, lack of progress awareness, spouse disapproval, boredom and difficulties with individual commitment. He concludes that the problem is not
to motivate people to take the first step toward an exercise program, but rather to keep them motivated.

Several authors have addressed the subject of positive forces involved in maintaining motivation to stay in a program. Franklin (1978) suggests that group activities are good, because they often provide incentive (group approval, disapproval, support, etc.) when interest sags. Heinzelman and Bagley (1970) did a longitudinal study of 18-month duration involving 239 men ages 45-59 enrolled in exercise groups at several different sites. Data on attitudes and behavior were gathered at three- to four-month intervals. Participants were questioned at the end of the program as to what motivated them to stay in the program. Almost 90% of the 195 people who responded said they preferred to exercise with a group, because they enjoyed it more, experienced social support, felt a sense of personal commitment, and welcomed the opportunity to compare their progress and the level of fitness with others. Contrary to the reasons for joining the program (health, participating in research), recreation and social aspects were ranked highly by 29% and 26%, respectively. Roth (1974), in a study of motivation, interviewed or had conversations with 30 people who stayed in some systematic exercise program. Some of the motivational themes he elicited included: (a) A powerful stimulant to remain was social interaction with other
members; (b) The group also counteracted negative social reaction and attenuated the feelings of social deviance; (c) Delinquency from program was disapproved of by the group which tends to enforce its norms. Furthermore, Berger (1984b) cites evidence that components of self-esteem for women in contrast to men, is contingent on the "certainty that other people like them" which supports the importance of the social element. She states, "It seems that a client's social concerns are important considerations in encouraging her to participate in a running program" (p. 184).

Keefe and Blumenthal (1980), in a study of three men who had problems maintaining a regular exercise program, found that stimulus control (same time and setting), warm-up exercises, and realistic goal-setting contributed to their continued participation nine months later. Franklin (1978) also suggested that a program regularly scheduled would lead to acceptance of exercise as a part of the daily schedule.

Layman (1960), in a review of the literature on the psychological benefits of exercise, suggested that the studies reviewed provided evidence that modern dance has potential for promoting mental health. Some of the characteristics of dance that aid in promoting mental health suggested were that: it helps an individual to acquire poise and confidence in social situations; it is non-verbal communication and helps the individual to relate and
identify with others, rhythmic movement is a channel through which an individual can express feelings, desires, drives and fantasies which in turn possibly provide release of tension and promote spontaneity. Krestonikoof (Franklin, 1978) reported energy expenditure in exercise increased slightly and participants also reported it was easier. Additionally, Berger (1984b) suggests that running may create gender-role conflict because traditionally "women" and "athlete" roles have been dissonant.

In a perusal of the journals and books concerned with disseminating scientific knowledge about running, the author noted that a constant focus of attention is the injuries that arise from running. There are many exercise prescriptions for preventing and treating injuries. Most injuries are attributed to lack of warm-up, cool-down, flexibility, or improper stretching. Massie and Shepard (1970), in their study of running versus a YMCA group program (which included warm-up, running and free activity), found the incidence of injuries (shin splints, aching muscles, swollen ankles) was far greater in the running group. In the Y group only one injury (fractured finger during swimming) was reported. The high frequency of injuries occurring with running when compared to other types of exercise motivated Pollock, Gettman, Milesis, Bah, Durstine and Johnson (1977) to study the influence of frequency, duration and intensity of running on the
incidence of injury and attrition from exercise programs. Their study varied frequency; one, three or five days at 30 minutes per session; duration, three days per week for 15, 30 or 45 minutes; intensity 80 or 90% of maximum heart rate (MHR). Injuries with the three- and five-day frequency groups were 12% and 39%. Duration of 15, 30 or 45 minutes produced injuries of 15%, 24% and 54%. Intensity of 80% MHR had an attrition rate of 15% while 90% MHR resulted in 40% attrition. They concluded that although intensity was an important consideration in adherence and injury prevention, duration and frequency had a further synergistic effect. They were surprised at the injuries because the subjects had lower than average fat and body weight, were relatively young (20-35) and had average to above-average cardiorespiratory fitness. Franklin (1978) after his review concluded that dropout from exercise programs was the result of injury in 50% of the cases.

Cooper's definition of aerobic exercises is, "...those activities that require oxygen for prolonged periods and place such demand on the body that it is required to improve its capacity to handle oxygen" (Cooper, 1982, p. 13). Garcia (1978) describes aerobic dance as "Choreographed dance composed of vigorous dance movements and steps which can improve or maintain cardiovascular endurance" (p. 2).

The continuous and vigorous movements in aerobic dance result in increased energy demand. Igbanugo and Gutin
(1978) studied the effects of light, moderate and heavy intensity aerobic dance from the standpoint of energy cost and regulation of dance by non-dancers. After doing laboratory measurements of VO2 max they concluded that medium- and high-intensity dance routines can provide adequate cardiovascular stress and elicit a training effect. With the exception of one subject, Karvonen's threshold was met during moderate intensity.

Cooper (1982) suggests that any endurance program be supplemented with strength and muscle building. He states, "There are at least two reasons: First of all, improving the strength and flexibility of key muscle groups can improve your performance in any sport. And secondly, paying attention to muscular development and flexibility can reduce your susceptibility to injury in your chosen sport" (p. 114, 115). Pollock et al. (1978), in describing a balanced fitness program, believes cardiorespiratory endurance activities are of paramount importance, but only as part of a total program. Flexibility, muscular strength and muscular endurance add to make a total well-rounded program.

Garcia (1978) listed the physical benefits of an aerobic dance program and suggested that they include increased flexibility, muscular endurance, cardiovascular endurance and, to a limited degree, muscular strength. There are also motor performance improvements such as agility, balance, coordination and rhythm.
In summary, aerobic dance meets many of the suggested motivational variables: it is a group activity which gives social support and counter-acts negative reaction, attenuates feelings of deviance, sets norms, and meets needs for social interaction and gratification. Psychologically, dance can be a positive influence in acquisition of poise and confidence, non-verbal communication of feelings can help an individual to relate and identify, and music increases intensity of work while ameliorating the feeling of hard work being performed. Aerobic dance not only meets the criterion for endurance training but flexibility, muscle strength and endurance needs are met by various components and motor performance is improved. It has an integral warm-up and cool-down period. In addition, Cooper (1982) has referred to an IBM company wellness program which offers many activities and which disclosed that aerobic dancing is one of the most frequently requested programs.

Exercise Program

Cooper's (1978, 1982) program for aerobic dancing is not quantified as are his programs for other activities; his point system is a vague approximation. Cooper (1982) awards .2 points per minute duration in his formula for points, but he footnotes that this point value may vary according to effort. In his progressive exercise program, he gives the same point value no matter what the intensity of work is.
After a review of the literature, Pollock (1973) summarized that intensity and duration were the most important factors in estimating training effects. Lack of a quantified program for aerobic dance necessitated a review of the literature concerned with acquisition of training effects. The variables that were considered important were incorporated into the design of this program.

Several authors (Cooper, 1982; Pollock et al., 1978; Pollock, 1973; Garcia, 1978) suggest that warm-up and cool-down are necessary parts of any exercise program. Pollock et al., more specifically state that warm-ups should be 10 to 15 minutes and include stretching and light to moderate muscular strength and endurance exercises. This was taken into account, and in all classes there are two stages of warm-up, progressing from mild to more intense. Initially the warm-up is prolonged, but as the duration of the endurance section increases, warm-up decreases, but remains an integral part of the program. All of the above authors also suggest a cool-down phase. This was implemented into the program in two stages with progressive decreases in duration, but maintained as an integral part of the program.

Pollock et al. (1978), Stoedfolke (1978), and Pollock (1973), when discussing an exercise prescription for endurance training, focus on these factors: intensity, duration, frequency, mode of activity and level of fitness.
Intensity is considered the most important factor. Karvonen (Roskamm, 1967) did an experiment with college men. The subjects ran five times per week, 30 minutes per session, and found no sign of improvement in those subjects whose heart rate did not reach 135 beats per minute. Those who sustained heart rates above 153 beats per minute showed significant improvements over time.

Hollman and Vernath (cited in Pollock, 1973), in a similar experiment, found 130 or more beats per minute were needed to stimulate a training response. The data suggest that young men must exercise at a heart rate level of more than 60% of the difference between maximal and resting heart rates. Sharkey and Holleman (1967) studied the effects of heart rate intensity on 16 college males. Heart rate levels were 120, 150 and 180 heart beats per minute. Subjects walked for 10 minutes at 3.5 miles per hour. The grade was modified to maintain these heart rates. They completed 16 sessions. The 180 beats per minute group was significantly better than the other two groups. The 150 beats per minute group was significantly better than the 120 beats per minute and the control groups. There was no resting pulse rate change in any group. Roskamm (1967) tested 80 men, 18-25 years of age using bicycle ergometers. They were tested for performance levels and placed in one of four groups: Group I uninterrupted work at 70% of the difference between maximum and resting heart rates; Group II did interval training.
The work load alternated every minute between 50% higher and lower than Group I; Group III also did interval work. The duration of intervals was changed to 2 1/2 minutes while the intensity was the same as in Group II; and Group IV was a control group doing normal military exercises. After four weeks of training, the amount of improvement was 10% for all groups (significant at $p < .001$). Continuous training was most effective in changing resting heart rate. Interval training with changes at 2 1/2 minutes was more effective than the one minute change, but both were effective in improving maximum performance. Shepard (Pollock, 1973) tested men at 96, 75 and 39% of maximum heart rates. The 96 and 75% heart rates had a 20% rate of improvement, while the 39% group improved 5 to 10%. He concluded higher intensities would be needed to reach threshold.

Ghedhill (Pollock, 1973) substantiated the value of intensity as a critical stimulus for eliciting threshold. He tested 36 college students at heart rates of 120-130-150 beats per minute. There were five sessions per week for five weeks. All group members improved on VO$_2$max and heart rate. When divided into low- and high-fitness groups, there was no improvement in VO$_2$max and individual performance times at heart rates of 120 beats per minute.

Kilbom (Drinkwater 1973) did a study of three age groups of females, 19-31, 34-48, 51-63, with two heart-rate intensities, for seven weeks. Intensity in one group was
70% of maximal aerobic capacity alternating three minutes of work with two minutes of rest. When heart rate decreased the intensity of work was increased. A second group worked at 50% intensity walking or working on the bicycle. There was significant change for the 70% and 50% groups working on the bicycle. The walking group working at 50% intensity had no significant change. Additionally, $VO_2$max changes were inversely related to age and levels of fitness. Sharkey (Pollock, 1973) also found the magnitude of cardiovascular change inversely related to fitness ($r=-0.54$). Those who had lower levels of aerobic power and trained at 70% had the greatest increases in $VO_2$max. Thirteen of the women participated in a study of cardiac output. They were grouped 21-48 years ($n=9$) together because there were no significant age differences in $VO_2$max changes. They had decreased heart rates accompanied by significant increase in stroke volume. Systolic, diastolic and mean pressure were low after training regardless of age. $VO_2$max at maximal work loads was increased 10-11% in the young group and greater stroke volume was reported to be the reason for increase in $VO_2$max.

Duration has also been found to be a significant factor in establishing a conditioning effect, (Pollock et al., 1978). Olree, Corbin, Penrod and Smith (Pollock, 1973), trained men for 20, 40 and 60 minutes and found more significant improvements with longer duration. This was
paired with training heart rate (THR) of 180 beats per minute approximately 95% of maximum heart rate. Tooshi (Pollock, 1973), using middle-aged subjects jogging either 15, 30 or 45 minutes for 20 weeks found more improvement with longer duration. Wilmore, Royce, Girandola, Katch and Katch (1970), studied the physiological changes resulting from a 10-week conditioning program. Males, ages 17-59, exercised 12 or 24 minutes three times a week. They measured VO$_2$max on the bicycle ergometer and resting pulse rate and blood pressure. Both groups showed significant increases in VO$_2$max and decreases in resting heart rate. The 24-minute group had decreases in weight and increases in total work. Distances covered by all ages were the same but the rate of speed decreased with age. Little if any age trend was noted related to the training response up through the 33-44 year old group. The 45-59 year-old group exhibited the smallest change (even though the potential for change was greatest). Yeager and Brynteson (1970), studied the effect of 10-, 20-, or 30-minute exercise duration on 18 college females. Each subject engaged in 18 conditioning sessions on the bicycle ergometer at 144 beats per minute for the different time periods. Physical work capacity (PWC-170) and VO$_2$max (Astrand method) was measured. Overall the training period caused increases in cardiovascular fitness in all groups. The 30-minute group showed more
improvement on both tests while the 10- and 20-minute groups had improvement on only one of the measures.

Cooper (1968, 1972, 1978, 1982), and Bailey (1977) place great emphasis on increasing duration. Pollock (1973) concluded that although changes can come about with short duration and high intensity, in general, shorter duration shows significantly lower training effects.

Frequency of training is another variable that has been considered. It appears that frequency is the least important for training effects, but also a source of significant injury. For example, Gettman, Pollock, Durstone, Ward and Linnerud (1976) did a 20-week study in which they had male subjects in 1-, 3- or 5-day programs of 30 minute duration and 85-90% of maximum heart rate. He found significant improvement in resting and recovery heart rates in direct proportion to frequency of exercise. Treadmill performance time and VO₂ max were significantly improved (+17%), and there were no significant changes in resting and recovery blood pressure, maximum heart rate, or spirometry measures. For those in the five-day a week program (n=13) there was a chronic soreness throughout the 20-week period. Those in the three-day program (n=12) who had soreness, had histories of previous knee and ankle injuries. Pollock et al. (1977), cited previously in this study of frequency 1, 3 and 5 days, duration 15, 30, and 45 minutes and intensities of 89 or 90% heart rate, found
respiratory fitness directly related to frequency and duration of exercise. The five-day or 45-minute duration groups had 39% and 54% injury rate. Attrition due to these injuries was 6% and 17% respectively. Intensity of 90% maximum heart rate contributed to the highest attrition rate but the authors concluded duration and frequency of training might have a synergistic effect. Jackson, Sharkey and Johnson (Pollock, 1973) conducted an experiment varying frequency of training 1, 2, 3 or 5 days per week, 10 minutes per day for five weeks. The results showed the five-day group to be superior on the Balke treatmill test, while on the Taylor Busbirk and Henchel test and the Astrand-Rhyming, the two- or three-day groups showed greater improvement. The authors concluded that in experiments with sedentary people it can take several weeks to adapt to training and that the five-day program causes too much fatigue. Pollock (1973), citing two of his studies with men 30-45 years of age, with training two or four days per week, found both groups improved at 8 or 10 weeks of training (mid-training).

Pollock et al. (1978) and Franklin (1974) suggest that frequency of three days per week or every other day for those initiating programs, allows the musculo-skeleton system to adapt and prevents undesirable soreness, fatigue and injury.

The total amount of work (energy cost) is also a factor. Corbin, Berryhill and Olree (Pollock, 1973)
compared the effects of walking, running and bicycle ergometer training groups. Each group exercised 20 minutes, five times per week for 10 weeks. The heart rate was maintained at 150-160 beats per minute. They found running and cycling to be superior. Pollock (1973) also found all modes to be effective when heart rate was maintained at 85-95% of the maximum (175 beats per minute). He also suggested that short-term studies with middle-aged and older participants or those with a low level of fitness should avoid high intensity work and allow several weeks for adaption. Moderate work loads, such as bicycling, seem to be the best for those initiating exercise programs. Passmore and Durnin (Drinkwater, 1973) stated that a moderate work load was 4-6 Kcal/minute. Aerobic dancing of moderate intensity, tested by Igbanugo and Gutin (1978), used a mean of 6.57 kcal/min. Rockefeller and Burde (1979) tested energy cost and physiological effects of an aerobic dance program. Their findings support those of Igbanugo and Gutin. In addition, after 10 weeks of training, the subjects had a significantly decreased (p < .01) submaximal heart rate.

In summary, intensity and duration were found to be the most important variables in the design of an exercise program to produce endurance effects. The aerobic dance program was designed to give the most consideration to these factors. The frequency of training was predetermined, but
meets their suggestion of two to three days per week. The duration of training will closely approximate Cooper's (1982) progressive eight-week program. The intensity will be maintained above the Karvonen threshold for all ages and levels of fitness. Davis and Convertino (1975), in a study comparing heart rate methods for predicting intensity, found the highest correlation between VO$_2$ max and training heart rate using the Karvonen formula ($r+.96+.89$), in accurately reflecting the metabolic state of the trainee. The American Heart Association recommendation of 60-75% of maximum results in an inequality between this and the equivalent per ml of VO$_2$ max. Therefore, the Karvonen method will be used. The method involves getting a resting heart rate and maximal heart rate. Then you multiply the difference by the percentage of intensity you desire, take the result and add it to the resting heart rate.

For those in Category 1 and 2 by Cooper's criteria will be given a heart rate using .65 as the intensity limit. Those in Category 3 will be given an intensity level of .70. A behavioral description of different flexibility, warm-up and stretches can be found in Appendix I. A summary sheet of times is in Appendix II. A detailed description of each class is in Appendix III.
INSTRUMENTS

Physiological

In his discussion of ways of quantifying fitness changes Pollock (1973) suggests using a variety of measures because a change can occur on one parameter of physical fitness and not another. Therefore three measures of cardiovascular fitness were used:

1. Resting heart rate
2. Systolic and diastolic blood pressure
3. Coopers' 12-minute fitness test.

Pollock, Wilmore and Fox (1978) state that Cooper's 12-minute run has been found to correlate .96 and .89 with maximum $O_2$ consumption and closely reflects the actual metabolic state of the trainee. Cooper has obtained norms for a variety of fitness categories. He estimated (1968) that it had been utilized by approximately 20,000 officers and airmen. He also states that, "Many facilities throughout the country and overseas picked it up, as an easily administered field test measuring fitness applicable for individuals and particularly large groups" (1968, p. 34).

This test was completed indoors, because at the time of the study it was very hot and humid outdoors. Generally, increased temperature and humidity result in an increased heart rate and increased VO$_2$ response (Davis and
Convertino, 1975). Drinkwater (1973) states, "When a woman exercises in a hot environment, all of her normal responses to work are magnified. Core and skin temperatures rise, metabolic heat production and sweat rate increase, and pulse rate and systolic blood pressure rise" (p. 143). She cites a study by Wyndham, Morrison and Williams (1965), which was made in a hot, moist atmosphere, that reached these same conclusions. When females were compared with males, heart rate increased faster and reached higher levels than males, as did rectal temperature. Ninety-two percent of the women had to drop out of the experiment, while only 50 percent of the men had to drop out. When men did withdraw, their heart rates and temperature values were the same as the women.

She suggests these difficulties can be relieved by acclimation, but it takes repeated exposures. Drinkwater concluded that, "While Wyndham's female subjects were able to acclimatize as well as the men, the process was more difficult for them physiologically and psychologically" (p. 145).

Since these women were doing their exercise in an air-conditioned environment and since there is a need for accurate measurement, the 12-minute run will also be carried out indoors.
Both forms of Spielberger's anxiety measures were administered (STAI Y forms 1 and 2). Spielberger (1972) believes that measurement of anxiety can be approached from two different directions. He devised a test to measure either state or trait anxiety. Spielberger describes trait anxiety as:

...a relatively stable individual difference in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with A-State reactions. A-Trait may also be regarded as reflecting individual differences in the frequency and intensity with which A-Sates have been manifested in the past, and in the probability that such states will be experienced in the future. Persons who are high in A-Trait tend to perceive a larger number of situations as dangerous or threatening than persons who are low in A-Trait, and to respond to threatening situations with A-State elevations of greater intensity (p. 39).

State anxiety is described as a:

...transitory emotional state or condition of the human organism that varies in intensity and fluctuates over time. This condition is characterized by subjective consciously perceived feelings of tension and apprehension, and activation of the autonomic nervous system. Level of A-State should be high in circumstances that are perceived by the individual to be threatening, irrespective of the objective danger; A-State intensity should be low in non-stressful situations, or in situations where an existing danger is not perceived as threatening (p. 39).

STAI Y forms 1 and 2 were used. Each form has 20 items which assess the presence and intensity of anxiety.

Two scales from the Multiple Affect Adjective Check List (MAACL) were used. The MAACL measures the presence,
but not the intensity, of three affective dimensions: depression, hostility and anxiety. The test uses 132 adjectives that can be used to measure state or traits. Directions are given to check those items that describe how he/she feels today or generally (Spielberger, 1972). The depression and hostility subscales were considered relevant to this study.

Procedure

Initial contact was made during the first class of the term. At this time an oral presentation was made to the class (see Appendix IV). This presentation described the research as an investigation into the relationship between personal health factors and aerobic exercise. An explanation of aerobic exercise was given and the requirements of participation were stated. At this time subjects were informed of the importance of and procedure for keeping logs (Appendix V). The presentation to control subjects was modified by deleting references to and information about, aerobic exercise. After the presentation, volunteers were requested to complete a packet which contained: (a) the consent form (Appendix VI); (b) the demographic and health questionnaire (Appendix VII); (c) MAACL Today forms (Appendix VIII); (d) MAACL In General form (Appendix VIII); and (e) STAI (Appendix IX). The order of presentation of forms in the packet was rotated to
prevent sequencing effects. After completion of the packets, subjects were randomly divided and resting blood pressure and heart rate were obtained. Blood pressure was obtained electronically with the Pressure-tronic by Aquatherm Medical Products Division, Rahway, New Jersey. Heart rate was obtained using the Cardio Tach, Series 4600, Model DS-21 Applied Science Lab, Gulf and Western, Waltham, Carolina. A sequence of eight electronic recordings of pulse was obtained. The final score was calculated by taking the mean of the 6th, 7th and 8th pulse.

During the second class meeting Coopers' 12-minute run was completed. The subjects were tested at Rollins College gym. The subjects were paired with one of each pair recording while the other ran. Those subjects who were to run were led through limbering up exercises as suggested by Cooper (1972). These exercises consisted of trunk circling, toe-touching, side leg raises and side bends (a description of exercises is given in Appendix I). They were then given the instruction set suggested by Cooper:

The running test involves running and walking as far as you can comfortably in 12 minutes. You run until you're winded, then slow down until you get your breath back, then run again. However, since it's a test for your maximum capacity, it's important to push yourself as much as you reasonably can. If any unusual symptoms occur during the test, do not continue (Cooper 1972, 1982).

In addition, they were given the following instructions: "When I blow the whistle, start immediately."
When the whistle is blown again, stop immediately. Stay where you are so your partner can record the exact place you stopped.

Following these instructions, subjects were led to the starting line, the whistle was blown, and simultaneously the timer was set for 12 minutes (timer accuracy was previously checked against a stopwatch). After the run subjects were asked to continue walking around the basketball court for five minutes. Cooper states (1978, p. 282):

An important consideration at the end of the run is the "cool down" period. The subjects should be cautioned about standing around immediately after the run to prevent venous pooling (i.e., pooling of blood in the lower extremities, which reduces the return of blood to the heart). Instead, they should be instructed to walk for an additional five minutes in order to enhance venous return and aid in recovery.

Following these procedures, subjects were told they would receive the training heart rate (T.H.R.) the next class. They were reminded to continue to practice taking their pulse.

The last week of class physiological and psychological measures were obtained. The measures were obtained in the same order as the pre-testing. The first class of the week a packet containing the paper and pencil psychological tests and a post exercise questionnaire (Appendix X) were administered. Resting heart rate and blood pressure were obtained using the same measuring instruments and procedures. During the second class Cooper's 12-minute run
was performed using the identical procedure previously described.

The dance class was taught by an experienced dance instructor. She has experience teaching pupils in the age range of 3-60. She is well-versed in all styles of dance from classic ballet to tap and acrobatics. The instructor was not aware of the psychological changes that were expected nor of the measures that were being used. A request was made that she encourage the subjects not to worry about the caliber of their performance, to just relax and enjoy the dance patterns and participate wholeheartedly.
RESULTS

The primary design was a one-way analysis of covariance (ANCOVA) with two groups (experimental and control) and 11 dependent variables. Comparison will be made between experimental versus control group post measures of physical and psychological functioning.

The data were analyzed using ANCOVA with the pre-training scores as the dependent variable. The physiological dependent variables consisted of: (a) results from Cooper's 12-minute run analyzed both by fitness category and distance covered; (b) systolic and diastolic blood pressure and (c) heart rate. Psychological change was measured by MAACL state and trait depression and hostility, and STAI state and trait anxiety. Additionally, a post-training questionnaire specifically designed for this research was examined.

It was hypothesized that subjects in the experimental group (aerobic fitness training) would have significantly increased physical functioning and significantly decreased scores on depression, hostility and anxiety post-training relative to the control group. ANCOVA on the physiological measures revealed only one significant difference between groups. This occurred in the aerobic group (experimental) which had a significantly greater increase in fitness
category relative to the control group $F(1, 28) = 4.058, p < .05$). Table 1 presents the means and standard deviations, and ANCOVA statistics on the pre- and post-physiological measures.

ANCOVA on the psychological measures revealed no significant decrease in the mood variables. Table 2 presents the means, standard deviations and ANCOVA statistics on pre and post scores on the psychological data. Table 3 presents the questionnaire with percent responses in the positive direction for the experimental and control group. Where pertinent, the majority response will be given.
TABLE 1

RESULTS OF ANCOVA COMPARING EXPERIMENTAL AND
CONTROL GROUPS ON PHYSIOLOGICAL TESTS

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>PRE</th>
<th>POST</th>
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<th>DIFF.**</th>
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* significant at .05 level

** these scores are the raw post-test minus pretest difference scores provided for convenience
<table>
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<tr>
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<th>F RATIO</th>
<th>DIFF.**</th>
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<td>8.80</td>
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<td>9.20</td>
<td>6.68</td>
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<td>Control</td>
<td>7.22</td>
<td>3.93</td>
<td>11.11</td>
<td>10.52</td>
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<td>Hostility (MAACL)</td>
<td></td>
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<td></td>
<td></td>
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<tr>
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<td>3.54</td>
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<td>4.20</td>
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<td>4.98</td>
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<tr>
<td>Anxiety (STAI)</td>
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<td>7.80</td>
<td>39.77</td>
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* significant at .05

** these scores are the raw post-test minus pretest difference scores provided for convenience
### TABLE 3
RESULTS OF POST QUESTIONNAIRE

Percent of answers in positive direction for experimental (E) and control (C) subjects. Where an explanation was requested the most common response is provided.

<table>
<thead>
<tr>
<th>Question</th>
<th>E (%)</th>
<th>C (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you noticed any significant change in your work performance?</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>I have a greater capacity to work harder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt greater enthusiasm about working</td>
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</tr>
<tr>
<td>In general do you feel you have more stamina and energy?</td>
<td>75</td>
<td>55.5</td>
</tr>
<tr>
<td>Do you have a greater ability to deal with tension and stress?</td>
<td>45</td>
<td>55.5</td>
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<tr>
<td>I feel I have more energy</td>
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<td></td>
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<tr>
<td>Have you increased your activities with family or friends?</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Do you have a more positive image of yourself?</td>
<td>65</td>
<td>66.5</td>
</tr>
<tr>
<td>I feel I'm in better shape</td>
<td></td>
<td></td>
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<tr>
<td>I feel more confident</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has there been a shift in your feelings about your ability to change?</td>
<td>25</td>
<td>55.5</td>
</tr>
<tr>
<td>Has there been a change in your feelings about your ability to achieve?</td>
<td>20</td>
<td>55</td>
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<tr>
<td>I feel I can accomplish more</td>
<td></td>
<td></td>
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<tr>
<td>Do you have a more positive attitude about your health?</td>
<td>60</td>
<td>78</td>
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<tr>
<td>I'm in better shape</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Did you have any weight reduction?
E: 30%  C: 11%

Have you changed your eating habits?
E: 55%  C: 55.5%

I eat less and foods that are better, less junk food

Have you experienced any change in your sleeping habits?
E: 30%  C: 55%
DISCUSSION

It was hypothesized that subjects in the experimental group would have a significant increase in physical fitness and a decrease in state and trait anxiety, hostility and depression. The findings of this investigation do not support these hypotheses. Table 1 reveals that the only statistically significant ($p < .05$) physiological increase occurred with a change in Coopera's Fitness category. The more sensitive measure of distance covered, however, did not reflect significant ANCOVA post-training differences between groups. On the other hand, $t$-tests on change scores for the experimental and control groups revealed a significant increase for the experimental group subjects ($t(19)=2.47, p < .05$) but not for the control group ($t(8)=-.48, p < .05$). These data, taken together suggest that the experimental aerobic group did in fact experience some conditioning effects.

The more sensitive measures reflecting training effects, i.e., resting heart rate and blood pressure, did not show significant decreases. In fact, increases in these parameters were noted for both groups.

The most straightforward explanation for the lack of overall significant differences between groups might be attributed to the experimental design, which involved
comparison of two groups that may have been too homogeneous to produce stronger differences in fitness. That is, the intensity and duration of exercise in the control group may have been comparable to the experimental group. Additional possibilities include the fact that intact groups were used and it appears that students who selected these classes were in better physical condition than would be expected thus producing a restricted range of potential conditioning effects. All subjects were in or near the fair (3) fitness category to start. This is contrary to what Folkins, Lynch and Gardner (1972) found in their study. Female students who registered for the aerobic course in their study were in Cooper's very poor (1) category. Many studies which make comparisons between groups do not measure or give sufficient information on comparison groups to identify if this is a common occurrence. Second, examination of the logs of the experimental subjects revealed that no subject reached THR in every class. Five subjects (25%) never approached (within 40 BPM) training heart rate. Four subjects (20%) reached THR more than once but less than 10 classes. Only 11 subjects (55%) reached THR in more than 10 classes. As was mentioned earlier the most significant factor in achieving training effects is the intensity (stress on the cardiovascular system) of exercise. The importance of this factor is magnified given the initial level of fitness of both groups. Kilbom (Drinkwater, 1973), Sharkey (Pollack,
1973), Massie and Shepard (1971) found that as fitness increased if changes in the program did not modify the workload to maintain intensity, significant overall fitness changes did not occur. Sinning and Adrian (1968), measuring changes in fitness in a women's basketball team, found changes in \( VO_2 \text{max} \) but not heart rate or blood pressure. They concluded the program was not strenuous enough to reach potential for physical conditioning. A possible insight into why this occurred was provided by one of the subjects in the post questionnaire. She asked why the training heart rate was important. It appears that insufficient information was given about the necessity of maintaining training heart rate. Given the amount of popular information on aerobic dance and jazzercise, programs which ordinarily do not pay attention to heart rate, it appears that much more attention should have been given to this factor.

An unexpected finding was the nonsignificant increase in heart rate and blood pressure for both groups. The increase in these parameters might be explained by the timing of the measurement. These subjects were in the final week of the academic term. Changes in amount of physical activity, less sleep, increase in caffeine intake or smoking, and increased anxiety (with overall increase in adrenalin output) occurrences which are common during the last week of the term may well have impacted these indices.
However, it might be noted that subjects in the experimental group had a 7.6 BPM (beats per minute) increase while controls had a 8.88 BPM increase. Systolic blood pressure increased 1.05 for experimental subjects, while controls increased 9.44. Diastolic blood pressure increased 5.35 for experimental subjects, while controls increased 11.11. This suggests that when stressful periods occur, those who are physically fit may have less physical dysfunction or lower levels of arousal.

The lack of obtained expected differences in the psychological variables may mean the increased physical fitness training does not have any direct relationship on psychological functioning. However, the lack of expected decrease in the psychological measures of mood might also be explained by the timing of the measurement and lack of significant fitness changes. On the other hand, several trends were noted. As was previously mentioned, subjects, initially, were at higher levels of fitness than expected. This also appears to be true for psychological measures. Overall, the subjects in both groups appeared to be more psychologically fit when compared to peers. On the MAACL (state) norms, female college students have mean depression scores of 13.6 and mean hostility scores of 7.20. The overall mean of this sample on depression was 11.51 and 6.72 for hostility. On the STAI-S the college female norm is 36.47 while the overall mean for this sample was 31.89.
Norms for the MAACL trait depression and hostility are not available. However, comparison of MAACL trait anxiety reveals the mean for this sample was 4.45 while the norm is 5.61. On the STAI-T the norm for college females was 40.4 while the current overall sample mean was 35.65. The initial level of fitness coupled with lower levels of negative mood lends support to the suggestion that there is a connection between level of fitness and psychological functioning.

Analysis of all trait measures of psychological functions (depression, hostility, anxiety) revealed consistently higher increases for the control subjects than the experimental subjects. Control subjects showed significantly greater increases in depression ($F(2.26) = 3.054, p < .05$) and MAACL anxiety scores (Exp: $M=4.00$; Con: $M=6.66$; $F(2,26)=4.472= p < .02$) than experimental subjects. Additionally, control subjects showed consistent, but nonsignificant greater increases in hostility and STAI anxiety scores (see Table 2) than the experimental subjects. Thus, while experimental subjects showed a decrease of .1 on hostility and an increase of 1.85 on STAI-anxiety, control subjects showed increases of 1.11 and 3.98 on these indices.

State measures, as noted above, were probably more responsive to situational factors like the end of term. These measures all showed nonsignificant increases for the
experimental subjects versus control subjects (see Table 2). While none of these increases is significant, this was a very unexpected event. One possible explanation is that the experimental subjects may have been more self-aware of negative arousal. In a series of experiments on self-awareness, Fegnisten and Carver (1978) found heart beat feedback increased self-awareness. Schreier and Carver (1977) found heightened self-attention leads to an increased awareness of salient self-elements (i.e., the experience of transient affective states are subjectively intensified as a function of self-focus). For 21 sessions the experimental subjects focused on their physiological responses of heart beat and respiration. This may have generalized to overall increased self-awareness which led to the appropriate increase in negative mood, specifically, anxiety, hostility and depression during this stressful time.

The results of the questionnaire suggest that most subjects experienced an increased ability to perform work, more energy, changes in self-image and more positive attitudes about health. The perception of increased physical and psychological functioning unrelated to fitness change replicates the findings of Jasnoski et al. (1981), Heaps (1978) and McPherson et al. (1967). These findings support the hypothesis that expectancies of those who engage in exercise may account for some of the perceived psychological changes that occur. Additionally, comments on
the questionnaire suggest that increased feelings of self-efficacy produced by engaging in exercise increased involvement in other spheres of life such as work and social interaction which in turn increased feelings of self-efficacy.

Conclusions and Limitations

Although the results of this experiment not support the original hypotheses, several interesting phenomena were noted. It appears that initial level of physical fitness was related to psychological fitness. Both the experimental and control subjects were initially in or near Cooper's fair (3) level of fitness and their mean scores on the measures of anxiety, depression and hostility were below college norms. This replicates the findings of several authors (Folkins, Lynch & Gardner, 1972; Hilyer & Mitchell, 1979; McPherson et al. 1967; Jasnoski & Holmes, 1982).

Experimental subjects had a significant increase in distance covered and Cooper's fitness category, however they did not have decreases in heart rate and blood pressure. It was postulated that these results were due to defects in the design. First, the experimental subjects failed to maintain heart rate intensity needed to achieve significant change given their initial level of fitness. It was suggested that this occurred because not enough emphasis was given to this factor. Second, all subjects were in the last week of the
term and changes in activity, increased consumption of caffeine and nicotine, and increased levels of adrenalin due to stress would account for increase in resting heart rate and blood pressure. It was noted that a differential amount of increase occurred. It appears that experimental subjects had increases of less magnitude in these parameters than the controls. These findings are in agreement with Dienstbier et al. (1982) and Cox et al. (1979), who found lower levels of physical arousal in aerobically fit individuals in stress situations. Dienstbier et al. (1981) suggested that increased sympathetic nervous system arousal produced by chronic strenuous exercise might prepare the arousal system to deal with stress more efficiently. Lack of decreases in blood pressure and heart rate with significant increase in VO₂max further supports the suggestion that more than one measure of fitness change is necessary in order to have more conclusive results. An unexpected finding was the increase in trait measures of hostility, anxiety and depression. It was pointed out earlier that trait measures are more stable indices of personality not susceptible to fluctuation created by transitory situations. A study by Gorsuch in 1969 (Spielberger et al. 1970) with college students found that increase in trait anxiety occurred when there was a period of time in which there were substantial increases in A-State anxiety. Since there is a substantial increase in stress the last week of the term this might account for
increases across trait measures for all subjects. However, it was found that the magnitude of increase was substantially less for experimental subjects. It might be postulated that for individuals who engage in persistent strenuous exercise, this conditioning serves as at least a partial buffer against negative psychological effects during periods of high stress. Zimmerman and Fulton (1981) found more aerobically fit subjects had significantly lower levels of trait anxiety when exposed to psycho-social stressors. They suggest this might be due to feeling more at ease with themselves. Other authors have suggested that the differences in psychological functioning may be due to physical changes. The findings of the questionnaire reveal that all subjects, control and experimental, had increased perception of physical and psychological functioning, which were unrelated to physical change. However, the differential response on trait measures suggest that increased physical functioning may be a valid component of increased psychological functioning during periods of high stress.

The higher levels of state anxiety in the experimental subjects, when compared with control subjects, were totally unexpected. It was postulated that the experimental subjects were trained to be more self-aware because of repeated focus on heart rate and respiration during class periods.
This study is limited in several ways. First, lack of random assignment appears to have resulted in selection bias of more physically fit individuals. An independent control would have given more information on the general fitness level of this sample of college students. Second, although comparison of two exercise groups would have provided empirical evidence of the components involved in better psychological functioning (i.e., expectancies, achievement of goals, changes in behavior that result from being in an exercise program) more care should have been taken to explain the necessity of maintaining the training heart rate in order to achieve changes in fitness. An extended treatment time or a request for the experimental students to engage in outside aerobic exercise might have led to more conclusive results. Third, increases in depression, anxiety and hostility were attributed to the timing of the testing; a sedentary or independent control would have provided valuable information on changes that generally occur.

In view of the practical implications of fitness training on changes in self-perception and mood that occur when individuals persistently engage in exercise, it appears that findings in this area would be of wide interest and have practical implications for clinicians.
APPENDIX I

BEHAVIORAL DESCRIPTION OF FLEXIBILITY,
WARM-UP AND STRETCH EXERCISES
Flexibility exercises-are isolation exercises that warm up joints and allow the body and its parts to go through a wide range of motion without undue muscle strain.

Some examples are:

**Neck Roll**

Stand with feet in straddle position, 8-10 inches apart. Arms are held at sides or behind the back. The head is dropped forward and rolled in a circular motion over the right shoulder. The head drops to the back and continues to roll left shoulder.

**Arm Circles**

Stand with feet in straddle position, 8-10 inches apart. Arms are held at sides. The right arm is moved in a circular motion in front of the body. The circular pattern is continued over the head and back to original position. Repeat motion with the left arm.
Double Arm Circles

Feet in straddle position, 8-10 inches apart. Arms are held at sides. Circle both arms simultaneously, crossing in front of the body, circling overhead and returning to original position.

Floor Brush Straddle

Feet in the straddle position, approximately 30 inches apart. Arms are held out at sides. The body is bent forward at the waist. The floor is brushed with hands and swept up, crossing arms in front of the body.

Side Bends

Feet in straddle position, approximately 30 inches apart. The right arm is extended out to the side and circled overhead, while bending left from the waist. The left arm should slide down the left leg past the knee. This position is held for 5 seconds. The same action is repeated to the left side.
Dances consist of patterns, which are two or three steps linked together. Three or four patterns make a dance. Locomotor and non-locomotor movements are used in the dance patterns. Locomotor movements are: runs, walks, slides, leaps, hops, jumps, gallops and skips. The non-locomotor movements are turns, swings, sways, releases, falls, contractions, recoveries and twists. They are done with increasing vigor.

Cool down consists of stretches to counteract the muscular contraction that occurred during the dance sequences. Static stretches, previously mentioned are used. Ballistic stretching is also done. Ballistic stretching involves bobbing and rebounding movements while the body works to its limit of stretch.

Hamstring Lunge

Stand in the straddle position with toes forward. Bend the left knee, keeping body weight over the left leg. The right leg straight. Place hands behind the back. Bounce gently several times.

Floor stretches are used to build strength and endurance and increase flexibility.

Bent Knee Sit-Ups

This exercise develops tone and endurance of the abdominal muscle. Bend knees, clasp hands behind head, curl forward touching elbows to the knees. Roll back down.
**Inverted Cycling**

From a back lying position, roll back onto shoulders, lift hips by supporting with you hands.

**Bent Knee Leg Lifts**

A lying position on the back with hands behind the head. Bent knees are pulled to a position above the head. Straighten legs, while extending and lowering them slowly to about six inches off the floor, hold. Back is kept pressed to the floor.

**Straddle Sit**

Feet in a wide straddle position. Bend forward, arms outstretched. Return to original position. Bend body to the left over the left leg. Assume original position. Bend body to the right over the right leg.
Knee Lift-Ankle Rolls

Stand with feet together. Lift right knee, grasp right knee with both hands, hold knee up and in front of the body. Begin rolling the ankle in a circular motion to the left, repeat rolling action to the right. Repeat exercise with the left ankle. This may also be done with the leg raised 20 degrees to the front, side and back.

Leg Raises

Stand with feet together. Arms are held out at sides. The right leg is raised as high as possible. This position is held for 5 seconds. The exercise is repeated with the left leg.

Ankle Extension (Plantar Flexion)

Take a sitting position on the floor. The right leg is stretched so the knee is locked and extended and the right foot is extended from a vertical position to as near a horizontal position to shin bone as possible. This can also be done with leg raised. The procedure is repeated with the left foot.
Warm-up stretches and toning, these exercises are to avoid muscle and joint strain and decrease the amount of muscle soreness that may occur. Static stretching is done at this time. The individual moves slowly into maximum position and hold the position steady for brief periods.

Some examples are:

**Knee Bends**

Stand with feet together. Bend knees and hold position for 5 seconds. The bend should not be deep, but rather should stress keeping the heels on the floor, stretching the achilles tendon and the gastrocnemius (calf) muscle. The back should be kept relatively straight during the performance of this exercise.

**Gastrocnemius (Calf) Stretch**

Stand in a long stride position, right foot forward, left foot back. The toes of both feet are facing forward. Bend the right knee and shift weight forward. The left leg is kept straight, with left heel on the floor. Hold this position for 5 seconds. Continue exercise by now bringing arms down to touch the floor in front of the right foot. Repeat this exercise with the left leg forward in stride position.
APPENDIX II

SUMMARY OF SECTION TIMES
## Summary of Section Times

<table>
<thead>
<tr>
<th>Class</th>
<th>Flex/Warm-up</th>
<th>Endurance</th>
<th>Cool/Stretch/Still</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>16</td>
<td>15</td>
<td>57</td>
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<td>2</td>
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<td>60</td>
</tr>
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</table>
APPENDIX III

DETAILED DESCRIPTION OF EACH CLASS
**Week 1**

**Music: Varsity**

I  
1. **Flexibility- Repeat** 5:00, 1:00, 5:00, 1:00  
2. **Warm-up-Repeat each** 7:00, 1:00, 7:00, 1:00  
3. **Learn section 1 of dance #1** 4:00, 1:00, 4:00, 1:00  
4. Repeat dance again 4:00, 1:00  
5. Cool-down walks 4:00  
6. Stretches- Intro 2, repeat 5:00  
7. Stillness, cool-off 5:00  

II  
1. **Flexibility- Repeat** 5:00, 1:00, 5:00, 1:00  
2. **Warm-up- Repeat** 7:00, 1:00, 7:00, 1:00  
3. **Review dance #1 section 1 (p), repeat (p), repeat** 10:00  
4. Learn section 2, repeat (p) 10:00  
5. Cool-down walks 4:00  
6. Stretches-review two add one 5:00  
7. Stillness 4:00  

III  
1. **Flexibility-Repeat**, 5:00, 1:00, 5:00, 1:00  
2. **Warm-up-Repeat 7:00, 1:00, 7:00, 1:00**  
3. Review section 1 & 2 (p) repeat(p) repeat (p) 10:00  
4. Learn section 3 (p) 10:00  
5. Cool-down walks 5:00  
6. Stretches-review 3, add 1 4:00  
7. Stillness 4:00  

**Week 2**

I  
1. **Flexibility 6:00**  
2. **Warm-up 16:00**  
3. Dance 1 review (p) Repeat,(p) C 15:00  
4. Learn section 1 of dance 2 (p) Repeat 8:00  
5. Cool-down walks 4:00  
6. Cool-down stretches 5:00  
7. Stillness 5:00  

II  
1. **Flexibility 6:00**  
2. **Warm-up 16:00**  
3. Dance 1 (p) Repeat (p) C10:00  
4. Dance 2 section 1 review (p) Repeat (p) C 8:00  
5. Learn section 2 (p) C 4:00  
6. Cool-down walks and stretches 9:00  
7. Stillness 5:00  

III  
1. **Flexibility 6:00**  
2. **Warm-up 16:00**  
3. Dance 1 review, Repeat (p) C 10:00  
4. Dance 2 section 1&2 (p) Repeat C8:00  
5. Learn dance 2 section 3 (p) C4:00  
6. Cool-down walks, stretches 9:00  
7. Stillness 5:00  

(p)= pulse  
C = continuous
Week 3

I 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 section 1, section 2, section, section 3 C 4:00 (p)
5. Dance 2 complete, Repeat C 8:00 (p)
6. Dance 1 C 5:00 (p)
7. Cool-down walks 5:00
8. Stretches 7:30
9. Floor stretches introduced 2 7:30
10. Stillness 4:00

II 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 section 1, section 2, section, section 3 C 4:00 (p)
5. Dance 2 complete, Repeat C 8:00 (p)
6. Dance 1 C 5:00 (p)
7. Cool-down walks 5:00
8. Stretches 7:30
9. Floor stretches. Add 2 new 7:30
10. Stillness 4:00

III 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 C 4:00 (p)
5. Dance 1 C 5:00 (p)
6. Dance 3 section, Repeat C 10:00 (p)
7. Cool-down walks 5:00
8. Stretches 7:30
9. Floor stretches, 4, 7:30
10. Stillness 3:00

Week 4

I 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2, Repeat C 8:00 (p)
5. Dance 1 C 5:00 (p)
6. Review dance 3 section 1, Repeat C 10:00 (p)
7. Learn dance 3, section 2, Repeat 5:00
8. Cool-down walks 5:00
9. Stretches, standing/floor 5:00
10. Stillness 4:00

II 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2, Repeat C 8:00 (p)
5. Dance 3, section 1 C 5:00 (p)
6. Dance 3, section 2 C 5:00 (p)
7. Learn dance 3, section 3 C 5:00
8. Cool-down walks
9. Stretches, Standing/floor 8:00
10. Stillness 3:00

III 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2, Repeat C 8:00 (p)
5. Dance 3 section 1, section 2, section 3, C 5:00 (p)
6. Dance 3, Repeat C 10:00 (p)
7. Cool-down walks 5:00
8. Stretches, standing/floor
9. Stillness 3:00

Week 5

Swing 6:30 6:30

I 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1, Repeat C 10:00
4. Dance 2, Repeat C 8:00 (p)
5. Dance 3 section 1, section 2, section 3 C 5:00 (p)
6. Dance 3 C 5:00 (p)
7. Cool-down walks 5:00
8. Stretches, standing/floor, add 2 new stretches 8:00
9. Stillness

II 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1, Repeat C 10:00 (p)
4. Dance 2, Repeat C 8:00 (p)
5. Dance 3, Repeat C 10:00 (p)
6. Dance 4, section 1, Repeat 7:30
7. Cool-down walks 5:00
8. Stretches, standing/floor 8:00
9. Stillness

III 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1, C 5:00
4. Dance 2, C 4:00 (p)
5. Dance 3, C 5:00 (p)
6. Dance 4, section 1 C 7:30 (p)
7. Learn dance 4, section 2, 7:30
8. Stretches, floor/standing 8:00
9. Stillness 5:00

Week 6

I 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 C 4:00 (p)
5. Dance 3 C 5:00 (p)
6. Dance 4, section 1, section 2, C 7:30 (p)
7. Learn dance 4, section 3, Repeat C 15:00
8. Cool-down Walks 5:00
9. Stretches, standing/floor, 4:00
10. Stillness 3:00

II 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 C 4:00
5. Dance 3 C 5:00 (p)
6. Dance 4, section 1, section2, section3, Repeat C 15:00 (p)
7. Dance 3 C 5:00
8. Cool-down walks 5:00
9. Stretches, standing/floor 4:00
10. Stillness 3:00

III 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1 C 5:00
4. Dance 2 C 4:00
5. Dance 3 C 5:00 (p)
6. Dance 1 C 4:00 (p)
7. Dance 4 complete, C 15:00 (p)
8. Cool-down walks 5:00
9. Stretches, standing/floor 4:00
10. Stillness 3:00

Week 7

I 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1, C 5:00
4. Dance 2, C 4:00
5. Dance 3, C 5:00 (p)
6. Dance 4, section, section2, section3 C 7:30 (p)
7. Dance 4, complete C7:30 (p)
8. New dance C 2:00
9. Cool-down 5:00
10. Stretches, standing/floor 8:00
11. Stillness, 5:00

II 1. Flexibility 6:00
2. Warm-up 8:00
3. Dance 1, C 5:00
4. Dance 2, C 4:00 (p)
5. Dance 3, C 5:00 (p)
6. Dance 4, Repeat C15:00 (p)
7. New dance section 1, section 2 2:00
8. Cool-down 5:00
9. Stretches, standing/floor 8:00
10. Stillness 5:00

III Same as day II
Weeks 8-12

Same all week

1. Flexibility 4:00
2. Warm-up 4:00
3. Dance 1 C 5:00
4. Dance 2 C 4:00
5. Dance 3 C 5:00 (p)
6. Dance 4 C 7:30 (p)
7. Dance 5 C 7:30 (p)
8. Dance 2 C 4:00
9. Cool down 4:00
10. Stretches, standing/floor 3:00
11. Stillness 3:00
APPENDIX IV

ORAL PRESENTATION TO SUBJECTS
I'm Dolores Gerscovich, a graduate student in Clinical Psychology at the University of Central Florida. I'm doing a research thesis on the relationship between personal health factors and aerobic exercise. First, let me explain what aerobic exercise is. Aerobic means using oxygen or living in air. Aerobic exercise is any exercise where your heart-beat is increased enough to place demands on your body to take in more oxygen. It has to be a continuous demand of at least five minutes. Doing aerobic exercise causes you to breathe faster so your lungs can take in more oxygen, your heart beats faster to transport the oxygen all over your body. Doing this kind of exercise on a regular basis forces your body to become more efficient in taking in oxygen and getting it around your body. Your heart becomes stronger as each beat forces out more blood, so it takes less beats to get as much oxygen to the tissues. The size and number of your red blood cells increase. The amount of blood in your body will increase. Your lungs will also be much more efficient in handling oxygen. This is called "training effect." As this training effect occurs, your body will have to work less to produce the same amount of work.

I became interested in aerobic exercise for different reasons than all those good things I mentioned above. I became interested in aerobic exercise as a help to control weight. I've always had to fight fat. Ever since my first child was born, it's been a continuous struggle. As I got older, it got harder. So I started a running program to lose weight. Then I noticed other changes. I always felt exercise was good, but my life had become very sedentary. After coming to Florida, distances were long and to get anywhere, it was not convenient to walk. I spent a great deal of my time in the car driving everywhere. It seemed I was getting a lot of exercise doing housework and taking care of my children. But looking back, I realize that it was not proper exercise. If I did have to move fast, I got out of breath and tired very easily. I read avidly about aerobic exercise, which was not difficult. It seems almost daily there is something about aerobic exercise in the newspapers and most magazines, and now even on television it has become a big thing. I'm sure you all have seen people running or jogging in your neighborhood. The benefits from this kind of exercise have been supported by research. The biggest medical application of aerobic exercise is in rehabilitating people after a heart attack. There is also evidence that it may reduce the incidence of heart attacks in people who are high risk. There is also some evidence that it helps in weight control. While doing a term paper a couple of years ago on exercise I noticed that most of the research was done using college males or post heart attack and healthy adult males. Being a woman I felt a little bit
left out and concerned about the gap. Which is why I'm here today.

Let me tell you what is involved in this course. Each class will consist of a warm-up, continuous period and a cool-down. The warm-up exercises get your muscles ready to do the continuous part. These exercises are necessary to prevent injury to your muscles and muscle soreness. Then you will be doing continuous exercises for 15 minutes in the beginning, a few minutes extra will be added on each week, until you are doing 39 minutes of continuous exercise. Now, if I were you, I would probably be thinking, she must be crazy. It will not be as difficult as it seems. First of all, you will each be given a heart rate to work at. This rate will be calculated according to your heart's ability to handle exercise right now. Exercising at this rate will keep you from becoming too tired, but still allow you to get the training effect. Your body will be adjusting to exercise so the 39 minutes you will end up doing will not be so difficult. I also need to warn you that it will take persistence and you will need to be here two times a week.

After the continuous exercise there will be a cool-down, stretching and stillness period. This will allow your breathing and heart beat to return to its regular rate. The cool-down prevents blood from pooling in your legs. The stretching serves two purposes; it loosens up your muscles which tightened up during the continuous work period. They also strengthen the muscles, so they will be able to tolerate more work. One of the advantages of a program like this is you can learn the proper way to warm up and cool down if you decide to start your own program. Many times people are very enthusiastic when starting to exercise and overdo it. They get too fatigued or injured and stop before they can get the benefits and good feeling. I have incorporated things from the available research in this program to give you a safe and enjoyable introduction to aerobic exercise.

This project will also involve some tests before and after the training. Before you start the classes we will take your pulse and blood pressure. We will also give you Cooper's test for fitness. This test will involve walking and running at maximum effort for 12 minutes. This will tell us your overall fitness level right now. It will also give us the information needed to calculate your heart rate. These same tests will be performed after your 12 weeks of training to tell us how much you have changed. You will also be asked to fill out a questionnaire which will ask you for information like your age and personal habits.
You will be given two tests that will ask you about your feelings either now or most of the time. These same tests will also be given at the end of the program to see if there are any differences.

There will also be an added questionnaire after the program to give me an idea about your feelings about this program and changes that you feel occurred. At this time you might be concerned about sharing personal information with me. Your responses will be anonymous. This is so that you can be completely comfortable being honest. The data are not analyzed on an individual but on a group basis. It will be necessary to have some identifying number so data won't be counted twice or in order to group two pieces together. Therefore, on each paper you will put your birthdate. For example, if you were born on September 5, 1942 your number would be 9542. Paula will be the only one who will have both pieces of information, if there is any change in the class roll or attendance she can tell me which data to remove. I will be the only one who will handle these papers. Another thing you will be requested to do is to keep a log of the heart rate you maintained during your continuous exercise. I will explain this more later.

If you decide to participate, the last thing you will have to do is sign a slip of paper that says you agree to participate in the project, and permission to publish the data. This paper will have your name, address and telephone number so that if you wish to be informed of the results of the research I can give you that information when it is available. Time permitting, the personal information, paper and pencil tests, pulse and blood pressure will be done today.

Heart Rate Information

As I mentioned earlier, you will be given the heart rate that will be most beneficial to you. This rate is calculated from your maximal and resting heart rate. A percentage of the difference will then be used for your training heart rate. The percentage taken will be according to your fitness level at this time. It is very important that you maintain the rate given, going neither 5 beats more nor less. If you find you are below you will have to exert yourself more. This can be done by raising your legs higher or moving a little faster. If you find your heart is beating too fast, you will need to slow down your pace. Now you may be thinking, if I do it faster I'll get the training effects sooner. Well, this has not proven to be true. There has been a lot of research on this, and the findings
have been that going above puts too much stress on the body and results in fatigue or injury. This is why it's important to maintain your rate.

During the continuous period of exercise you will take your pulse three times. Ms. Gale will mark the time for you to count, which will be 10 seconds, you can get your pulse rate by multiplying by 6. For example, if my training heart rate was 154 beats per minute, the range I would be aiming for would be between 149-159 beats per minute. If I got 30 beats in the 10 second period, my rate for the minute would be 180 beats, which is too high. I would tell myself to slow down, because it was much too fast. If I got 20 beats for the 10 second period I would only be achieving 120 beats per minute, which would be too slow, so I would speed up. Now, say I'm lucky and I get 25 beats for the 10 second period, that would be 150 beats per minute, which is within my limit. If that occurs, what you should do is pay attention to how your body feels, how your breathing feels and how your heart beat feels. By doing this you will become accomplished in knowing what your heart beat is during exercise even when you are not taking it. You can become more accurate in your judgement, while exercising, it will help you to consistently maintain this heart rate, during the continuous period, which is what we're aiming for. Now don't expect to do this immediately, it can take a short time or longer time to learn, depending on how much attention you paid to your body before. Just keep this up and you will be successful. (Demonstration of pulse taking). Please practice taking your pulse at home. Do it in the morning when you wake up, at lunch time and bed time. If you think of it at other times, practice. The more you practice, the easier it will be to do it.

These are the log sheets I mentioned earlier. You will be given one on Monday. In the upper corner will be your birthdate, which the teacher will call so you get the proper log sheet. Right under the birthdate will be your heart rate. After you take your pulse in class I would like you to remember the one which came closest to your training heart rate and record it in the space provided. Keeping this log will be a good reminder of your heart rate. It will also help us to explain any changes that may have occurred. These logs will be turned in after the last class.

Now, I would like to bring up a few more points and we will be finished. Despite everything we have done to prevent muscular aches, there may be some soreness in the beginning. We want to know about this, so Paula can give you special exercises for the area where the soreness is.
We want this to be a pleasant educational experience, so please don't hesitate to ask at the beginning of the class.

Another important thing is the type of clothes you wear. To be the most comfortable, wear shorts or a leotard with sneakers. The sneakers will protect your feet and ankles. Many times people wear plastic pants while doing exercise. They are advertised to cause weight loss. This is a fallacy, the only thing they do is hold the heat in your body and cause you to perspire more. While doing this kind of exercise, it is best not to increase the heat because you will be overworking your system and as I mentioned earlier, this will cause fatigue. So please don't wear anything like that to class. Thank you.
APPENDIX V
LOG
Birthday_______
Training Heart Rate_______

<table>
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<tr>
<th>Class</th>
<th>Heart Rate</th>
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<td>24</td>
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</tbody>
</table>

Please put the heart rate that was closest to your training heart rate. Turn in these logs after the last class.
APPENDIX VI

CONSENT FORM
CONSENT FORM

I______________________________, agree to participate in a study of the effects of fitness training on women, currently being conducted by Dolores R. Gerscovich, Clinical Psychology graduate student at the University of Central Florida. I understand that I will have to respond to several personal questionnaires and that these responses will be anonymous. I also understand that I may discontinue participation at any time. I further consent to the use of all data in any publication of the results of the study, under the assurance that my participation will be confidential and anonymous.

Date_________________________ Name______________________________

Address____________________________ Telephone Number__________________
APPENDIX VII

DEMOGRAPHIC AND HEALTH QUESTIONNAIRE
Course Name_____________________

Birthday________
Age________
Religion_____________________
Marital Status______________

Have you ever participated in or established an endurance program (aerobic dance, swimming, running, etc.) in the past?
Yes____ No____

If yes:
   How long ago_________________
   How long did you participate or maintain your program_________________
   Why did you drop out_________________

Do you smoke?  Yes____ No____

If so, approximately how many cigarettes do you smoke per day_______

Are you under a physician's care for any illness at the present time? Yes____ No____

If yes, what are you being treated for__________________________________________

Have you ever been in psychotherapy (individual, group or other) Yes____ No____

If yes, please indicate what type______________________________

What was it for?________________________________________________________________
APPENDIX VIII
MULTIPLE AFFECT ADJECTIVE CHECKLIST
TODAY & IN GENERAL FORM
DIRECTIONS: On this sheet you will find words which describe different kinds of moods and feelings. Mark an X in the boxes beside the words which describe how you feel now - today. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly.
DIRECTIONS: On this sheet you will find words which describe different kinds of moods and feelings. Mark an X in the boxes beside the words which describe how you generally feel. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly.
<table>
<thead>
<tr>
<th>A</th>
<th>D</th>
<th>M</th>
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<tr>
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<tr>
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<td>forlorn</td>
<td>pleased</td>
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<td>frank</td>
<td>pleasant</td>
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<td>reckless</td>
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<td>gay</td>
<td>rejected</td>
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<td>rough</td>
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<tr>
<td>fine</td>
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<td>young</td>
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</table>
APPENDIX IX

SPIELBERGER TRAIT-STATE ANXIETY INVENTORY
FORMS Y & Y-2
SELF-EVALUATION QUESTIONNAIRE

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm ................................................... 1 2 3 4
2. I feel secure ................................................. 1 2 3 4
3. I am tense .................................................... 1 2 3 4
4. I feel strained ............................................... 1 2 3 4
5. I feel at ease ................................................ 1 2 3 4
6. I feel upset .................................................. 1 2 3 4
7. I am presently worrying over possible misfortunes ............. 1 2 3 4
8. I feel satisfied ............................................... 1 2 3 4
9. I feel frightened ............................................. 1 2 3 4
10. I feel comfortable ........................................... 1 2 3 4
11. I feel self-confident ....................................... 1 2 3 4
12. I feel nervous ............................................... 1 2 3 4
13. I am jittery ................................................. 1 2 3 4
14. I feel indecisive ............................................ 1 2 3 4
15. I am relaxed .................................................. 1 2 3 4
16. I feel content ............................................... 1 2 3 4
17. I am worried .................................................. 1 2 3 4
18. I feel confused .............................................. 1 2 3 4
19. I feel steady ................................................. 1 2 3 4
20. I feel pleasant .............................................. 1 2 3 4

Developed by Charles D. Spielberger in collaboration with R. L. Gorsuch, R. Lushene, and P. R. Vagg.

(PLEASE COMPLETE OTHER SIDE!)
**SELF-EVALUATION QUESTIONNAIRE**  
**STAI FORM Y-2**

**DIRECTIONS:** A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>21. I feel pleasant.</td>
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<tr>
<td>22. I feel nervous and restless.</td>
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<td>23. I feel satisfied with myself.</td>
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<td>24. I wish I could be as happy as others seem to be.</td>
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<td>25. I feel like a failure.</td>
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<tr>
<td>26. I feel rested.</td>
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<tr>
<td>27. I am &quot;calm, cool, and collected&quot;.</td>
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<td>28. I feel that difficulties are piling up so that I cannot overcome them.</td>
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<td>29. I worry too much over something that really doesn't matter.</td>
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<td>30. I am happy.</td>
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<tr>
<td>31. I have disturbing thoughts.</td>
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<td>32. I lack self-confidence.</td>
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<tr>
<td>33. I feel secure.</td>
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<tr>
<td>34. I make decisions easily.</td>
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<td>35. I feel inadequate.</td>
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<td>36. I am content.</td>
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<td>37. Some unimportant thought runs through my mind and bothers me.</td>
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<td>38. I take disappointments so keenly that I can't put them out of my mind.</td>
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<tr>
<td>39. I am a steady person.</td>
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<tr>
<td>40. I get in a state of tension or turmoil as I think over my recent concerns and interests.</td>
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APPENDIX X

POST EXERCISE QUESTIONNAIRE
Birthdate: Class:

Please answer these questions candidly. Your answers will help other researchers to design more effective exercise programs.

Have you ever participated in or established an endurance (aerobic dance, swimming, jogging etc.) program in the past Yes No
   If yes
      1. How long ago
      2. How long did you participate or maintain your program
      3. Why did you drop out?
   If yes, what type of exercise do you plan to do
   Please list any suggestions you might have to improve the program

Have you noticed any significant change in your work performance Yes No
   If yes, please check the appropriate spaces
      I have a greater capacity to work harder
      My decision making was improved
      My power of concentration was improved
      I felt greater enthusiasm about working
      Other
   In general do you feel you have more stamina and energy Yes No
   Do you have a greater ability to deal with tension and stress Yes No
   Have you experienced any change in your daily life Yes No
   If yes, please explain

Have you increased your activities with family or friends Yes No
   If yes, please explain

Do you have a more positive image of yourself Yes No
   If yes, please explain

Has there been a shift in your feelings about your ability to change Yes No
   If yes, please explain

Has there been a change in our feelings about your ability to achieve Yes No
   If yes, please explain

Do you have a more positive attitude about your health Yes No
   If yes, please explain

Did you have any weight reduction Yes No
   Have you changed your eating habits Yes No
      If yes, do you eat More Less
      Please explain any other change in eating habits

Have you experienced any change in you sleeping habits Yes No
   If yes, please explain
APPENDIX XI

LETTER TO J. H. BLUMENTHAL
Dr. J.A. Blumenthal
Department of Psychiatry and Medicine
Duke University Medical Center
Durham, North Carolina 22710

Dear Dr. Blumenthal:

I am a graduate student in a Clinical Psychology program at the University of Central Florida. I am presently working on my Master's thesis research project. The study will measure the psychological effects of an aerobic dance program on non-clinical sedentary females aged 18-49.

Today I read an abstract from the Physician and Sportsmedicine of your study, Psychological Changes Accompanying Physical Exercise: A Controlled Study. An outgoing search of previous material had not revealed a controlled study of the non-clinical, sedentary, middle-aged adult population. A reprint of this study and any relevant information you could send me would be an immense help.

This is a particularly critical moment for me, because my study will begin June 1, 1983. As you can see, I must move rapidly and surely.

I would greatly appreciate any assistance you can give me.

Sincerely yours,

Dolores Gerscovich

Dolores Gerscovich
REFERENCES


Gutin, B. (1966). Effect of increase in physical fitness on mental ability following physical on mental ability following physical and mental stress. Research Quarterly, 37, 211-220.


