THE EFFECTS OF AN EXERCISE PROGRAM ON SELF CONCEPT AND PHYSICAL FITNESS ON OKLAHOMA STATE UNIVERSITY COMMISSIONED PEACE OFFICERS

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CHAPTER I

INTRODUCTION

Man is body. Man is mind. Man is spirit. These facets of man's being, though separate, must be considered as one; an integrated whole. The interrelationship of these aspects determines the total being.

The World Health Organization (62, p. 1) describes health as, "not only the absence of disease, but a state of physical fitness and of mental and social well-being". Likewise Hawley (33, p. 10) refers to health as a "harmonious relationship between body, mind and spirit". The interrelationship of physical, spiritual, mental, emotional and social is labeled "fitness qualities" by the President's Council on Physical Fitness and Sports (47).

In the earlier issues of the President's Council's Physical Fitness Research Digest (49) (50), the concept of the "totality of man" is discussed in some detail. They suggest a close tie between physical fitness and organic soundness. For example, exercise has a direct role in weight control. Fitness activities strongly influence social and psychological adjustment, while lack of activity is linked to social and personal deficiencies. The President's Council also points out that while many studies

show a positive relationship between physical fitness and mental alertness and achievement, this does not mean that an axiomatic relationship exists between fitness and quality of mental effort. This is logical since many other factors, "such as intelligence, motivation, interest, time spent in study, and the like, have significant influences upon one's intellectual productivity" (50, p. 1).

To look at man as a whole being requires an analysis of the individual facets of the total being. What effect do these different aspects have on one another? Can a cause-effect relationship be established between these sub-parts? How do these interrelationships affect the whole person? The answers to these questions can be obfuscated. Physical fitness and self concept are two such facets and they will be the focus of this study.

When one looks at physical fitness and self concept in human beings, it is important to lay a basic foundation of knowledge concerning these two ideas.

Physical Fitness

Probably one of the most widely accepted definitions of fitness was delineated in the first Physical Fitness Research Digest (48).

> . . . Physical fitness is defined as the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure time pursuits and to meet unforseen emergencies. Thus, physical fitness is the ability to last, to bear up, to withstand stress, and to preserve under difficult circumstances where an

> unfit person would quit. It is the opposite to becoming fatigued from ordinary efforts, to lacking energy to enter zestfully into life's activities, and to becoming exhausted from unexpected, demanding physical exertion (p. 1).

The Digest goes on to describe the component parts that make up a functionally fit person. The basics are as follows:

1. Muscular strength - the contractile power of the muscle.

2. Muscular endurance - the ability of the muscles to perform work over a period of time.

3. Circulatory-respiratory endurance - the ability of the heart and blood vessels to process and transport oxygen to needed parts of the body.

Other factors that make up physical fitness include muscular power, agility, speed and flexibility. Of these, flexibility, or range of movement, is probably more important to the average adult population. Pollock (45) points out that poor hip-truck flexion is linked to low back pain, which has become so prevalent in today's sedentary society.

In addressing the "Totality of Man" concept, the President s Council (48) synthesized much of the information concerning the relationship between physiological and psychological traits. In studies done on various populations, fit persons are more energetic, optimistic, and action minded when compared to unfit. On the other hand, unfit persons appear to be nervous, insecure and tense.

Persons who display high levels of fitness are more playful, more aggressive, more independent and more emotionally mature than unfit (48).

Self Concept

As previously indicated, many factors make up the physical attributes that are known as fitness. Likewise, there are several aspects of "self" that must be considered when discussing self concept.

Roger's (53) states that:

> . . . the self concept or self-structure may be thought of as an organized configuration of perceptions of the self which are admissible to awareness. It is composed of such elements as the perceptions of one's characteristics and abilities; the percepts and concepts of the self in relation to others and to the environment; the value qualities which are perceived as associated with experiences and objects; and goals and ideals which are perceived as having positive or negative valence (p. 136).

The number of ideas being presented make it difficult to understand self concept. Other terms, such as, self esteem and personality are also used as synonyms for self concept. It is important to establish, with some degree of clarity, the differences between these ideas.

Wylie (63) referred to self concept as an arrangement of self references, or how one looks at one's self. For the most part, Wylie purported this to be a conscious process reflecting certain cognitions about ones' self.

Wells and Marwell (59) described self-esteem as an affective process whereby a person applies some value to

his/her concept of self. The process implies making some judgement or evaluation of self concept. The authors suggest that there is a very close tie between self concept and self-esteem and, in reviewing the literature, most researchers do not attempt to distinguish the two. Therefore, self concept instruments will overlap into the area of self-esteem, because it is extremely difficult to measure a perception without also measuring the value of that perception.

In discussing personality, Gale (26) addressed the ways a person behaves or solves problems that are useful to that individual. Like self concept and self-esteem, personality is very complex and reflects a collection of influences and determinate factors. This "configuration of learned behavior" includes knowledge, beliefs, morals, values, laws, customs, heritage, culture and socioeconomic factors.

In summary, self concept may be seen as the cognitive or conscious picture one has of one's self. Self-esteem is the affective process of evaluating or judging that picture. And, personality is the behavior that reflects that picture and its value.

Statement of the Problem

The problem of this study was to determine the effects of an individually prescribed exercise program on self concept and physical fitness. The Tennessee Self Concept Scale and subscales were used to ascertain self concept. Predicted maximal oxygen intake based on the results of a

walking treadmill test served as the primary determinant of physical fitness. Weight residual, maximal breathing capacity, vital capacity, grip strength, simple reaction time, vertical jump reaction time and flexibility were used as secondary measures of fitness. The subjects were pre-tested for self concept and fitness. The results of the fitness evaluation were used to prescribe a 16-week exercise program. At the end of the program, the subjects were post-tested for fitness and self concept. Differences between pre- and posttest means were analyzed to determine if there were significant changes in the dependent variables, self concept and physical fitness, as a result of participation or non-participation in the exercise program.

Subproblems

1. To determine if relationships existed between changes in self concept scores and changes in physical fitness for the participant group and the non-participant group.

2. To determine if relationships existed among changes in physical fitness variables for the participant group and the non-participant group.

Hypotheses

The null hypothesis was employed in examining the following questions:

1. There was no significant change in self concept scores as a result of participation in the exercise program.

2. There was no significant change in self concept scores as a result in non-participation in the exercise program.

3. There was no significant change in physical fitness as a result of participation in the exercise program.

4. There was no significant change in physical fitness as a result of non-participation in the exercise program.

5. There was no relationship between changes in self concept and changes in physical fitness for the participant group.

6. There was no relationship between changes in self concept and changes in physical fitness for the non-participant group.

7. There was no relationship among changes in physical fitness measures as a result of participation in the exercise program.

8. There was no relationship among changes in physical fitness for the non-participant group.

Limitations

Since the entire Oklahoma State University Commissioned Peace Officer force served as subjects for this study, there was no control group.

Delimitations

1. All of the subjects were Oklahoma State University Commissioned Peace Officers.

2. Since the entire male police force was used as subjects and no control group was necessary, no attempt was made to generalize results to a larger population.

Assumptions

1. The subjects kept accurate records of their activity patterns.

2. The tests selected to determine work capacity were valid predictors of physical fitness.

3. Some of the subjects participated in the exercise program to a greater degree than others.

4. Any changes in physical fitness were a result of the exercise program.

Significance of the Study

Conrad (32), the Executive Director of the President's Council on Physical Fitness and Sports, purported that a starting point for a program of preventive medicine is in the work place. People associate so many facets of their lives with their profession that it only seems logical to begin an adult program of health maintenance in the office.

Certainly, the work setting is associated with emotional and personal problems. Police work is no exception.

Armstrong (2, p. 1) reported that "statistics indicate the police profession ranks in the top five in each of the following (categories): alcoholism, suicides and divorce rates. Sad but true." Job stresses influence mental and physical well being.

Reiss (51) stated that the stressful, daily situations faced by police officers cause much emotional strain. James (35) added that the constant threat of violence, the many forms of disrespect for constituted authority and negative public opinion all compound to make a police officer's life very difficult.

It is important for a person to be satisfied with his/her quality of life. It is especially important for those persons in high stress occupations. California Highway Patrol Commissioner Craig (20) expected a physical fitness program to improve occupational safety records and, more importantly, reward each officer with an improved quality of life and better personal health.

As Kostrubala (37) pointed out, the concept of holistic health implies an important relationship between the physical being, the mental being and the emotional being. The current study was an attempt to analyze two facets of well-ness, physical fitness and self concept.

Definition of Terms

1. Graded Exercise Test (GXT): Also known as a treadmill test or stress test, it is a walking treadmill test,

involving increasing workloads. The test was used to predict maximal oxygen intake.

2. Maximal oxygen intake ($\dot{V}O_2$ Max): The maximum amount of oxygen the body can process when subjected to all out effort. In this study, $\dot{V}O_2$ Max was expressed in ml/kg/min. and used as the primary determinant of cardiovascular fitness.

3. Aerobic: With oxygen. Originally coined by Cooper (18), it is used to describe an activity where the oxygen requirements for that activity can be met during the activity. Approved aerobic activities are endurance activities that tax the body sufficiently to cause an increase in the oxygen processing functions of the body.

4. Self Concept: How individuals perceive themselves. These perceptions, as described by Fitts (24) in the Tennessee Self Concept Scale Manual, fall into the following categories:

(A) The Self Criticism Score (SC): A measure of openness or defensiveness.

(B) Total P Score: The most important score, reflecting overall self esteem.

(C) Identity: How he sees himself.

(D) Self Satisfaction: How he feels about the person he sees.

(E) Behavior: How he acts.

(F) Physical Self: His view of his body, health and sexuality.

(G) Moral-Ethical Self: His relationship to God or good and bad.

(H) Personal Self: His sense of personal worth.

(I) Family Self: His worth as a family member.

(J) Social Self: Self in relation to a set of general others. The others are not as close to the individual as the Family.

(K) Variability: The degree of consistency with which the person looks at himself.

(L) Distribution: The distribution of answers; the amount of certainty with which one describes one's self.

5 Commissioned Peace Officer (CPO): An Oklahoma State University campus police officer who is authorized to carry a badge, a gun, and make arrests.

6. METS: Metabolic equivalent; a unit of measure for energy expenditure and work load. Usually expressed as working or exercise metabolism divided by resting metabolism. One MET is generally accepted as resting metabolism or 3.5 ml/kg/min.

7. Weight Residual: Excess weight. Actual weight minus ideal weight.

8. Ideal Weight: A predicted optimum weight based on height, circumference measures and percent body fat.

9. Maximal Breathing Capacity (MBC): The maximum amount of air that can be forcefully expelled from the lungs

in a rapid succession of deep breaths. The test is normally conducted for 15 seconds and expressed in liters/min.

10. Vital Capacity: The maximum amount of air that can be exhaled after a maximum inhalation. (Expressed in milliliters or cubic centimeters.)

11. Target Heart Rate: A prescribed heart rate for the subject to maintain during exercise in order to derive benefit from his/her exercise session.

12. Electrocardiogram (EKG): A graphic recording of the electrical changes accompanying the cardiac cycle.

13. Flexibility: The range of motion of a joint or series of joints.

Description of Instruments

1. Quinton Motorized Treadmill: An instrument used to control work load while a subject is walking or running on a moving belt. An electric unit varies elevation from 0-40%. The electrically driven speed-change mechanism varies speed from 1.5-15 MPH. (Model 24-72, Quinton Instruments, Seattle, Washington.)

2. Physiograph and Preamplifiers: Device(s) used to record physiological data, such as heart rate and blood pressure. (Model PMP-4A, Narco BioSystems, Houston, Texas.)

3. Biotelemetry Receiver: An instrument used to receive radio transmissions of biological functions, such as heart rate. (Model FM-1100-7, Narco BioSystem, Houston, Texas.)

4. Biotelemetry Transmitter: An instrument used to transmit radio signals of biological phenomena, such as heart rate. (Model 1100-E2, Narco BioSystems, Houston, Texas.)

5. Electrodes: When properly attached to skin surface, they pick up electrical action of muscles. Two types of electrodes commonly used are disc and plate.

6. Birtcher Electrocardiograph: An instrument used to record the electrical activity of the myocardium. (Model 335, The Birtcher Corporation, Los Angeles, California.)

7. Sphygmomanometer: A device used to indirectly monitor blood pressure. (Trimline by PyMaH Corporation, Sommerville, New Jersey.)

8. Stethoscope: An instrument used to manually monitor heart sounds. (Exercise Model, Quinton Instrument, Seattle, Washington.)

9. Lange Skinfold Calipers: An instrument used to assess body fat. (Model HH-4-8, Cambridge Scientific Industries, Cambridge, Maryland.)

10. Tape Measure: A device used to measure length or circumference. (Metal tape, 0-201 cm in length, Preston Corporation, New York, New York.)

11. Scales: An instrument used to measure height and weight. (Detecto-Medic, Detecto Scales, Brooklyn, New York.)

12. Oscilliscope: An instrument used to monitor electrocardiograms continuously. (Model 7803A Monitor

Scope Hewlett-Packard, Waltham, Massachusetts.)

13. Collins Tissot Tank: An instrument used to measure large volumes of gas. (Chain-compensated Gasometer, 120 liter capacity, Collins, Inc., Boston, Massachusetts.)

14. Collins Vitalometer: An instrument used to measure volumes of gas. (Collins, Inc., Braintree, Massachusetts.)

15. Flexibility Box: A device used to measure hip-trunk forward flexion or sit and reach flexibility.

16. Dekan Automatic Performance Analyzer: A device used to measure elapsed time between a stimulus and a response. (Dekan Timing Devices, Glen Ellyn, Illinois.)

17. Harpenden hand dynamometer: An instrument used to measure grip strength. (British Instruments, Ltd. London, England.)

CHAPTER II

REVIEW OF RELATED LITERATURE

Martens (40) supported the idea previously presented, that self concept is not a single concept but a system or attitude about oneself. It embraces the cognitive, affective and behavioral domains. The author also purported that there is a lack of sound research dealing with physical activity and its relationship to psychological soundness.

At a Colloquium on Exercise and Fitness in 1959, several noted physiologists, physicians, psychologists and physical educators presented papers relating their areas to exercise and fitness. At that conference Cureton (21) supported the concept of the whole person, mind-body and spirit. He reported that anxiety and mental fatigue demonstrated an inverse correlation with physical endurance. In other words, as physical endurance increased, anxiety and mental fatigue decreased.

Cattell (14), author of Cattell's Sixteen Personality Factor Questionnaire, also presented a paper at the 1959 Colloquium on Exercise and Fitness. The presenter reported that at that time evidence was still scarce and warned against measuring temporary psychological states, such as anxiety, excitement and depression. Cattell suggested that

when designing experiments and constructing hypothesis, researchers should focus on relatively permanent characterological traits, such as anxiousness, dominance and super ego strength.

In 1952, Weber (58) studied the relationship between physical fitness as measured by the Iowa Physical Efficiency profile and success in school as measured by academic grades at the State University of Iowa. He also investigated the relationship between physical fitness and personality as measured by the Minnesota Multiphasic Personality Inventory. The subjects used in this study were two hundred forty-six male freshmen who were required to take physical education. The fitness instrument consisted of four activities. They were: Sit-ups for two minutes, pull-ups, 100-yard pick-a-back run and 300-yard shuttle run. Weber found a significant relationship between physical fitness and grade-point averages. The coefficient of correlation was .41, which was significant at the .01 level. This finding indicated that good physical fitness, as measured, tended to accompany, fairly well, achievement of academic success. There was no significant relationship between the physical fitness scores and the scores in the nine measures of personality in the MMPI. According to the results obtained from the subjects used in this study, the physically fit have no more stable traits of personality than do the physically unfit. The coefficient of correlation was a negative .04.

Tillman (57) used the Cattell Sixteen Personality Factor Questionnaire, the A-S Reaction Study of Allport and the Kuder Preference Record-Form C to relate personality and fitness as measured by two items of the AAHPER Youth Fitness Test. The items were pull-ups and the 600-yard run. The fitness and personality tests were given to three hundred eighty-six junior and senior high school boys. The upper fifteen percent (N = 63) and the lower fifteen percent (N = 50) were then compared on the three personality tests to determine the difference between the highly physically fit group and the group of low physical fitness on the various personality traits. The upper group appeared more surgent and enthusiastic ($p < .02$). They exhibited greater social dependence ($p < .001$) and indicated they were less tense than the lower group ($p < .01$). The subjects who finished in the lower fifteen percent on the fitness test were divided into an experimental group (N = 26) and a control group (N = 24). The experimental group participated in a strenuous physical fitness program administered by the author in lieu of their regular physical education class. At the end of the nine month exercise program, the groups were posttested and changes in fitness and personality traits were statistically examined by use of the t test to determine whether an improvement in physical fitness was accompanied by a personality change. The experimental group changed significantly on only one out of twenty-eight personality trait measures. They demonstrated a lesser

interest in clerical preference on the posttest than on the pre-test. The experimental group did not attain the physical fitness level of the upper group at the beginning of the study; it reached the forty-fourth percentile, whereas the upper group was at the ninety-second percentile.

Gutin (29) tested the hypothesis that an increase in physical fitness has a positive effect on the ability of individuals to perform complex mental tasks following physical and mental stress. Fifty-five college men who had been assigned to take a remedial physical fitness course were randomly selected and divided into experimental (N = 29) and control (N = 26) groups. The groups were pre- and posttested using the following procedure. Immediately after a 45-minute stress period of moderate intensity, both groups were administered four tests of the Employee Aptitude Survey: Verbal Comprehension, Visual Pursuit, Verbal Reasoning and Symbolic Reasoning. The stress period was composed of the Indiana Motor Fitness Index II (push-ups, chin-ups, standing broad jump), 30 step-ups on a 20-inch bench for one minute, 25 minutes of long addition and subtraction and another one-minute bout of 30 step-ups. The experimental group participated in a twelve week program of isometric training, calisthenics and circuit training. In no between-groups comparisons did any significant differences arise in favor or the experimental group. A significant relationship (r = .35) did exist between the degree of fitness improvement and the degree of mental task improvement.

Christian (15) tested one hundred eighty-nine college students using the Tennessee Self Concept Scale. After a program of calisthenics, weight training, vigorous sports and games, the experimental group had significant ($p < .05$) gains in physical fitness, but neither the experimental group nor the control group showed any significant change in self concept.

In 1969, McClenney (41) found that of the fifty college males tested, the high fit group was more group dependent, more trusting and free of jealousy. The low fit group was more self sufficient, more suspicious and self-opinionated.

Brunner (10) administered the Adjective Check List and a revised Willert questionnaire to sixty adult male Caucasians. The men were divided into two equal groups, participants and non-participants in vigorous physical activity. The participants exercised regularly, at least three times a week. The non-exercisers engaged in physical activity less than three times a week. Average age of the group was 37.74 years. The participants scored significantly ($p < .05$) higher on: Intraception, number of favorable adjectives checked, defensiveness, achievement, dominance and self-confidence. Non-participants scored significantly higher on succorance and counseling readiness. An examination of the personal descriptions relevant to these eight scales revealed more extroverted traits among the participants and more introverted traits among the non-participants when intergroup comparisons were made. Members of the participant group

stated that the primary reason or motivation for regular participation was the desire to keep physically fit and the associated feeling of physical and mental well-being. The non-participants stated that the primary reason for not participating regularly was the feeling of lack of time due to business reasons.

Baron (5) used the Discomfort Relief Quotient and Berger Scales to compare high and low fit men in a fitness program. The high fit group indicated a lower estimate of self tension and a higher attitude toward others than the low fit group.

In 1971, Brown (9) pre- and posttested seventy-nine college males using the following instruments: Tennessee Self Concept Scale, the Thurstone Scale for Measuring Attitudes toward Physical Fitness and Exercise, and the Triceps Skinfold Test. Following a ten week program of exercise and education on weight loss, Brown found a significant ($p < .05$) inverse relationship between obesity and self concept. As obesity decreased, self concept improved.

White (60) used strength, flexibility and cardiovascular tests to determine fitness levels and the Tennessee Self Concept Scale to measure self concept. The seventy-six member experimental group went through a ten week program of individual circuit weight training. The posttests revealed significant gains in all fitness measures for the experimental group. The exercisers also increased in the following areas: overall self esteem, identity,

self-satisfaction, behavior, physical self, personal self and social self. The control group did not show any improvement on any of the tests.

Collingwood and Willett (16) investigated the effects of physical training on self-attitude changes in obese teenagers who were enrolled in a special YMCA obese physical training program. The subjects were pre- and posttested using the following fitness measures: weight, waist size, resting pulse rate, lung capacity, Kraus-Weber series of overall fitness, balance tests, chalk jump, push-ups and sit-ups. The five male subjects (13-16 years) were also pre- and posttested using Osgoods' Sematic Differential Body Attitude Scale and Bills' Index of Adjustment and Values. The three week program consisted of ten hours per week, divided evenly among jogging, swimming and group counseling. The results of the paired t test indicated that the subjects demonstrated a significant weight decrease ($p < .005$), a nonsignificant waist decrease, a significant decrease in resting pulse ($p < .001$), and a nonsignificant increase in lung capacity. The subjects also improved significantly on the Kraus-Weber series ($p < .05$), balance tests ($p < .05$), chalk jump ($p < .05$), push-ups ($p < .01$) and sit-ups ($p < .01$). The subjects rated themselves significantly higher on the evaluative dimension (good-bad, awkward-graceful) and the potency dimension (weak-strong, hard-soft). Attitude scales also revealed a significant ($p < .05$) improvement in self concept and self acceptance. The results indicated that the

physical training provided a fairly concrete growth and success experience which gave the subjects positive feedback of themselves affecting their self-attitudes.

The following year Collingwood (17) conducted a similar study involving twenty-five matched pairs of male rehabilitation clients (18-26 years). The experimental group was pre- and posttested using the step test, sit-ups, push-ups and the Kraus-Weber series. All subjects were pre- and posttested using the Body Attitude Scale, Bills' Index of Adjustment and Values, rehabilitation counselor evaluations and vocational counselor evaluations. The control group received the standard rehabilitation facility services. The experimental group received the same services plus the physical training program. The four week program consisted of jogging, calisthenics and agility drills. Paired t tests revealed significant improvements in resting heart rate, push-ups, sit-ups and the Kraus-Weber series. One-way analysis of variance showed that the experimental group had significant increases in body attitude, positive self-attitude, self-acceptance and positive physical, intellectual and emotional-interpersonal behaviors.

Morgan (42) studied the interrelationships of depression, age, height, weight, percent body fat, strength of grip and physical working capacity among sixty-seven adult males, ages 26-55. Depression was measured by the Zung Self-Rating Depression Scale and the Minnesota Multiphasic Personality Inventory. Pearson product-moment correlations revealed no

significant relationships among the variables. However, a significant ($p < .01$) reduction in depression was observed in those subjects (N = 11) who were depressed initally following a six week exercise program.

Keith (36) recruited ninety-nine male subjects to complete the Motivational Analysis Test (MAT) and Willert's Physical Activity Questionnaire. The subjects (22-68 years) were volunteers from church congregations and from YMCA members. Scores from the physical activity questionnaires were used to divide the group into highly active (N = 33) and sedentary (N = 31). The sedentary group scored significantly higher on the erg fear (escape) and the sentiment superego (strength of development of conscious). The active group scored significantly higher on the mating erg (sex drive) and the erg narcism-comfort (sensual indulgence).

In 1974, Sharp (54) reported that aerobic fitness positively correlated with the more favorable scales on the Minnesota Multiphasic Personality Inventory and negatively correlated with the less favorable scales. Gain scores in aerobic fitness, as measured by Cooper's 12-minute run and the Astrand-Rhyming bicycle ergometer test, and the Minnesota Multiphasic Personality Inventory revealed that subjects who initially scored highest on the fitness test also gained the most phychologically but the least physically. Conversely, the subjects who scored the lowest on the aerobic test gained the least psychologically but the most physically.

In a study of aged men (60-79 years), Buccola and Stone (12) divided the group into joggers (N = 14) and cyclists (N = 20). The subjects were pre- and posttested using the Astrand bicycle ergometer test and the Cattell Sixteen Personality Factor Questionnaire. The exercise program was fourteen weeks long and consisted of three sessions per week of 25-50 minutes per session. Both groups increased maximal oxygen intake and decreased blood pressure ($p < .05$). The joggers increased flexibility ($p < .05$), while the cyclists decreased percent body fat ($p < .05$). The joggers became less surgent and more self-sufficient ($p < .05$). The cyclists did not change in any personality variables, but comparisons revealed that they were more surgent and tough-minded than the joggers.

Folkins (23) studied the effects of fitness on the mood of thirty-six (40-58 years) high risk coronary heart disease males from police and fire departments in Sacramento County, California. The pre- and posttests consisted of the following: blood pressure, blood lipids, cardiovascular function, Anxiety and Depression Scales from the Multiple Affect Adjective Checklist, The Secord and Jourard Body Cathexis Scale, and the Self Confidence and Personal Adjustment Scales of the Adjective Checklist. The experimental group participated in a twelve week exercise program. The exercise group demonstrated significant ($p < .05$) improvements in the following fitness areas: maximal oxygen intake, ventilation, work capacity, blood pressure, and hypertriglyceridemia.

The exercise group also showed significant decreases in anxiety ($p < .01$) and depression ($p < .05$). There was no change in adjustment, self confidence or body image.

Leonardson (38) studied one hundred sixty-five high school students and thirty-three college freshmen using the Piers-Harris Childrens Self Concept Scale and a perceived physical fitness self rating scale. Physical fitness and self concept were significantly ($p < .05$) but moderately correlated for both high schoolers ($r = .34$) and college freshmen ($r = .41$). The author purported that perceived physical fitness is an important aspect of the construct of self concept, and that perceived fitness and actual physical performance are related.

Male runners were compared to the general population using the Cattell Sixteen Personality Factor Questionnaire by Hartung and Farge (31). The subjects were more intelligent, imaginative, reserved, self-sufficient, sober, shy and forth right than the general population. The authors implied that it was not known for certain whether these factors were a result of, or a causal factor in, the subjects' habitual exercise pattern.

Neale, Sonstroem and Metz (43) divided one hundred sixty-five adolescent boys (ages 12-17) into high and low fitness groups based on their performance on the AAHPER Youth Fitness Test. Subjects were also given Rosenberg's ten item self esteem scale, the Physical Activity Attitude Inventory and a physical activity voluntary participation rating scale.

The high fit group was significantly higher in self-estimates of physical ability ($p < .001$) and self-reported attraction to physical activities ($p < 001$). There was no significant difference in general self-esteem nor in reported extent of participation in voluntary physical activities. In addition, significant correlations were observed between self-estimates of physical ability and attraction to physical activity ($r = .59$, $p < .01$), and between attraction to physical activity and extent of voluntary participation in physical activity ($r = .54$, $p < .001$).

Powell and Pohndorf (46) tested seventy-one adult males (34-75 years), who were volunteers in the University of Illinois Adult Fitness Program. The subjects were considered homogeneous in their level of education, as they were primarily professors at the university or professional men from the university community. The eight physiological measurements taken included: basal metabolic rate, serum cholesterol, total peripheral resistance, sitting systolic blood pressure, sitting diastolic blood pressure, postexercise (step test) blood pressures (systolic and diastolic) and the Scheider Index. They were also given the Culture Fair Intelligence Test as a measure of mental ability. Fluid intelligence referred to certain intelligent factors which decrease as age increases, whereas, other factors that improve with age were labeled crystallized intelligence. The subjects were divided into three groups: exercisers ($n = 26$), who had run three times a week for three years,

non-exercisers (N = 22), who had been sedentary for three years and semi-exercisers (N = 23), whose exercise patterns were not known. Partial correlation coefficients, with age held constant, revealed significant relationships between fluid intelligence and total peripheral resistance ($r = -.32$, $p < .01$), sitting diastolic blood pressure ($r = -.28$, $p < .02$) and the Schneider Index ($r = .25$, $p < .05$). Likewise, t tests indicated significant differences between exercisers and non-exercisers on the same three variables. Circulatory factors most characteristic of exercisers were also most related to fluid intelligence. Although subjects who exercised regularly had a higher average fluid intelligence score than subjects who did not exercise, no significant difference was found between the two groups.

In 1976 Young and Ismail (64) investigated personality differences among high-fit, young (N = 7); high-fit, old (N = 7); low-fit, young (N = 7); and low-fit, old (N = 7) groups before and after a four month physical fitness program consisting of jogging, calisthenics and recreational activities (ninety minutes per day, three days per week). The subjects were selected from ninety Purdue University faculty and staff and local businessmen, ages 21-61. Personality characteristics were assessed using the Cattell 16 PF Questionnaire, the Eysenck Personality Inventory and the anxiety scale of the Multiple Affect Adjective Check List. Physiological performance was based on the following data: submaximal exercise pulse, percent lean body weight, maximal

oxygen intake, submaximal minute volume ventilation, resting diastolic blood pressure and resting pulse pressure. The subject walked a motor driven treadmill at 3 mph, 2 degree increase in grade every two minutes, (8 degrees maximum) followed by 6 mph, 0 degrees, with 1 degree elevation every minute (10 degrees maximum). Submaximal and maximal gas samples were collected and analyzed for oxygen and carbon dioxide percents. ANOVA was used to determine the effects of the physical fitness program on the twenty personality variables between and within the fitness and age groups. The high-fit group was more unconventional, composed, secure, easygoing, emotionally stable, adventurous and higher on crystallized intelligence than the unfit group. The young group was more extraverted and outgoing than the old group. The high-fit, young group was more dominant and aggressive than the high-fit, old group. The low-fit, young group was higher in superego strength than the low-fit old group. Over the period of the exercise program, the high-fit group became more self-sufficient. All of the subjects were more socially precise, persistent and controlled at the end of the exercise program. The findings indicated that the most pronounced personality differences between high-fit and low-fit individuals were on factors dealing with emotional stability and security.

Later that same year Young and Ismail (65) again used fifty Purdue faculty men, ages 30-65, to test the effects of exercise on personality, physiological and biological

variables. The same treadmill protocol, exercise program and fitness determinants were used as in the previous study. The Eysenck Personality Inventory (extraversion and neuroticism scales) was used to assess personality. Blood samples were also analyzed for serum cholesterol and serum glucose. The group was divided into high-fit (N = 12) and low-fit (N = 12). Initially, the high-fit group was characterized by a higher percent lean; lower submaximal heart rates; lower systolic and diastolic blood pressures and a lower score on the neuroticism scale (indicating emotional stability). At the end of the program the same factors discriminated between high and low-fit groups with the exception of blood pressures.

In 1975, Young and Ismail (66) retested forty-eight Purdue University faculty/staff and local businessmen who participated in the 1971 Adult Fitness Program evaluation. Each subject completed an Exercise and Leisure Questionnaire designed to determine the degree of involvement in physical activity. From the results of this questionnaire, the subjects were divided into three groups of sixteen each. The groups were: (a) regularly active before and after 1971, (b) inactive before 1971, took the program and dropped out, and (c) inactive before 1971, took the program and continued to exercise regularly during the subsequent four years. In 1971, the pretest consisted of a bicycle ergometer test, measuring oxygen intake (submaximal and maximal). In 1975, posttests were conducted using the treadmill protocol

described in earlier research (64) (65). The Cattell 16 Personality Factor Questionnaire was utilized as a personality determinant. As expected, only the two active groups increased significantly on physical fitness status over the four-year period. None of the three groups altered significantly on the personality factors over the four-year period, but the longtime exercisers scored significantly lower at both test periods, indicating greater self-confidence and emotional stability.

Carter (13) determined the relationship of physical exercise to happiness by administering a questionnaire which elicited both an individual's exercise patterns and happiness levels. Fitness levels were quantified by reference to Cooper's (18) aerobic points chart. The two hundred sixteen subjects (18 years or older) were not randomly chosen, but recruited from the Washington D.C. area. It was found that the exercise scores had a positive coefficient of correlation to present happiness of .215 ($p < .05$) and a positive coefficient of correlation to global happiness of .266 ($p < .05$). When compared to Chi square values for the same variables, the author concluded that physical exercise alone may not make an individual happier, but if an individual is already pretty happy, exercise may result in that individual becoming very happy.

Brown (8) studied the psychological correlates of exercise in normal and depressed subjects. Depression was determined by the Zung Depression Scale, the Eysenck

Personality Inventory and Human Figure Drawings. The ten week exercise program consisted of a choice between several activities. Decreases in depression scores were noted for those who participated in wrestling, mixed exercises, jogging and tennis. Jogging for five days a week for a ten-week period was associated with significant ($p < .001$) reductions in the depression scores of both the depressed (N = 26) and nondepressed control group (N = 23).

Greist (28) investigated various treatments of depression for males (N = 13) and females (N = 15), ages 18-30. The Symptom Checklist-90 was used to determine degree of depression. The subjects were randomly assigned to either ten sessions of time-limited psychotherapy, which focuses on the immediate changes people can make to help themselves feel better; time-unlimited psychotherapy, which is usually insight-oriented, dynamic psychotherapy; or running treatment. Nine were assigned to time-limited psychotherapy, seven to time-unlimited psychotherapy and eight to running treatment. Six of the eight patients who ran were essentially well within three weeks and remained well for the duration of the active treatment. A seventh patient recovered during the sixteenth week after the study began. She had never been able to run and did not start her walking program until the sixth week of the study. The eighth patient ran conscientiously according to prescription and showed neither improvement nor deterioration in depression during the ten-week period of active treatment. The author concluded that the

results of running therapy compare favorably with those of psychotherapy.

In 1978 Leonardson and Garguilo (39) used Cooper's 12-minute run test and a forty-four item semantic differential scale to measure fitness and self concept in eleven male and twenty-two female college students. The subjects were placed on a ten week jogging program consisting of thirty minute sessions, twice a week. The authors discovered that actual physical performance did not significantly correlate to self concept. Perceived physical fitness did significantly ($p < .05$) correlate to self concept on pre- and post-test ($r = .53$ and $.57$, respectively).

Heaps (34) studied fifty-six male physical education majors using the following tests: Cooper's 12-minute run, Index of Adjustment and Values, Dominance Scale of the California Psychological Inventory, Taylor Manifest Anxiety Scale, the Hypochondriasis Scale of the Minnesota Multiphasic Personality Inventory, Secord and Jourard's Body Cathexis Scale and the Marlowe-Crowne Social Desirability Scale. The subjects' perceptions of fitness related positively to self acceptance and negatively to anxiety about bodily functioning. Actual fitness was only slightly related to fitness self estimates and were not related to other attitudes. The author purported that although there is definite psychological benefit following consistent exercise and physical change, this benefit results not from physical improvement, but from the emotional or psychological perception of physical and personal value of continued exertion.

In a recent study of 29-70 year old faculty men, Renfrow and Bolton (52) found that the twenty-three member exercise group was more reserved, expedient, forthright, liberal and self sufficient on the primary traits of the Cattell Sixteen Personality Factor Questionnaire than non-exercisers. The exercisers were also more alert, independent, less discreet, and evidenced lower superego strength than the non-exercisers on the broader secondary patterns.

Completed research was scarce concerning the relationship of mental and physical well being within professional groups. However, a few studies have been done concerning the importance of fitness in the police profession. A summary of those studies follows.

Pohndorf and Cathey (44) stated that cardiovascular fitness is the most difficult to attain and maintain, but it is the category of fitness that is most necessary (to law enforcement officers). The authors studied seventeen officer-trainees, ages 21-31. The subjects were pre- and posttested for cardiovascular fitness, strength, flexibility, balance, agility and body fat. The fourteen week program consisted of 1½ hours per week hand-to-hand combat and wrestling. There were no significant changes in any of the fitness measures. The authors suggested that future programs should emphasize cardiovascular training, and that physical fitness be considered a part of the requirement for promotion and hiring.

Gladis (27) reported that back pain and cardiovascular disease are among the top contributors to early retirement of police officers.

Craig (20, p.14) observed the physical standards of California Highway Patrol, and found that eight percent of those tested had coronary heart disease in varying stages, "indicative that a substantial number of officers might be subject to heart problems during periods of strenuous physical exertion". The author also pointed out a case study in which an officer was seriously injured.

> . . . The doctor at the hospital was amazed to find the injured officer's pulse rate and blood pressure were normal and that there was no evidence of shock. When this case was compared to two other similar accidents, it was noted that the officer's period of recuperation was only one-third as long; the doctor attributed the relatively speedy recovery to his physical condition (p. 14).

The injured officer participated in a regular physical fitness program.

Summary

Completed research was limited in the area of exercise versus mental/emotional states in normal populations. There were several studies concerning athletic participation and personality. However, it was not the intention of this investigation to measure the effects of competition on self concept.

From the literature it was concluded that physical fitness is often associated with a feeling of psychological

well-being. Fitness also appears to be associated with physical and psychological benefits regardless of the subject's age and/or sex.

Physical fitness training included a variety of exercise programs. However, recreational or voluntary programs (competition held to a minimum) appeared to yield more psychological gains.

Finally, the biological benefits of exercise may be associated in part with psychological changes. But, it cannot be stated that there is a cause-effect relationship between exercise and self concept.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to measure the effects of an exercise program on physical fitness and self concept. This chapter outlines the methodology and procedures used for assessing physical fitness and self concept.

Selection of Subjects

The entire male force of Commissioned Peace Officers at Oklahoma State University was used as subjects for this study. Twenty-four officers between the ages of twenty-two and sixty-two participated in the pre- and posttest. The average age was 34.58 years.

Personal Data

Upon arrival at the Physiology of Exercise Laboratory, each officer was asked to fill out a pre-evaluation form (see Appendix A), including the following information: Name, age, sex, address, phone number, physician, date of last medical, results of last medical, contraindications to exercise, smoking history, alcohol consumption history, family history, activity patterns and medication. Each subject was also required to sign an Informed Consent Form

(see Appendix A). All subjects over the age of thirty-five were asked to have their personal physician sign a Physicians Approval Form (see Appendix A).

The Self Concept Instrument

Each subject was asked to respond to the 100 self-descriptive phrases in the Tennessee Self Concept Scale, according to the instructions in the test booklet. Five responses were provided from which the subject selected one. Those responses included the following: completely false, mostly false, partly false-partly true, mostly true and completely true.

Fitts (24) reported that the norms for the TSCS were developed from a broad sample of 626 people from various parts of the country, representative of all social, economic, intellectual and educational levels from grade six through the Doctor of Philosophy degree. Age range of the sample was from 12 to 68 years. There were approximately equal number of both sexes and both black and white subjects.

Reliability coefficients of .80 to .90 for the various subscale scores were reported by Fitts (24). Willis (61) stated that highly significant differences have been found between psychiatric patients and non-patients ($p < .001$) on most dimensions of the TSCS, which were indicative of the validity.

Apparatus and Equipment

The essential pieces of equipment used in this study were the physiograph, Quinton motorized treadmill, bio-telemetry transmitter and receiver, sphygmomanometer, stethoscope, scales, Birtcher electrocardiograph with patient and exercise cables, oscilliscope, Lange skinfold calipers, tissot tank, vitalometer, flexibility box, anthropometric tape, Dekan Automatic Performance Analyzer, Harpenden hand dynamometer and various support apparatus.

Testing Procedure

The subjects reported to the Physiology of Exercise laboratory wearing activity clothes-tennis shoes, shorts and shirt. Personal data was collected and the Tennessee Self Concept Scale was administered. Height and weight were measured and recorded.

Strength

Each subject was asked to squeeze the Harpenden hand dynamometer as hard as he could. Two maximal trials were taken with each hand and the highest score recorded on the appropriate form (see Appendix A).

Reaction Times

Simple reaction time (SRT) was measured on the Dekan Automatic Performance Analyzer by having the subject respond as quickly as possible to an auditory stimulus (buzzer).

The subject held the response button under the index finger of his dominant hand. The researcher gave the command, "Ready", as he pressed the "Delay Start" button. Following a 1-3 second delay, the buzzer sounded, at which time the subject responded by pressing the button. Ten trials were recorded to the nearest 1/100th of a second. The last five were averaged for the SRT score.

Vertical Jump reaction time (VJRT) was also determined as a response to an auditory stimulus. Each subject stood on the electrically wired floor mat, which was plugged into the "Stop on Break" receptacle. The same procedure was used as in SRT. At the sound of the buzzer, the subject broke contact with the mat by jumping straight up. Ten trials were recorded to the nearest 1/100th of a second. The last five were averaged for the VJRT score.

Respiratory

Vital capacity was measured on the Collins vitalometer. Each subject was asked to inhale as much as possible and exhale totally into the vitalometer. Two trials were attempted and the best effort was recorded. The results were corrected for body temperature, pressure, saturated (1.085x) and compared to medical norms. Vital capacity was reported as a percent of norm.

In order to determine maximal breathing capacity, each subject breathed as rapidly and deeply as possible (hyper-ventilated) into a Collins 100 liter tissot tank for 15

seconds. Two trials were given and the best score reported. Results were read from the kymograph in millimeters. That score was changed to milliliters by multiplying by the tank constant factor of .1332. The corrected score was multiplied by 4 (per minute) and corrected for BTPS. MBC in liters per minute was compared to medical norms and reported as a percent norm.

All respiratory function tests were accomplished with the subject using a nose clip to prevent air transference through the nostrils.

Flexibility

Each subject sat on the floor, knees straight and locked and feet flush against the flexibility box. After sufficient static warm up, the subject was instructed to bend at the hips and reach as far as possible with both hands holding for one second. Where the subject touched the recording stick was measured as flexibility.

Body Fat

Skinfold measurements were taken on the right side of each subject using the Lange skinfold calipers. Tricep, bicep, iliac, abdominal, chest and back (subscapular) measurements were used to determine percent body fat. Tricep, chest and abdominal measurements were used in the nomogram by Best (7). Tricep, bicep, iliac and back readings were used in the age adjusted sum of fours chart by Durnin and Womersley (22). See Appendix A for those two forms.

Body circumference measurements were taken using the metal tape measure at the following places: shoulders, chest, waist, buttocks, wrists, forearms, upper arms, thighs, knees, calves and ankles. Using the Benhke (6) eleven measure formula, (see Appendix A) a suggested weight was determined.

The percent body fat measures and the body circumference data were analyzed and evaluated, and a suggested ideal weight was determined. The difference between actual weight and ideal weight was recorded as weight residual.

Cardiovascular

Each subject was instructed to remove his shirt and assume the supine position on the patient table. The EKG patient cable was prepared with EKG paste and affixed to the patient with the rubber straps. A 12-lead electrocardiogram was recorded.

Once the 12-lead EKG had been recorded, telemetry and EKG disc electrodes were prepared with EKG paste and placed on the subject using double adhesive disc washers. The telemetry electrodes were placed below the left nipple and on the sternum (first intercostal space). The EKG electrodes were placed in the following positions: right shoulder, left shoulder, right and left side of rib cage (seventh or eighth intercostal space) and in the V-5 position. The exercise blood pressure cuff was also placed on the subject's upper arm. The biotelemetry receiver was tuned to the proper

frequency. A connector cable was attached to the receiver and to channel one of the physiograph. Lying heart rate and blood pressure were then recorded.

The subject was instructed to stand. Standing blood pressure, heart rate and pre-exercise EKG were recorded.

The oscilliscope was attached to the EKG machine by use of a connecting cable. This allowed continuous monitoring of the EKG during the treadmill walk.

The treadmill was started at 0% grade and 3.4 MPH. The subject was instructed on mounting the treadmill. Once on the treadmill the subject walked at 0% grade for two minutes, at which time the treadmill was elevated to 2% and an additional 1% each minute thereafter. A constant speed of 3.4 MPH was maintained. This procedure is known as the Balke (3) protocol. Harrison (30) reported that the Balke protocol is probably the most widely accepted test of functional work capacity, and it is highly valid in predicting maximal oxygen consumption.

Heart rate was recorded at the end of each minute. Blood pressure and EKG were recorded every 3-5 minutes throughout the test. Each subject walked to voluntary maximum or until other symptoms indicated stopping the test. During the last minute of the walk, heart rate and blood pressure were recorded.

At the end of the stress test, the subject walked at 3.4 MPH and 0% grade for a 2 minute cool down period. The subject was then instructed to assume the sitting position.

Certain criteria were utilized during the graded exercise portion of the fitness evaluation. A subject was not allowed to walk the treadmill if standing diastolic blood pressure exceeded 110 mmHg. The treadmill test was halted if any one of the following incidents occurred: voluntary maximum, diastolic blood pressure in excess of 110 mmHg, sudden drop in systolic blood pressure, abnormal gate, stumbling or a change in skin palor.

From the percent grade and heart rate attained during the stress test, a predicted maximal oxygen intake ($\dot{V}O_2$ Max) was determined from Balke's (3) regression chart. This information was used to place the subject into one of Cooper's (19) age adjusted fitness categories.

The results of the entire fitness evaluation were recorded on the Computer Summary Sheet and the Client Summary Graph (see Appendix A).

Exercise Prescription

From the results of the fitness evaluation, an aerobic exercise program was prescribed. This prescription was individualized for each subject and presented to him on the Client Prescription Sheets (see Appendix A). The basic prescription consisted of a 5-10 minute warmup period (strength, flexibility and respiratory exercises), 15-30 minutes of exercise in the target heart rate zone and a 5-10 minute cool down period.

A combination of the prescription techniques recommended by the American College of Sports Medicine (1) and Zohman (67) were utilized. Target Heart rate was determined from the METS, and heart rate obtained from the graded exercise test. Proper exercise intensity was insured by target heart rate maintenance. Frequency of exercise was determined from the body fat measurements. If an officer was more than 15 pounds overweight, he was asked to exercise five times per week. Everyone else was requested to exercise at least three times per week.

Aerobic type activities were the only activities the subjects could count as exercise. Those activities included ones that involved large muscle groups in rythmic, moderate contraction over a fairly long period of time; such as running, jogging, swimming, bicycling, rope jumping, stair climbing and walking.

Each officer was personally counseled concerning the results of his fitness evaluation and given an exercise prescription. The results of the Tennessee Self Concept Scale were not discussed.

The exercise prescription was carried out over a 16 week period. During that period the subjects were asked to keep a record (see Appendix A) of their aerobic activity. A subject who accomplished two-thirds or more of this prescribed program was classified as a participant. Those who accomplished less than two-thirds were non-participants.

Statistical Treatment

The following pre- and posttest data was recorded on computer cards: total p, self criticism, identity, self satisfaction, behavior, physical self, moral-ethical self, personal self, family self, social self, total variability, distribution, participation/non-participation, maximal oxygen intake, flexibility, strong hand grip strength, percent body fat-nomogram, percent body fat-sum of fours, weight residual, vital capacity percent norm, maximal breathing capacity percent norm, lying blood pressure, lying heart rate, fitness category, simple reaction time, vertical jump reaction time, EKG abnormality and maximum double product (heart rate times systolic blood pressure recorded during the last minute of the GXT). Raw score differences and percent of change were determined on all data for each subject.

A paired t test was utilized to determine differences, if any at the .05 and .01 levels of significance between pre- and posttest data. The t's were calculated for the entire group, the participant group and the non-participant group.

A correlation coefficient matrix was constructed, analyzing the relationships of all the variables at the .05 and .01 levels of significance. The correlation matrix was calculated for the entire group, the participant group and the non-participant group.

All computations were done at the Oklahoma State University Computer Science Center, using the Statistical Analysis System (SAS).

CHAPTER IV

RESULTS AND DISCUSSION

Twenty-four male commissioned peace officers participated in the pre- and posttest fitness evaluation and self concept test. A total of twenty-seven variables were measured and recorded from both the pre- and posttest. Twelve variables were obtained from the Tennessee Self Concept Scale and fifteen from the fitness evaluation.

From the results of the fitness evaluation, an individually prescribed exercise program was given to each officer. If an officer accomplished two-thirds or more of his program, he was classified as a participant. If he accomplished less than two-thirds, he was classed a non-participant. Eleven subjects participated in the exercise program, and thirteen officers were classified as non-participants.

Two non-participants were not allowed to take the treadmill posttest due to excessively high, standing diastolic blood pressure. Therefore, $\dot{V}O_2$ Max, fitness category, and double product scores did not appear on the posttest for those two officers. One subject was not allowed to take the posttest vertical jump reaction time test due to a recent back surgery.

Paired t tests and correlation coefficients were calculated on all variables. The .05 and .01 were chosen as levels of significance. Calculations were done on the entire group, the participant group and the non-participant group. A summary of the pre- and posttest raw data appears in Appendix B.

Means and standard deviations for the entire group's pre- and posttest are displayed in Tables I and II. The test group was separated into participants and non-participants. Pre- and posttest means and standard deviations for the two groups are presented in Tables III-VI.

Pre- and posttest mean self concept scores for participants and non-participants fell between T scores of 40-60, or $\pm$ one standard deviation. The exception was total variability, which was slightly below a T score of 30.

On the pretest the officers scored below average on all physical fitness measures, except simple reaction time and vertical jump reaction time, which were above average. Although improvement was demonstrated in certain areas, posttest mean scores were generally average or below.

Significant Differences

Analysis of the t tests for the entire group differences and percentage changes revealed no significant changes on any of the self concept scores (**see Tables VII and** VIII).

TABLE I

ENTIRE GROUP PRETEST

Variable	N	Mean	Standard Deviation
Total P	24	355.54	19.98
Self Criticism	24	33.38	4.98
Identity	24	131.13	8.19
Self Satisfaction	24	107.79	8.77
Behavior	24	117.04	7.23
Physical Self	24	68.96	5.57
Moral Ethical	24	72.25	4.87
Personal Self	24	70.83	5.05
Family Self	24	73.17	5.95
Social Self	24	70.21	7.33
Total Variation	24	24.63	5.62
Distribution	24	117.38	17.22
Max Oxygen Intake	24	34.00	6.47
Flexibility	24	10.13	4.20
Grip Strength	24	113.46	17.35
% Body Fat (Nomogram)	24	21.67	5.12
% Body Fat (Sum 4's)	24	24.17	4.96
Weight Residual	24	13.58	0.98
Vital Capacity	24	114.96	15.04
Max Breathing Capacity	24	106.79	17.15
Systolic BP	24	133.75	15.41
Diastolic BP	24	82.50	12.07
Heart Rate	24	77.08	11.25
Fitness Category	24	2.16	0.92
SRT	24	16.92	2.64
VJRT	24	29.04	4.46
Double Product	24	3326.75	372.58

TABLE II

ENTIRE GROUP POSTTEST

Variable	N	Mean	Standard Deviation
Total P	24	352.21	21.62
Self Criticism	24	33.42	5.05
Identity	24	129.67	8.99
Self Satisfaction	24	107.29	9.97
Behavior	24	115.25	8.85
Physical Self	24	68.75	6.68
Moral Ethical	24	72.21	5.63
Personal Self	24	69.54	5.67
Family Self	24	7.92	7.28
Social Self	24	68.63	6.47
Total Variation	24	22.88	4.34
Distribution	24	111.25	21.62
Max Oxygen Intake	22	36.91	6.82
Flexibility	24	8.67	3.37
Grip Strength	24	117.37	18.77
% Body Fat (Nomogram)	24	19.38	3.97
% Body Fat (Sum 4's)	24	23.25	6.53
Weight Residual	24	16.17	0.95
Vital Capacity	24	111.46	11.13
Max Breathing Capacity	24	112.71	17.11
Systolic BP	24	140.75	18.32
Diastolic BP	24	87.92	11.45
Heart Rate	24	72.00	11.74
Fitness Category	22	2.86	1.03
SRT	24	16.75	1.62
VJRT	23	28.78	4.44
Double Product	22	3377.45	445.44

TABLE III

PARTICIPANT GROUP PRETEST

Variable	N	Mean	Standard Deviation
Total P	11	353.73	12.38
Self Criticism	11	32.27	5.35
Identity	11	132.82	4.21
Self Satisfaction	11	105.64	8.32
Behavior	11	115.27	4.92
Physical Self	11	70.18	4.64
Moral Ethical	11	70.45	4.34
Personal Self	11	71.18	2.60
Family Self	11	71.27	5.18
Social Self	11	70.36	3.38
Total Variation	11	24.09	2.84
Distribution	11	112.82	13.03
Max Oxygen Intake	11	37.09	4.93
Flexibility	11	10.00	4.97
Grip Strength	11	114.18	20.97
% Body Fat (Nomogram)	11	21.55	5.10
% Body Fat (Sum 4's)	11	24.00	4.77
Weight Residual	11	13.54	0.89
Vital Capacity	11	115.55	12.99
Max Breathing Capacity	11	110.64	16.40
Systolic BP	11	130.91	14.97
Diastolic BP	11	82.73	7.19
Heart Rate	11	73.09	12.53
Fitness Category	11	2.45	0.93
SRT	11	16.54	2.21
VJRT	11	28.54	5.32
Double Product	11	3417.00	394.53

TABLE IV

PARTICIPANT GROUP POSTTEST

Variable	N	Mean	Standard Deviation
Total P	11	346.09	19.12
Self Criticism	11	33.00	3.58
Identity	11	129.18	10.15
Self Satisfaction	11	103.18	8.94
Behavior	11	113.73	8.73
Physical Self	11	68.81	5.28
Moral Ethical	11	69.55	4.01
Personal Self	11	68.91	5.17
Family Self	11	67.55	6.02
Social Self	11	68.73	4.56
Total Variation	11	23.36	3.47
Distribution	11	103.00	17.39
Max Oxygen Intake	11	41.27	3.79
Flexibility	11	8.00	4.07
Grip Strength	11	121.73	22.62
% Body Fat (Nomogram)	11	10.09	3.27
% Body Fat (Sum 4's)	11	21.73	4.15
Weight Residual	11	10.36	0.65
Vital Capacity	11	113.00	5.27
Max Breathing Capacity	11	116.55	14.89
Systolic BP	11	138.64	10.94
Diastolic BP	11	87.45	4.72
Heart Rate	11	68.73	14.29
Fitness Category	11	3.55	0.82
SRT	11	16.27	1.55
VJRT	11	27.82	4.47
Double Product	11	3528.82	375.94

TABLE V

NON-PARTICIPANT GROUP PRETEST

Variable	N	Mean	Standard Deviation
Total P	13	357.08	25.13
Self Criticism	13	34.31	4.64
Identity	13	129.69	10.43
Self Satisfaction	13	109.62	9.04
Behavior	13	118.54	8.63
Physical Self	13	67.92	6.24
Moral Ethical	13	73.77	4.92
Personal Self	13	70.54	6.56
Family Self	13	74.77	6.27
Social Self	13	70.07	9.66
Total Variation	13	25.07	7.30
Distribution	13	121.23	19.81
Max Oxygen Intake	13	31.38	6.61
Flexibility	13	10.23	3.63
Grip Strength	13	112.84	14.50
% Body Fat (Nomogram)	13	21.77	5.34
% Body Fat (Sum 4's)	13	24.31	5.29
Weight Residual	13	13.62	1.08
Vital Capacity	13	114.46	17.10
Max Breathing Capacity	13	103.54	17.73
Systolic BP	13	136.15	15.96
Diastolic BP	13	82.31	15.36
Heart Rate	13	80.46	9.21
Fitness Category	13	1.92	0.86
SRT	13	17.23	3.00
VJRT	13	29.46	3.75
Double Product	13	3250.38	350.00

TABLE VI

NON-PARTICIPANT GROUP POSTTEST

Variable	N	Mean	Standard Deviation
Total P	13	357.38	22.98
Self Criticism	13	33.77	6.16
Identity	13	130.07	8.30
Self Satisfaction	13	110.77	9.77
Behavior	13	116.53	8.58
Physical Self	13	68.69	7.89
Moral Ethical	13	74.46	5.95
Personal Self	13	70.07	6.22
Family Self	13	75.62	6.24
Social Self	13	68.54	7.92
Total Variation	13	22.46	5.06
Distribution	13	118.23	22.99
Max Oxygen Intake	11	32.55	6.44
Flexibility	13	9.23	2.68
Grip Strength	13	113.69	14.74
% Body Fat (Nomogram)	13	19.62	4.59
% Body Fat (Sum 4's)	13	24.54	7.96
Weight Residual	13	14.15	1.15
Vital Capacity	13	110.15	14.50
Max Breathing Capacity	13	109.46	18.74
Systolic BP	13	142.54	23.15
Diastolic BP	13	88.31	15.25
Heart Rate	13	74.77	8.70
Fitness Category	11	2.18	0.75
SRT	13	17.15	1.63
VJRT	12	29.67	4.42
Double Product	11	3226.09	474.27

TABLE VII

t TESTS FOR ENTIRE GROUP DIFFERENCES

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	24	-3.33	17.88	-0.91	0.37
Self Criticism	24	0.04	4.48	0.05	0.96
Identity	24	-1.46	8.29	-0.86	0.39
Self Satisfaction	24	-0.50	7.58	-0.32	0.75
Behavior	24	-1.79	7.65	-1.15	0.26
Physical Self	24	-0.20	5.65	-0.18	0.86
Moral Ethical	24	-0.04	4.39	-0.05	0.96
Personal Self	24	-1.29	4.89	-1.29	0.21
Family Self	24	-1.25	5.38	-1.14	0.27
Social Self	24	-1.58	5.49	-1.41	0.17
Variation	24	-1.75	5.98	-1.43	0.16
Distribution	24	-6.13	17.62	-1.70	0.10
Max Oxygen Intake	22	2.04	3.27	2.93	0.008**
Flexibility	24	-1.45	2.53	-2.82	0.009**
Grip Strength	24	3.91	9.53	2.01	0.06
% Body Fat (Nomogram)	24	-2.29	3.63	-3.09	0.005**
% Body Fat (Sum 4's)	24	-0.91	4.02	-1.12	0.27
Weight Residual	24	-1.16	0.53	-1.35	0.27
Vital Capacity	24	-3.50	8.37	-2.05	0.06
Max Breathing Capacity	24	5.91	12.11	2.39	0.02*
Systolic BP	24	7.00	16.99	2.02	0.06
Diastolic	24	5.41	11.03	2.41	0.103*
Rest Heart Rate	24	-5.08	8.74	-2.85	0.009**
Fitness Category	22	0.63	0.72	4.11	0.0005***
SRT	24	-0.16	2.33	-0.35	0.73
VJRT	23	0.04	4.61	0.05	0.96
Double Product	22	48.81	251.37	0.91	0.37

* significant at .05 level
** significant at .01 level
*** significant at .001 level

TABLE VIII

t TESTS FOR ENTIRE GROUP PERCENTAGE CHANGES

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	24	-0.01	0.05	-0.82	0.42
Self Criticism	24	0.01	0.15	0.35	0.73
Identity	24	-0.01	0.06	-0.71	0.49
Self Satisfaction	24	-0.01	0.01	-0.22	0.83
Behavior	24	-0.01	0.06	-1.08	0.29
Physical Self	24	-0.01	0.07	-0.08	0.93
Moral Ethical	24	0.00	0.06	0.05	0.96
Personal Self	24	-0.02	0.06	-1.20	0.24
Family Self	24	-0.02	0.07	-1.04	0.31
Social Self	24	-0.02	0.07	-1.14	0.26
Variation	24	-0.05	0.18	-1.30	0.21
Distribution	24	-0.05	0.15	-1.61	0.12
Max Oxygen Intake	22	0.05	0.10	2.69	0.013*
Flexibility	24	-0.13	0.22	-2.93	0.007**
Grip Strength	24	0.03	0.08	2.15	0.04*
% Body Fat (Nomogram)	24	-0.09	0.13	-3.30	0.003**
% Body Fat (Sum 4's)	24	-0.04	0.15	-1.33	0.19
Weight Residual	16	-0.15	0.47	-1.32	0.20
Vital Capacity	24	-0.02	0.07	-1.58	0.13
Max Breathing Capacity	24	0.06	0.12	2.49	0.02*
Systolic BP	24	0.05	0.13	2.20	0.03*
Diastolic BP	24	0.07	0.14	2.66	0.014*
Rest Heart Rate	24	-0.06	0.10	-2.75	0.011*
Fitness Category	22	0.41	0.60	3.19	0.004**
Double Product	22	0.01	0.07	0.93	0.36

* significant at .05 level
** significant at .01 level

The mean pretest score for $\dot{V}O_2$ Max was 34 milliliters per kilogram-minute, with a standard deviation of 6.82. This yielded a mean difference of 2.04 (5 percent) or t of 2.93 (2.69 on percent change). The mean posttest score was 36.91 ml/kgXmin., with a standard deviation of 6.82.

The flexibility measures also revealed a significant improvement ($p < .01$). The mean pre- and posttest scores were 10.12 and 8.66 respectively, indicating a -1.45 mean difference and a -.13 percent improvement. The t values were -2.82 (difference) and -2.93 (percent), both significant at the .01 level. It should be noted that an improvement in flexibility is indicated by a decrease in the score. The lower a person can reach, the more supple the hip-trunk region.

Grip strength improvement averaged 3 percent, which produced a t of 2.15. This was significant at the .05 level. The raw difference score did not show a significant change. The mean pre- and posttest grip strength scores were 113.45 pounds and 117.37 pounds with standard deviations of 17.35 and 18.77, respectively.

Percent body fat was reduced from a mean of 21.66% to 19.37%, with standard deviations of 5.12 and 3.96, respectively. This indicated a mean difference of -2.29 or a 9 percent change. The t values were -3.09 (difference) and -3.30 (percent); significant at the .01 level.

The pre- and posttest means for maximal breathing capacity were 106.79 liters/minute and 112.70 liters/minute

with standard deviations of 17.14 and 17.10, respectively. This indicated a mean difference of 5.91 or a 6 percent difference. The t values of 2.39 and 2.49 were significant at the .05 level.

Systolic blood pressure showed an average rise of 5 percent, from a pretest mean of 133.75 mmHg to a posttest mean of 140.75 mmHg, with standard deviations of 15.41 and 18.32, respectively. The computed t score of 2.20 was significant at the .05 level. There was no significant change in the raw data difference scores.

Diastolic blood pressure also rose from a mean of 82.50 mmHg (s.d. = 12.09) to 87.91 mmHg (s.d. = 11.45). This indicated a mean difference of 5.41 or a 7 percent change. Respective t values were 2.41 and 2.66, both significant at the .05 level.

Mean values for resting heart rate were 77.08 beats per minute (pretest) and 72.00 beats per minute (posttest), with standard deviations of 11.25 and 11.73, respectively. The mean difference was -5.08, representing a 6 percent change. The respective t values of -2.85 and -2.75 were significant at the .01 and .05 levels.

Fitness category improved from an average of 2.16 (standard deviation = .92) on the pretest to a mean of 2.86 (standard deviation = 1.03) on the posttest. Mean difference was .63 and the t was 4.11; significant at the .001 level. The mean percent change was .41, and the t value of 3.19 was significant at the .01 level.

Significant improvements were shown in several areas of physical fitness for the entire group. Decrements in two areas, indicated by a rise in systolic and diastolic blood pressures were also noted. Changes in participant and non-participant groups affected the overall means, differently; therefore, entire group means and differences were difficult to analyze and evaluate. More understanding of the effects of the exercise program was gained by analysis of the participants and non-participants, separately.

Participants

The participant group showed a general decrease in all self concept subscores, except self criticism (see Tables IX and X). Family self scores went from a pretest mean of 71.27 (standard deviation = 5.17) to a posttest average of 67.55 (standard deviation = 6.02). This revealed a mean difference of -3.72 ($t = -3.43$) or a 5 percent decrease ($t = -3.35$). These were significant at the .01 levels. It appeared that persons who chose to engage in an exercise program had to make time to do so. This extra time apparently came from leisure time normally spent with the family, rather than work time. This reduced time with the family apparently lowered the concept of how one views himself as a family member.

There was also a significant decrease in the distribution scores. The pretest average was 112.81 (standard deviation = 13.02) and the posttest mean was 103.00

TABLE IX

t TESTS FOR PARTICIPANT GROUP DIFFERENCES

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	11	-7.63	18.52	-1.37	0.20
Self Criticism	11	0.72	5.40	0.45	0.66
Identity	11	-3.63	7.73	-1.56	0.15
Self Satisfaction	11	-2.45	7.54	-1.08	0.31
Behavior	11	-1.55	9.47	-0.54	0.60
Physical Self	11	-1.36	6.85	-0.66	0.52
Moral Ethical	11	-0.91	5.48	-0.55	0.59
Personal Self	11	-2.27	5.81	-1.30	0.22
Family Self	11	-3.72	3.60	03.43	0.006**
Social Self	11	-1.64	3.61	-1.50	0.16
Variation	11	-0.72	4.38	-0.55	0.59
Distribution	11	-9.81	13.44	-2.42	0.04*
Max Oxygen Intake	11	4.18	1.88	7.35	0.0001****
Flexibility	11	-2.00	1.73	-3.83	0.003**
Grip Strength	11	7.55	10.01	2.50	0.03*
% Body Fat (Nomogram)	11	-2.45	4.39	-1.85	0.09
% Body Fat (Sum 4's)	11	-2.77	2.10	-3.59	0.005**
Weight Residual	11	-3.18	0.65	-1.07	0.19
Vital Capacity	11	-2.54	9.74	-0.87	0.40
Max Breathing Capacity	11	5.90	6.31	3.10	0.011*
Systolic BP	11	7.72	19.32	1.33	0.21
Diastolic BP	11	4.72	9.20	1.70	0.11
Rest Heart Rate	11	-4.36	6.62	-2.19	0.053
Fitness Category	11	1.09	.30	12.00	0.001****
SRT	11	-0.27	2.00	-0.45	0.66
VJRT	11	-0.72	5.56	-0.43	0.67
Double Product	11	111.81	171.18	2.17	0.055

* significant at .05 level
** significant at .01 level
*** significant at .001 level
**** significant at .0001 level

TABLE X

t TESTS FOR PARTICIPANT GROUP PERCENTAGE CHANGES

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	11	-0.02	0.05	-1.34	0.21
Self Criticism	11	0.04	0.17	0.80	0.44
Identity	11	-0.03	0.06	-1.56	0.14
Self Satisfaction	11	-0.02	0.07	-1.04	0.32
Behavior	11	-0.01	0.08	-0.50	0.62
Physical Self	11	-0.02	0.09	-0.55	0.59
Moral Self	11	-0.00	0.08	-0.40	0.70
Personal Self	11	-0.03	0.08	-1.26	0.24
Family Self	11	-0.05	0.05	-3.35	0.007**
Social Self	11	-0.02	0.05	-1.47	0.17
Variation	11	-0.02	0.19	-0.31	0.76
Distribution	11	-0.08	0.12	-2.31	0.04*
Max Oxygen Intake	11	0.11	0.06	5.75	0.0002***
Flexibility	11	-0.23	0.17	-4.39	0.0014**
Grip Strength	11	0.07	0.09	2.49	0.03*
% Body Fat (Nomogram)	11	-0.09	0.15	-1.97	0.07
% Body Fat (Sum 4's)	11	-0.09	0.07	-3.92	0.002**
Weight Residual	11	-0.35	0.37	-1.07	0.19
Vital Capacity	11	-0.01	0.09	-0.48	0.64
Max Breathing Capacity	11	0.05	0.06	3.14	0.015*
Systolic BP	11	0.07	0.14	1.61	0.14
Diastolic BP	11	0.06	0.11	1.90	0.09
Rest Heart Rate	11	-0.06	0.08	-2.34	0.041*
Fitness Category	11	0.58	0.51	3.78	0.003**
Double Product	11	0.03	0.05	2.24	0.04*

* significant at .05 level
** significant at .01 level
*** significant at .001 level

(standard deviation = 17.39). Paired t calculations indicated a mean difference of -9.81 (t = 2.42) and a percent difference of eight (t = 2.31). These were significant at the .05 level. The reduced distribution scores indicated a decrease in the certainty with which an individual responded to the description items on the self concept scale. This would seem to follow the general decrease in self concept on all subscales and the significant decrease in the concept of family self. It would be very difficult to infer that participation in an exercise program would cause a person to become less certain of himself, especially in light of the other subscores.

The most significant change that occured was the improvement in $\dot{V}O_2$ Max scores for the exercise participants. Pretest means were 37.09 ml/kgXmin and posttest averages were 41.27 ml/kgXmin. This revealed a mean difference of 4.18. The paired t value of 7.35 was significant at the .0001 level. The 11 percent difference (t = 5.75) was significant at the .001 level. It is generally accepted that a sound aerobic exercise program of proper duration, frequency, and intensity will produce significant improvements in maximal oxygen intake. It was the author's opinion that the extremely significant improvement in this group was probably due to the fact that they started in relatively poor condition, as indicated by the mean participant fitness category of 2.45, which is border line between poor and fair. Therefore, it would appear that they

had more room for improvement than persons who started in average condition.

A decrease in flexibility scores from a pretest mean of 10 to a posttest average of 8 indicated a significant improvement ($t = 3.83$; $p < .01$) in hip-trunk flexibility. This 23 percent increase produced a t of -4.39, which was also significant at the .01 level. Flexibility exercises were particularly stressed during the counseling sessions, because many of the officers complained of low back problems associated with riding in patrol cars for much of their working day.

The pretest grip strength mean was 114.18 pounds, with a standard deviation of 20.96. The posttest average was 121.73 pounds, with a standard deviation of 22.62. This represented a mean difference of 7.55 or 7 percent. The respective t values of 2.5 and 2.49 were significant at the .05 level. Improvements in strength have generally been noted with strength-type exercises, such as ball squeezing and/or weight training. Although weight training was not an accepted aerobic exercise, six of the exercise participant group reported supplementing their aerobic workouts with weight training. All of the participant group used some form of strength training as part of their warm-up routine.

The participant group showed a general improvement in all body composition tests. The percent body fat, as determined by the sum of fours technique, improved from a pretest

mean of 24 percent to a posttest average of 21 percent. This change produced a mean difference of -2.77 or a 9 percent decrease. These represented t values of -3.59 and -3.92 respectively; both significant at the .01 level. This implied that participation in an aerobic conditioning program may reduce percent body fat.

Maximal breathing capacity was measured in liters per minute, compared to norms and reported as a percent of norm. The pretest mean was 110.64 percent with a standard deviation of 16.40. The posttest average was 116.54 percent with a standard deviation of 14.88. These measurements represented an average change of 5.90 or 5 percent. The t values of 3.10 (difference) and 3.14 (percent) were significant at the .05 level. Maximal breathing capacity is the ability to process air while under a maximal work condition. It stands to reason that an increase in physical work capacity, as measured by maximal oxygen intake, would be paralleled by an improvement in the lung's maximum ventilation volume.

There was a decrease in resting heart rate from a pretest mean of 73.09 beats per minute to a posttest average of 68.73 beats per minute for the participant group. This represented a 6 percent improvement in resting heart rate. The t of -2.34 was significant at the .05 level. There was no significant difference in the raw data means for resting heart rate. It was the opinion of the author that exercise produced an improvement in the heart's capability to do work, which allowed the heart to slow somewhat during rest.

Fitness category improved from a pretest mean of 2.45 (poor to fair) to a posttest average of 3.55 (fair to good). The mean difference of 1.09 produced a t of 12.00, which was significant at the .0001 level. This represented a 58 percent improvement, with a t of 3.78 ($p < .01$). Since fitness category is determined by maximal oxygen intake and age, one would expect similar changes as $\dot{V}O_2$ Max. Again, the fact that the subjects' started at a relatively low degree of fitness allowed greater room for improvement.

Double product increased from a pretest mean of 3417.00 to a posttest mean of 3528.82. This 3 percent increase was significant at the .05 level ($t = 2.24$). Double product was found by multiplying systolic blood pressure by heart rate during the last minute of exercise. Double product is generally recognized as a measure of the myocardial work output. Since physical work capacity was increased by the exercise program, myocardial work output (double product) also increased. It is not known if this increase in double product represents an improvement in the efficiency of the cardiovascular system. A better technique may have been to measure double product at a given work load. At a given work load, an inverse relationship would exist between cardiovascular efficiency and double product.

Non-Participants

There were no significant changes in any of the self concept subscores for the non-participant group. Slight

improvements occurred in the physiological areas of grip strength, flexibility, maximal breathing capacity, resting heart rate and simple reaction time. Deteriorations were observed in maximal oxygen intake, vital capacity, blood pressure and vertical jump reaction time. (see Tables XI and XII)

There was a significant decrease ($p < .05$) in percent body fat measured from the nomogram. The pretest average was 21.77 percent with a standard deviation of 5.34. The posttest mean was 19.62 percent, with a standard deviation of 4.59. The mean difference of -2.15 (8 percent) produced a t value of -2.57 (-2.68). These statistics seemed confusing in light of the fact that percent body fat measured by the sum of fours increased from 24.31 percent to 24.54 percent. The nomogram formula utilized the skinfold measurements from the tricep, chest and abdomen. The sum of four formula used the bicep, tricep, iliac and back. There was an average decrease of 8.15 millimeters in the abdominal skinfold measurements for the non-participant group. This difference could have accounted for the 2.15 percent decrease in body fat measurements. Due to the prevalence of low back pain, many of the non-participants did sit-ups and flexibility exercises, even though they did not participate in aerobic exercises. This could have accounted for the decrease in abdominal skinfold measurements.

TABLE XI

t TESTS FOR NON-PARTICIPANT GROUP DIFFERENCES

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	13	0.30	17.21	0.06	0.95
Self Criticism	13	-0.53	3.64	-0.53	0.60
Identity	13	0.38	8.59	9.16	0.87
Self Satisfaction	13	1.15	7.49	0.56	0.59
Behavior	13	-2.00	6.11	-1.18	0.26
Physical Self	13	0.76	4.45	0.62	0.54
Moral Ethical	13	0.69	3.27	0.76	0.46
Personal Self	13	-0.46	4.01	-0.41	0.68
Family Self	13	0.84	5.84	0.52	0.61
Social Self	13	-1.54	6.85	-0.81	0.43
Variation	13	-2.61	7.12	-1.32	0.21
Distribution	13	-3.00	20.53	-0.53	0.61
Max Oxygen Intake	11	-0.09	2.98	-0.10	0.92
Flexibility	13	-1.00	3.05	-1.18	0.26
Grip Strength	13	0.84	8.26	0.37	0.72
% Body Fat (Nomogram)	13	-2.15	3.02	-2.57	0.024*
% Body Fat (Sum 4's)	13	0.23	4.91	0.17	0.86
Weight Residual	13	0.46	0.52	0.63	0.55
Vital Capacity	13	-4.31	7.34	-2.12	0.056
Max Breathing Capacity	13	5.92	15.75	1.36	0.20
Systolic BP	13	6.38	15.54	1.48	0.16
Diastolic BP	13	6.00	12.71	1.70	0.11
Rest Heart Rate	13	-5.69	10.45	-1.96	0.07
Fitness Category	11	0.18	0.75	0.80	0.44
SRT	13	-0.07	2.66	-0.10	0.92
VJRT	12	0.75	3.64	0.71	0.49
Double Product	11	-14.18	307.66	-0.15	0.88

* significant at .05 level

TABLE XII

t TESTS FOR NON-PARTICIPANT GROUP PERCENTAGE CHANGE

Variable	N	Mean Difference	Standard Deviation	t	Prob T
Total P	13	0.02	0.04	0.18	0.86
Self Criticism	13	-0.01	0.11	-0.54	0.59
Identity	13	0.01	0.06	0.32	0.75
Self Satisfaction	13	0.01	0.07	0.63	0.54
Behavior	13	-0.01	0.05	-1.15	0.27
Physical Self	13	0.01	0.06	0.61	0.55
Moral Ethical	13	0.01	0.04	0.76	0.46
Personal Self	13	-0.01	0.05	-0.30	0.76
Family Self	13	0.01	0.08	0.65	0.53
Social Self	13	-0.01	0.09	-0.53	0.61
Variation	13	-0.07	0.17	-1.51	0.16
Distribution	13	-0.01	0.16	-0.36	0.72
Max Oxygen Intake	11	-0.01	0.09	-0.06	0.95
Flexibility	13	-0.05	0.23	-0.80	0.43
Grip Strength	13	0.01	0.07	0.50	0.62
% Body Fat (Nomogram)	13	-0.08	0.11	-2.68	0.02*
% Body Fat (Sum 4's)	13	0.01	0.19	0.03	0.97
Weight Residual	13	0.02	0.15	0.48	0.67
Vital Capacity	13	-0.03	0.05	-2.04	0.06
Max Breathing Capacity	13	0.06	0.16	1.52	0.15
Systolic BP	13	0.04	0.11	1.44	0.17
Diastolic BP	13	0.08	0.16	1.90	0.08
Rest Heart Rate	13	-0.06	0.13	-1.73	0.11
Fitness Category	11	0.24	0.66	1.20	0.25
Double Product	11	-0.01	0.09	0.14	0.89

* significant at .05 level

Correlations

The significant correlations for the entire group, participants and non-participants are presented in Appendix C. Changes in one variable were correlated with changes in all other variables. This correlation matrix produced over eight thousand correlations. Only the correlations that proved significant at the .05 and .01 levels were reproduced in the tables. Those variables which were obviously related were not presented. Some of those obvious relationships included: self concept subscore versus another self concept subscore, $\dot{V}O_2$ Max versus fitness category, which is determined by $\dot{V}O_2$ Max, and a mean difference versus a percent age change for the same variable.

The objective of the correlation matrix was to observe relationships between changes in variables. Many variables correlated to one another, but when one observes only those related variables which changed significantly, the list of relationships is reduced to less than ten.

Fitness category demonstrated a correlation coefficient of -.429 with family self ($p < .05$). This supported the findings previously presented that an improvement in physical fitness was accompanied by a diminished familial self concept.

A correlation coefficient of -.648 ($p < .05$) was found between resting heart rate and family self for the participate group. This relationship initially appears to contradict the earlier findings that decreased family self concept

scores paralleled improved fitness. But, analysis of the graphical representation of this relationship revealed that resting heart rate scores were accompanied by no decreases in family self scores for five of the eleven participants. Similarly, decreases in family self were associated with no decreases in resting heart rate for four subjects. The overall arrangement of the scattergram, however, appeared down and to the right, symbolizing the inverse relationship. So, although it would appear that an inverse relationship did exist, it could not be concluded that an increase in family self concept was associated with a decrease in resting heart rate.

Other relationships between significantly changed variables were demonstrated among the fitness variables. For example, $\dot{V}O_2$ Max and fitness category correlated with body fat measures. The r's ranged from -.641 to -.796. This indicated that as fitness improved, body fat was lowered. Some relationships, such as demonstrated between maximal breathing capacity and diastolic blood pressure ($r = .583$, $p < .05$), were not as easily evaluated. It would appear that as maximal breathing capacity increased, diastolic blood pressure increased. An increase in maximal breathing capacity is generally regarded an improvement, while elevated diastolic blood pressure is viewed as a decrement in physical health.

The large number of correlations and the small population made it possible for some apparently significant relationships

to occur due to chance. However, the relationships between significantly changed variables of self concept and fitness tended to support the findings of the t tests.

Summary of Results

The purpose of this study was to measure differences in self concept and fitness scores as a result of participation or non-participation in an aerobic exercise program. A secondary purpose was to examine the relationships among changes in self concept and changes in fitness variables for participants and non-participants.

The exercise participants improved significantly ($p < .0001$) in maximal oxygen intake and fitness category. It was expected that those who participated in two-thirds or more of their prescribed exercise program would increase in physical work capacity. The primary determinant of physical work capacity is $\dot{V}O_2$ Max. It also followed that exercise participation would improve one's fitness category, since fitness category is derived from $\dot{V}O_2$ Max.

Participants in the exercise regimen improved significantly in the following physiological measures: flexibility and body fat as measured by the sum of fours ($p < .01$); grip strength, weight residual, maximal breathing capacity, resting heart rate and double product ($p < .05$).

There was a significant decrease in family self concept scores among the exercise participants ($p < .01$). This seemed to indicate that those who chose to exercise took

time away from their families to do so, thereby, lowering their perception of how they function as a family member.

A significant decrease in distribution scores was found among exercise participants ($p < .05$). It appeared that exercisers became more defensive and guarded, less opinionated and more neutral.

The non-participant group had a significant improvement in body fat, indicated by a decreased body fat ($p < .05$). It was theorized that this unexpected difference was due to an overall decrease in the abdominal skinfold measurements in the non-exercisers.

Correlations between changes in self concept and changes in fitness generally supported the findings of the t tests.

It was difficult to analyze self concept scores and physiological measures. It is the opinion of the author that the self concept test was a measure of the subject's mental/emotional state. A state is a temporary condition that is continually affected by daily variations, such as; job stress, family problems and economic considerations. The following factors should be considered. The pretest was conducted in January, a time when the students were out of town, and there was relatively little work to be done by the officers. The police force was at full strength in January. The posttest was conducted in May, a time when the student population is busy departing the campus, and there was much work to be done by the officers. The police force was three men short in May, which resulted in officers

working overtime and double shifts. Eighteen of the twenty-four officers held two or more jobs; most of those jobs were seasonal. The officers who held seasonal jobs, such as roofing and lawn mowing, were working at both jobs in May. These factors could have accounted for the lowered self concept scores, as well as, the overall increase in blood pressures for the entire group.

In short, self concept is a measure of emotional state, which, as Catell (14) suggested is influenced by many factors daily. Although physiological functions change over a period of time, they do not appear as susceptible to variations as self concept.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

For many years, studies have analyzed the relationships between physical health, mental health and emotional health. Do changes in one aspect lead to changes in another? The results and conclusions have varied depending upon the evaluative instruments used and the subject group tested.

With the current interest in health maintenance programs conducted in the work place, it seemed appropriate to focus attention on one particular group of professionals. The unique aspects of this study were that it viewed an intact vocational group, and it utilized an individually prescribed exercise program based upon fitness evaluation results.

Twenty-four male Commissioned Peace Officers from Oklahoma State University were pretested using the Tennessee Self Concept Scale and the various measures of physical fitness. The results of the fitness evaluation were used to prescribe an individually tailored exercise program for each officer. The prescriptions were given to the officers in individual counseling sessions approximately one week after the pretest.

Over the sixteen week period that followed, the officers kept records of their activity patterns. If a subject accomplished two-thirds of his exercise prescription, he was classified as a participant. If an officer failed to accomplish two-thirds of either duration or frequency of exercise, he was classified a non-participant. The officers had to exercise at the proper intensity, utilizing the appropriate type (aerobic) of exercise, in order to be classed a participant.

At the end of the sixteen week period, each officer was retested utilizing the same self concept instrument and physical fitness measures.

A paired t test was used to analyze the changes between pre- and posttest scores. Mean raw data differences and mean percent changes were tested for significant differences at the .05 level of confidence.

A correlation matrix was constructed to investigate the relationships between self concept and physical fitness and among fitness variables.

Conclusions

Based on the hypothesis stated and the limits of this study the following conclusions were made:

1. There was no significant change in self concept scores as a result of participation in the exercise program. This hypothesis was rejected. A significant decrease in family self concept at the .01 level of

significance was found in the participant group. A significant decrease in distribution scores at the .05 level of significance was found in the participant group.

2. There was no significant change in self concept as a result of non-participation in the exercise program. This hypothesis was accepted.

3. There was no significant change in physical fitness as a result of participation in an exercise program. This hypothesis was rejected. Significant improvements at the .0001 level of significance were found in maximal oxygen intake and fitness category. Significant improvements at the .01 level of significance were found in hip-trunk flexibility and percent body fat sum of fours. Significant improvements at the .05 level of significance were found in grip strength, maximal breathing capacity, resting heart rate and double product.

4. There was no significant change in physical fitness as a result of non-participation in the program. This hypothesis was rejected. A significant improvement at the .05 level of significance was found in percent body fat nomogram.

5. There was no relationship between changes in self concept and changes in physical fitness for the participant group. This hypothesis was rejected. Correlation coefficients of .7 or greater were found between the following variables: simple reaction time and total P ($r = .841$), and simple reaction time and behavior ($r = .745$).

6. There was no relationship between changes in self concept and changes in physical fitness for the non-participant group. This hypothesis was accepted. No correlation coefficients of .7 or greater were found.

7. There was no relationship among changes in physical fitness measures as a result of participation in the exercise program. This hypothesis was rejected. Correlation coefficients of .7 or greater were found among the following fitness variables: fitness category and percent body fat (sum of fours) ($r = -.745$), fitness category and percent body fat (nomogram) ($r = -.796$), maximal breathing capacity and percent body fat (sum of fours) ($r = -.883$), simple reaction time and percent body fat (nomogram) ($r = .735$), and maximal oxygen intake and vertical jump reaction time ($r = -.727$).

8. There was no relationship among changes in physical fitness for the non-participant group. This hypothesis was rejected. A correlation coefficient of .7 or greater was found between maximal oxygen intake and vertical jump reaction time ($r = -.819$).

Recommendations

It was determined that more studies are needed to determine the effects of exercise on physical health and mental/emotional health. Possibly a more targeted study could focus on a narrow range of mental, emotional or physical variables.

In the future, tests of body composition should employ a T score for weight residual. Residuals in excess optimum should be greater than the T score for optimum weight residual. This change would give more meaning to the statistical analysis of weight residual.

When investigating professional groups, it would be advantageous in the future to use a similar employee group as a control. For example, the entire Oklahoma State University Police force would participate fully in the exercise program while the University of Oklahoma police force would not participate in any form of exercise and, thus, become the control group.

It was also recommended to accomplish the study over a longer period of time, optimally for one year. Not only would this allow for more changes to take place as a result of the exercise program but would also help hold self concept scores constant that might otherwise be affected by seasonal variation. However, if this suggestion is employed, ample research would need to be conducted into the aging factors that affect self concept and physical fitness.

In future studies, a larger group should be used in order to decrease the problems of variability associated with a small N. In a larger group the central tendency would be more easily determined.

Another helpful evaluative tool would be an employer analysis of job performance. Professional competence could then be added or substituted as a dependent variable.

In future studies of physical fitness, the variable, double product, should be utilized in a somewhat different manner. Since double product is an estimation of myocardial output, it would be more meaningful to measure this variable at given workloads. Therefore, if a subject demonstrated a lower double product at 10% grade on the posttest than on the pretest, it would be safe to assume that his cardiovascular system is in better condition because it does not have to work as hard at a given work load.

Finally, longitudinal case studies could be used. This would allow the utilization of several emotional tests, including subjective counselor evaluations and client perceptual tests (How do you feel?). The physical fitness measures used in this study were adequate, but more information concerning client's mental/emotional well being could have been derived from individual counseling sessions and other evaluative instruments.

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APPENDIXES

APPENDIX A

LABORATORY SOFTWARE

HEALTH AND FITNESS CENTER
Oklahoma State University

The following information is needed for our records and in assessing your current health and fitness status. By providing as much of this information as possible in advance, time will be saved during the evaluation. All information provided will be held in strict confidence.

NAME _____ DATE _____

ADDRESS: Street _____ City _____ State _____ ZIP_____

HOME PHONE _____ EMPLOYER _____

OCCUPATION _____ BUSINESS ADDRESS _____ PHONE _____

AGE LAST BIRTHDAY _____ BIRTH YEAR _____ Does your job require physical activity? _____

Do you currently smoke? _____ If so, what? _____ number/day _____
If not, have you ever smoked?____ If yes, what? _____ no/yrs_____ yrs. quit____

Do you ever drink alcoholic beverages? _____ If yes, approx. no.: less than 1/day _____
1-2 per day _____ 3 or more per day _____

Do you currently participate in any form of exercise on a regular basis?_____
Indicate no. of times/weekly of participation: walking _____ jogging _____ swim _____
golf _____ basketball _____ handball/racquetball _____ tennis _____ other (name)_____
If you walk, job or swim, please indicate distance and time covered each session and approximate pace _____

What is your estimate of your current medical condition? ex.__ good___ fair___ poor___
What is your estimate of your current physical fitness? ex.___ good___ fair___ poor___

Circle the number of blood relatives (parents, grandparents, brothers, sisters, that have been diagnosed as having some form of heart disease:
Under 60 years of age: 1 2 3 4 5 6 7 8 9 Over 60 years of age: 1 2 3 4 5 6 7 8 9

Have you ever been told that you have any form of heart disease? _____
Have you ever been told that you have diabetes? _____
Do you have blood relatives with diabetes? _____ If so, how many? _____

Do you consider yourself to be overweight? _____ If so, approx. how many lbs.? _____
Do you have any medical conditions (other than heart disease or diabetes) that might affect your exercise performance? _____ If so, please list _____

Who is your family physician? _____ City _____
Address, if known _____ date last medical exam _____
Would you like your stress test records sent to this physician? _____
If you would prefer to have your records sent to another physician, please list name and address _____

Are you currently taking any kind of medication? _____
If yes, is it non-prescription? _____ If so, name _____
If yes, is it prescription? _____ If yes, give name if possible _____

Have you ever been told that you had high cholesterol or high triglyceride levels in the blood? Cholesterol: yes___ no___ Triglyceride: yes___ no___

If you know your cholesterol and/or triglyceride levels, please list

Cholesterol _____ Triglyceride _____

OKLAHOMA STATE UNIVERSITY

HEALTH AND FITNESS CENTER

INFORMED CONSENT FORM

Subject's name_____ Date_____

I hereby authorize Dr. A. B. Harrison and/or such assistants as may be selected by him to perform the following procedure(s) and investigation(s):

A laboratory physical fitness evaluation including electrocardiogram, phonocardiogram, pulse waves, blood pressure, weight analysis, respiratory capacities and function and a treadmill walking test to predict maximal oxygen intake capacity,

on _____.
subject

The procedure(s) and investigation(s) has (have) been explained to me by Dr. A. B. Harrison or his assistant.

I understand that the procedure(s) and investigation(s) involve the following possible risks and discomforts:

All tests except the treadmill walk are resting tests and involve no unusual risk or discomfort. The treadmill test involves walking at a gradually increasing grade up to a target heart rate. The target heart rate is determined by age level, medical and physical condition. The EKG is monitored during the treadmill walk and the test is terminated upon signs of cardiac distress. The subject is free to terminate the test at any time at his own discretion.

I also understand that all test records will be kept confidential and will not be released to anyone without permission of myself or family. Test results will be tabulated for research purposes as group data and in no case will a subject's personal identity be associated with his test results without his express permission.

I understand that the potential benefits of the investigation are as follows:

The results of the test battery will give the subject an in depth view of his current fitness status. Test results will be explained and interpreted to the subject. Guidance concerning exercise programs will be given. Subjects will be encouraged to engage in a systematic exercise program to produce favorable changes in test scores. Subjects will be offered the opportunity for a re-evaluation annually.

I understand that I may terminate my participation in the study at any time.

Subject's signature_____

Witness_____

HEALTH AND FITNESS CENTER

Oklahoma State University

PHYSICIANS' APPROVAL FORM

To the physician of _____ DATE _____

This subject has indicated a desire to participate in the physical fitness evaluation program offered by our center. At the conclusion of this evaluation, we will make exercise recommendations based on the results plus your recommendations, if any. We expect the subject to have no medical conditions which would contraindicate participation in light to moderate exercise, and therefore, ask the subject to have this form signed by you.

Our evaluation consists of the following: (a) some resting tests (b) some tests requiring minimal effort and (c) a progressive treadmill walk test to predict maximal oxygen uptake capacity. The little or no-exercise tests include grip strength, reaction time, flexibility, 3-lead EKG, blood pressure, vital capacity, timed vital capacity, maximal breathing capacity, anthropometric and body fat measures. The exercise test is the Balke treadmill procedure with the speed being a constant walk of 3.5 mph and the elevation starting at 0% and being raised 1% each minute until a target heart rate is reached. Maximal oxygen uptake is then predicted from a regression equation developed by Balke. Target heart rates are always sub-maximal heart rates. For deconditioned subjects, we use the suggested target heart rates published by Dr. Kenneth Cooper, MD, which are age adjusted, or if a fitness measure is also available, we use Dr. Cooper's age-fitness adjusted target heart rates. The age-fitness targets are generally higher for a person in a good physical condition. The age adjusted target heart rates are as follows:

Under 30	175
30 - 34	170
35 - 39	165
40 - 44	160
45 - 49	155
50 - 54	150
55 - 59	145
60 - 64	140
65 and over	135

The EKG is monitered each minute of the exercise test and the test is terminated upon signs of ST elevation of depression or unusual arrythmias.

Copies of the subjects test results will be made available to you at the request of you or your patient.

THIS SUBJECT HAS MY APPROVAL TO PARTICIPATE IN THE PHYSICAL FITNESS EVALUATION.

Signed _____, MD

City _____

DUE TO MEDICAL CONSIDERATIONS, I FEEL THAT THE TARGET HEART RATE FOR THE EXERCISE TEST AS SUGGESTED BY DR. COOPER IS TOO HIGH/LOW. I RECOMMEND A TARGET HEART RATE OF _____BEATS/MINUTE.

On the back of this sheet, please comment on any medical condition which would contraindicate participation in any phase of this evaluation or in a subsequent exercise program.

OKLAHOMA STATE UNIVERSITY
HEALTH AND FITNESS CENTER

Name_____
Date_____

GRIP STRENGTH RT. 1._____ LT. 1._____
2._____ 2._____

PUSH TRIAL 1._____ PULL TRIAL 1._____
2._____ 2._____

FLEXIBILITY_____ OXYGEN SATURATION_____

LEG STRENGTH RT. 1._____ LT. 1._____
2._____ 2._____

SINGLE REACTION TIME
TRIAL 1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____

VERTICAL JUMP REACTION TIME
TRIAL 1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____

HEIGHT_____ WEIGHT_____ VITAL CAPACITY_____

_____

MAXIMAL BREATHING CAPACITY_____

_____

Data Collection for Estimation of Body Composition from Skinfold Measurement

Name _____ Age ____ Ht. ____ in. ____ cm. Wt. ____ lbs. ____ kg.

Date _____

Skinfold	Observer 1			Observer 2		
	First	Second	Mean	First	Second	Mean
1. Chest						
2. Abdominal						
3. Arm						

Specific Gravity _____ Specific Gravity _____

Percent Body fat _____ Percent Body fat _____

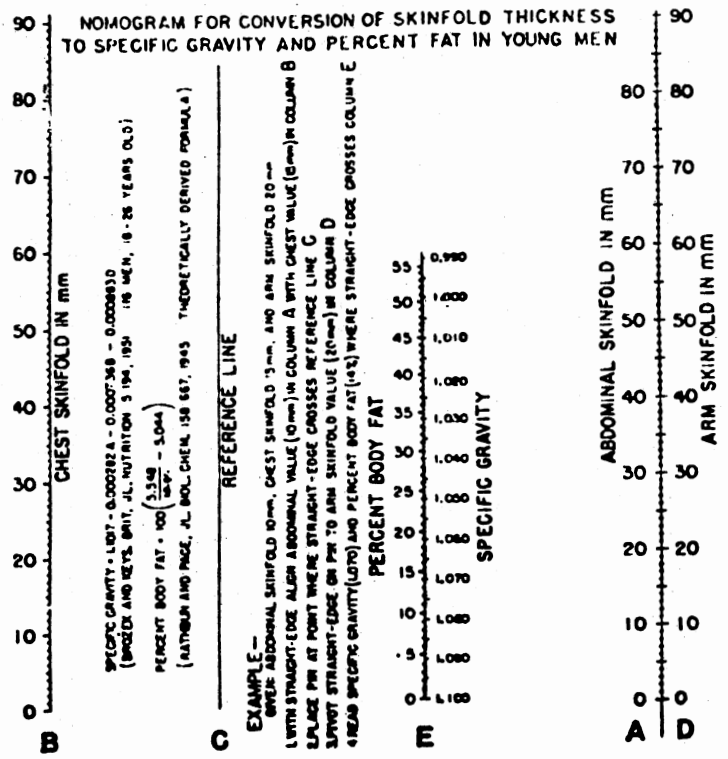


Figure 19-2. Nomogram for conversion of skinfold thickness to specific gravity and percent fat in young men. (From W.R. Best USAMRNL Report no. 113. August, 1953.).

In order to determine percent body fat it is necessary to use one of the following charts. One is for ages 17 years and above and the others are for ages 16 and below.

SKINFOLDS FOR ADULTS— 17 YEARS AND ABOVE

You can find out the percent body fat by totaling the sum of four skinfolds (biceps, triceps, iliac crest, and subscapula). Locate the proper age and sex column and then read across to find your percent fat. For example, if you are a twenty-four year old female and have a sum total for your skinfolds of 40, your percent fat would be 23.4 percent.

	Males (age in years)				Females (age in years)			
Skinfolds (mm)	17-29	30-39	40-49	50+	16-29	30-39	40-49	50+
15	4.8	—	—	—	10.5	—	—	—
20	8.1	12.2	12.2	12.6	14.1	17.0	19.8	21.4
25	10.5	14.2	15.0	15.6	16.8	19.4	22.2	24.0
30	12.9	16.2	17.7	18.6	19.5	21.8	24.5	26.6
35	14.7	17.7	19.6	20.8	21.5	23.7	26.4	28.5
40	16.4	19.2	21.4	22.9	23.4	25.5	28.2	30.3
45	17.7	20.4	23.0	24.7	25.0	26.9	29.6	31.9
50	19.0	21.5	24.6	26.5	26.5	28.2	31.0	33.4
55	20.1	22.5	25.9	27.9	27.8	29.4	32.1	34.6
60	21.2	23.5	27.1	29.2	29.1	30.6	33.2	35.7
65	22.2	24.3	28.2	30.4	30.2	31.6	34.1	36.7
70	23.1	25.1	29.3	31.6	31.2	32.5	35.0	37.7
75	24.0	25.9	30.3	32.7	32.2	33.4	35.9	38.7
80	24.8	26.6	31.2	33.8	33.1	34.3	36.7	39.6
85	25.5	27.2	32.1	34.8	34.0	35.1	37.5	40.4
90	26.2	27.8	33.0	35.8	34.8	35.8	38.3	41.2
95	26.9	28.4	33.7	36.6	35.6	36.5	39.0	41.9
100	27.6	29.0	34.4	37.4	36.4	37.2	39.7	42.6
105	28.2	29.6	35.1	38.2	37.1	37.9	40.4	43.3
110	28.8	30.1	35.8	39.0	37.8	38.6	41.0	43.9
115	29.4	30.6	36.4	39.7	38.4	39.1	41.5	44.5
120	30.0	31.1	37.0	40.4	39.0	39.6	42.0	45.1
125	30.5	31.5	37.6	41.1	39.6	40.1	42.5	45.7
130	31.0	31.9	38.2	41.8	40.2	40.6	43.0	46.2
135	31.5	32.3	38.7	42.4	40.8	41.1	43.5	46.7
140	32.0	32.7	39.2	43.0	41.3	41.6	44.0	47.2
145	32.5	33.1	39.7	43.6	41.8	42.1	44.5	47.7
150	32.9	33.5	40.2	44.1	42.3	42.6	45.0	48.2
155	33.3	33.9	40.7	44.6	42.8	43.1	45.4	48.7
160	33.7	34.3	41.2	45.1	43.3	43.6	45.8	49.2
165	34.1	34.6	41.6	45.6	43.7	44.0	46.2	49.6
170	34.5	34.8	42.0	46.1	44.1	44.4	46.6	50.0
175	34.9	—	—	—	—	44.8	47.0	50.4
180	35.3	—	—	—	—	45.2	47.4	50.8
185	35.6	—	—	—	—	45.6	47.8	51.2
190	35.9	—	—	—	—	45.9	48.2	51.6
195	—	—	—	—	—	46.2	48.5	52.0
200	—	—	—	—	—	46.5	48.8	52.4
205	—	—	—	—	—	—	49.1	52.7
210	—	—	—	—	—	—	49.4	53.0

In two-thirds of the instances the error was within ±3.5% of the body-weight as fat for the women and ±5% for the men.

Determination of percent body fat for the sum of the biceps, triceps, subscapula, and iliac skinfolds of males and females 17 years of age and above. (Adapted with permission from: Body Fat Assessed from Total Body Density and Its Estimation From Skinfold Thickness by J.V.G.A. Durnin and J. Womersley, British Journal of Nutrition, Volume 32, page 95, 1974.)

ANALYSIS OF BODY BUILD

Name_____ Wt._____lbs._____kg. Ht._____in._____dm.

(1)	(2)			(3)	(4)	(5)	(6)
Body Segment	Circumference			Male K Value	Female K Value	d Value	Equiv Wt(kg) d^2 X H
	L.	R	Av.				
1 Shoulder				55.4	52.0		
2 Chest				45.9	44.5		
3 Abdomen				40.6	38.7		
4 Buttocks				46.7	50.8		
5 Thighs				27.4	30.1		
6 Biceps				15.4	14.4		
7 Forearm				13.4	13.0		
8 Wrist				8.2	8.2		
9 Knee				18.3	18.8		
10 Calf				17.9	18.4		
11 Ankle				10.8	11.1		
Σ							
M							

Predicted Wt. as Mean of Equiv. Wts. (col. 6)_____

Predicted Wt. as $\frac{C}{K}$ = Sum (col. 2) / 300 _____

Date _____ mo./day/yr. SUMMARY SHEET Member No. 1-11

☐F (fac. pay)
☐C (comm. pay)
☐R (research)
☐S (special)
☐A (retest)

01 ☐ male ☐ female ☐ 0 ≥ 60 ☐ P PS ☐ H 50+ ☐ C cs ☐ M mthn Name _____ (first) _____ (last) Home Address _____ (zip code)

02 City _____ State _____ H Phone ( ) - W Phone ( ) -

Level of Supervision ☐ TLEX ☐ SEMP ☐ MNGR ☐ OFWK ☐ HSWF ☐ BCLB ☐ HVLB Profession _____ Birthyear _____ Age _____

03 Ht _____ Wt _____ BSA _____ Physician _____ City _____ Date Last Med _____

04 Contraindications _____
Medication _____ Family History _____ ☐ AS ☐ CS ☐ PS Risko _____

05 Smoking ☐ SM ☐ NS ☐ Q Years Quit _____ Years Smoked _____ ☐ CI ☐ CG ☐ PI Number/Day _____

Activity _____ type Days/Wk _____ Hrs/Session _____ Min/Session _____
Pts/Wk _____ Months on Pattern _____

Alcohol (yes/no) _____ ☐ less than 1 drink/day ☐ 1-2/day ☐ 3+/day

11 Schneider index _____ Resting Pulse: Lying _____ Standing _____

Blood Pressure: Sitting _____ Lying _____ Standing _____ ICE _____

12 RESP: O_2 intake _____ Min Vol Vent _____ /m^2 Vent EQ _____ TVC _____ FVC _____ FEV_1 _____
FVC/vc _____ vital cap _____ % norm _____ MBC _____ % norm _____ %MVV _____
TV _____ BPM _____

13 EKG: Comments _____ P-R _____ Pulse _____ Amp P _____ Amp R _____
Amp T _____ work time _____ rest time _____ rest/work _____ QIHS _____ QRS _____
EP _____ TP _____ EP/HR _____ EP/TP _____ ST depression _____ Arrythmia _____

14 ANT: Predicted weight (Benke Meas. Used) _____ Res ± _____ TRI _____ Chest _____ Abdom _____
Subscap _____ Iliac _____ Bicep _____ Rt. wrist _____ % B.F. nomogram _____ S.G. _____
4s _____ I. Wt. Res ± _____ under water _____

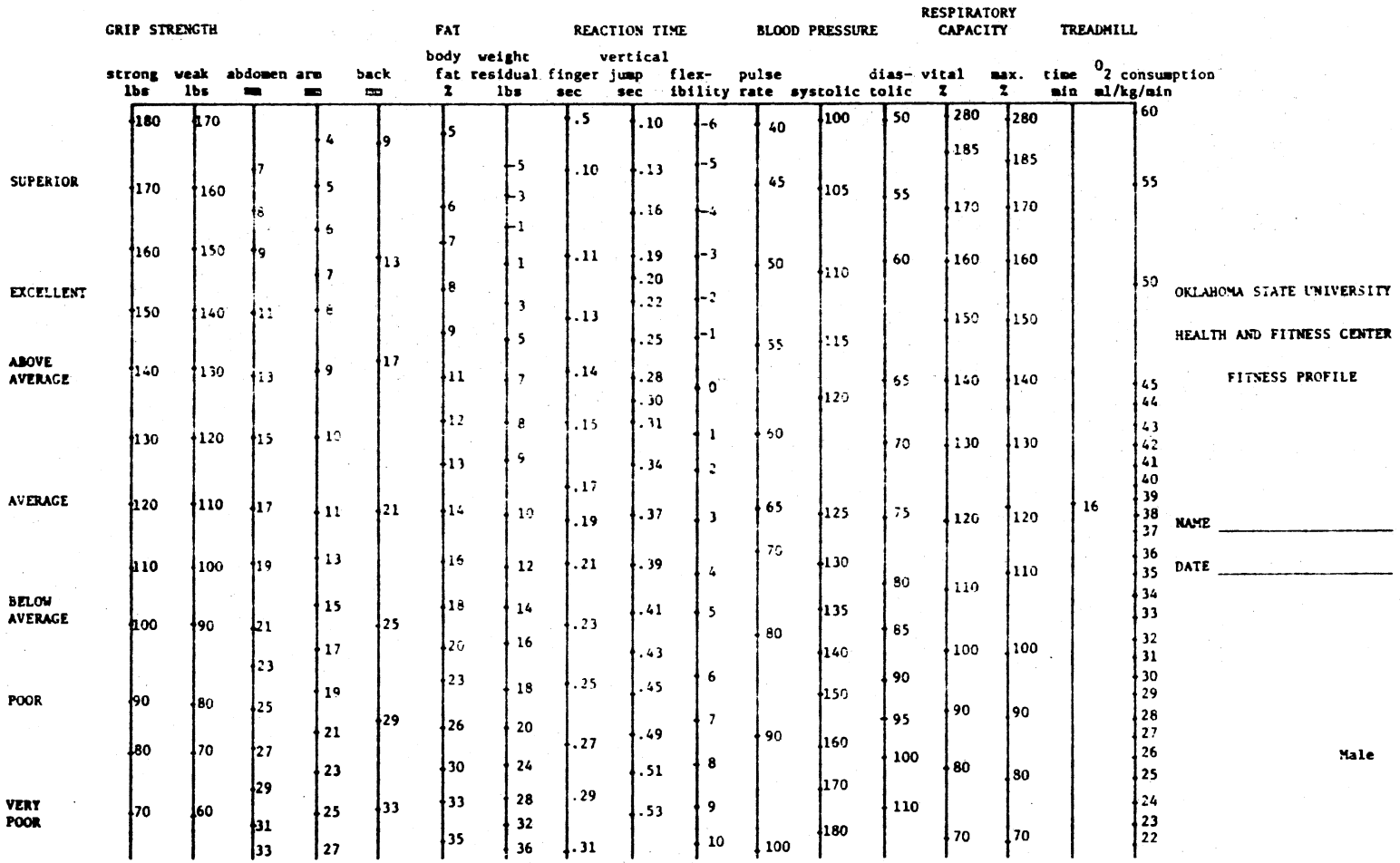
15 TREAD: Heart Rate _____ METS _____ Speed _____ % Grade _____ O_2L _____ O_2 ml/kg/min _____
Class _____ Comments _____

16 SFRT: Grip (strong) _____ weak _____ LEG strong _____ weak _____ flex _____
Push _____ Pull _____ SRT _____ VJRT _____ O_2 Sat _____

20 POST: 3 min. HR _____ BP _____ EP _____ TP _____ EP/HR _____ EP/TP _____ EKG _____ QIHS _____

21 5 min. HR _____ BP _____ EP _____ TP _____ EP/HR _____ EP/TP _____ EKG _____ QIHS _____

22 Chol-Tri Total _____ HDL _____ LDL _____ TRI _____



OKLAHOMA STATE UNIVERSITY

HEALTH AND FITNESS CENTER

FITNESS PROFILE

NAME _____

DATE _____

Male

Oklahoma State University

School of Health, Physical Education and Leisure Services

STILLWATER, OKLAHOMA, 74074
HEALTH AND FITNESS CENTER
610 ADAMS STREET
(405) 624-7685

Exercise Recommendations for _____

The key to success in your exercise program is consistency. You must place a high priority on your need to exercise, set aside a regular time period for it and then get your exercise at that time. The exercise program that we recommend for you is an aerobic type program that is to be monitored by pulse rates geared to your individual needs. The initial work loads will be light to moderate but they will be gradually increased as your conditioning gets better. Aerobic work or exercise is any that is light enough that you can take in all the oxygen that the body needs for that activity during the exercise. The best aerobic activities are continuous moving types that require large muscle action and preferably are rhythmical in nature. Recommended activities are walking, swimming, jogging, bicycle riding, bench stepping or stair climbing, rope jumping and aerobic dance. You may select any one or combination of these activities for your program. Other activities such as basketball, tennis, handball, raquetball and squash may be suitable but they sometimes require too much energy and at other times not enough to be effective. They are thus, generally not recommended for people over 45-50 years of age that have not been regularly participating in them. Golf is a satisfactory aerobic activity only if one walks briskly and plays as much as 18 holes for one exercise session. Carrying golf clubs is more effective than pulling a cart and riding a golf cart gives no effective exercise. Bowling is not an effective aerobic exercise.

The key to an effective exercise program is to be able to attain and maintain a threshold heart rate. This is commonly called the "target heart rate" (THR). When this rate is reached and held for five minutes or more you start to get the training benefit to the cardiovascular system. So it will not be necessary at any time to exercise maximally or all out. Your initial target heart rate is _____. This THR has been determined for you from the results of your treadmill test. It is more accurate for you than any THR that you may get from a book or magazine article. As you progress in your exercise program your THR will likely increase as you get into better aerobic condition. During and immediately after exercise you will need to check your heart rate to see if you are reaching your target rate. During the THR part of each exercise session you should be within 5-6 beats per minute of the target rate. You will determine your heart rate by feeling the pulses at the carotid artery just to the side of the adams apple on the neck. Press lightly with two fingers. Do not push on both sides of the neck at the same time. Count the beats for ten seconds and multiply by six to the rate per minute.

Exercise Frequency: You will need to exercise at least three times weekly to get the training benefits. If you are exercising only three times per week it is best to do so on alternate days. If you are using the exercise to burn up calories to help in a weight loss or control program, you

should exercise 5-6 times per week until the desired weight is reached, then you can drop back to 3 times per week.

Model for Each Exercise Period: Each exercise period will need to last for at least 30 minutes and may go as long as 45 minutes. This does not include changing clothes and showering. Each exercise session should consist of the following:

a. five to ten minutes of warm up
b. ten to thirty minutes of target heart rate exercise
c. five minutes of cool down activity

Suggested Warm Up Activities: The purposes of the warm up are to gradually raise the heart rate up to near target levels and to give us a chance to work on flexibility and strengthening activities which are also important components of physical fitness. The emphasis here should be on bending, strengthening activity. You will not necessarily need to do all of these suggested exercises and you may substitute others of your own choosing. Those checked are some that you especially need to do. In general, little or no equipment should be needed for any of the warm up activities.

1. Toes raises: Stand straight, feet slightly spread. Raise up on toes and at the same time raise arms overhead and inhale maximally. Come back down, lower arms and exhale. Repeat ten times.
2. Bending: Hands on hips, feet slightly spread. Bend forward then backward ten times. Repeat side to side ten times.
3 Forward flexion: Feet slightly spread, bend forward and reach fingers toward floor as far as possible, hold for ten seconds. Do not bounce.
4. One half squats from standing position: If one leg needs strengthening do half squats on that leg only with the other placed behind for balance. Do ten times.
5. Alternate toe touches: Feet slightly spread, touch right hand to left toe and alternate left hand to right toe. Do ten times.
6. Isometric push-pull: Hands in front of chest. Push one hand against the other maximally for ten seconds (for chest muscles). Clasp fingers and pull maximally for ten seconds (for upper back muscles).
7. Sit ups (good for abdominal muscles): Do these with knees bent, flat and stabilized or held down. Curl up with chin on chest and back rounded and uncurl going down. Start with a number that you can do comfortably and build up to about 20. Then add weight (5-10 lbs.) in hands over your head and start again at the number you can do easily and build up. If you can not do a single sit up, start with a sit back: Start in sitting position, knees bent, feet stabilized, hands on head and slowly lean back to a position one fourth to one half way back and hold for several seconds, then go on down. Do this 5-6 times and work up to 10, then try sit ups.
8. Ball squeezing (for grip strength): Squeeze a tennis ball maximally for 10 seconds.
9. Push ups, chin ups or bar dips: Good for chest, shoulder and upper arm strength. Keep body straight on push ups. You may start with modified push up from knees if necessary then graduate to pushing up from toes. Start with number that you can comfortably do and add one each week till you reach 20 push ups or 8 chins or dips.

Target Heart Rate Exercise: 10-30 minutes. This is the most important part of your exercise session in terms of reaping cardiovascular benefits and improving aerobic capacity. This is the most important aspect of physical

fitness to you. After warming up, your heart rate should be over 100 beats per minute. Follow these recommendations for your THR exercise during the activity of your choice.

Target Heart Rate

two weeks: 5 min. at
two weeks: 10 min. at
two weeks: 15 min. at
two weeks: 15 min. at
two weeks: 20 min. at
two weeks: 20 min. at
two weeks: 25 min. at
two weeks: 25 min. at

continue to work at the time desired at THR of

Cool Down: The purpose of the cool down period (five minutes) is to keep the blood circulating freely during the recovery and while the heart rate comes down to below 100 beats per minute. If one does not go through the cool down period the blood may pool in the extremities, especially if one lies, or sits down or merely stands. The best cool down activity is slow walking, although you may use slow bicycle riding or slow swimming if participating in those activities. We would like to see the heart rate back down below 100 beats per minute in five minutes after the end of the THR exercise. Do not go directly to a hot shower, steam or sauna bath after the THR exercise without going through the cool down exercise period as this may place undue strain on the heart and cardiovascular system.

Should you have problems or questions about your exercise program, please call or write:

A. B. Harrison, Ph.D.
OSU Health and Fitness Center
103 Colvin Center
Stillwater, OK 74074
(405) 624-5498

ACTIVITY REPORT

NAME ______________________ TIME PERIOD ______________

DATE	ACTIVITY	TIME SPENT ON ACTIVITY/min	HEART RATE ACHIEVED, bpm	DISTANCE COVERED run, swim, walk	COMMENTS

APPENDIX B

RAW DATA

TABLE XIII

PRETEST SELF CONCEPT SCORES

Subject Number	Participation/ Non-participation	Total P	Self Criticism	Identity	Self Satisfaction	Behavior	Physical Self	Moral Ethical	Personal Self	Family Self	Social Self	Total Variation	Distribution
01	P	364	41	138	102	124	79	73	72	73	67	19	120
02	N	332	37	117	101	114	72	67	63	60	70	17	83
03	N	339	39	129	105	105	68	64	68	77	62	26	113
04	P	351	24	131	102	118	69	72	73	64	73	22	97
05	N	351	36	133	102	116	67	70	69	72	73	23	105
06	N	313	36	117	98	108	56	76	59	70	52	30	139
07	P	334	26	129	94	111	65	63	72	68	66	24	103
08	N	379	30	140	121	118	72	74	77	77	79	17	125
09	N	386	33	143	116	127	75	75	77	76	83	45	135
10	N	384	33	134	123	127	71	80	76	79	78	21	135
11	P	343	32	135	95	113	65	63	72	69	74	28	134
12	P	343	28	124	107	112	65	69	72	66	71	22	90
13	P	368	34	131	119	118	73	75	72	76	72	24	115
14	P	374	38	134	117	123	72	76	70	81	75	25	126
15	P	344	28	132	102	110	66	71	69	69	69	25	112
16	P	353	33	137	101	114	75	68	69	68	69	22	105
17	N	352	31	115	114	123	74	71	78	69	70	26	118
18	N	387	40	141	116	130	71	78	75	81	82	28	155
19	P	363	32	138	110	115	72	73	76	77	65	29	119
20	N	358	31	136	101	121	67	79	63	83	66	25	121
21	P	355	37	132	113	110	71	72	66	73	73	25	120
22	N	327	43	118	105	104	61	71	65	71	59	18	91
23	N	350	30	123	102	125	57	75	70	76	72	27	123
24	N	384	27	140	121	123	72	79	77	81	75	23	133

TABLE XIV

POSTTEST SELF CONCEPT SCORES

Subject Number	Participation/ Non-participation	Total P	Self Criticism	Identity	Self Satisfaction	Behavior	Physical Self	Moral Ethical	Personal Self	Family Self	Social Self	Total Variation	Distribution
01	P	329	34	124	101	104	65	64	67	67	66	24	104
02	N	355	31	127	113	115	79	68	65	67	76	15	93
03	N	329	39	126	100	103	63	62	68	75	61	25	92
04	P	341	26	129	94	118	66	65	73	64	73	22	98
05	N	348	41	121	112	115	69	71	76	66	66	24	119
06	N	331	36	115	108	108	52	80	60	77	62	31	148
07	P	347	37	132	102	113	70	71	69	68	69	23	99
08	N	395	27	142	125	128	77	80	78	82	78	17	139
09	N	363	37	132	109	122	71	71	75	73	73	20	105
10	N	400	33	140	132	128	76	83	76	84	81	18	143
11	P	358	31	137	96	125	76	71	75	65	71	24	114
12	P	317	35	105	107	105	63	67	62	56	62	17	65
13	P	343	35	125	103	115	63	70	73	68	69	23	102
14	P	384	38	130	127	127	71	79	77	81	76	24	134
15	P	325	31	124	95	106	65	68	62	65	65	27	94
16	P	364	35	144	101	119	79	68	65	69	73	30	122
17	N	365	27	134	109	122	78	76	77	78	56	28	140
18	N	364	42	136	112	116	66	80	66	85	67	26	133
19	P	342	32	137	104	101	72	71	65	72	62	24	100
20	N	353	29	136	96	121	70	76	64	75	68	21	112
21	P	357	29	134	105	118	67	71	70	68	70	19	101
22	N	321	42	118	100	103	65	69	62	67	58	20	87
23	N	363	24	130	109	124	59	76	73	79	76	29	137
24	N	359	31	134	115	110	68	76	71	75	69	18	89

TABLE XV

PRETEST PHYSICAL FITNESS SCORES

Subject Number	P/No-P	Max VO2 ml/kg/min	Flex	Grip Strength lbs	% Body fat nomogram	% Body fat sum of fours	Weight Residual	VC	MBC	Blood Pressure Systolic/Diastolic		Resting Heart Rate	Fit Cat	SRT	VJRT	Double Product/10
01	P	42	2	127	16	17	2	124	112	120	80	60	3	19	30	3534
02	N	40	7	106	16	19	4	120	90	130	60	72	3	17	27	3162
03	N	29	9	132	20	23	11	123	105	150	85	96	1	23	29	4176
04	P	43	11	124	19	23	7	128	115	130	80	72	4	17	27	3420
05	N	35	18	108	27	28	15	115	84	120	80	72	2	23	31	3330
06	N	25	7	84	22	25	18	73	108	145	90	92	1	20	36	2997
07	P	33	15	136	20	29	24	123	90	160	95	78	2	15	28	4278
08	N	39	13	128	24	21	9	133	66	130	55	84	3	15	24	3240
09	N	38	6	132	16	19	3	120	119	114	80	66	3	16	24	3249
10	N	30	11	123	23	27	13	124	126	120	80	72	2	16	29	3132
11	P	40	10	73	21	22	10	96	105	120	75	60	3	17	29	3060
12	P	40	17	86	19	23	12	118	97	120	75	60	3	19	33	3444
13	P	31	10	134	28	25	25	130	105	150	90	96	1	16	24	3150
14	P	35	4	110	25	23	18	117	115	110	80	78	2	13	27	3060
15	P	30	16	103	32	34	21	124	112	130	90	72	1	17	30	2856
16	P	42	5	119	15	18	00	104	111	145	90	78	3	14	21	3780
17	N	21	12	114	21	29	12	97	109	120	80	90	1	17	34	3168
18	N	28	10	99	21	29	12	120	106	160	110	78	2	16	32	3432
19	P	32	11	114	23	27	22	91	101	125	80	90	2	20	41	3330
20	N	40	9	119	21	23	13	131	124	145	90	72	3	13	28	3441
21	P	40	10	139	19	23	8	116	154	130	75	60	3	15	24	3648
22	N	32	5	115	13	13	00	130	120	135	70	84	1	15	27	2610
23	N	22	12	112	34	32	46	99	86	165	105	84	2	17	34	3075
24	N	29	14	95	25	28	21	103	103	135	85	84	1	16	28	3240

TABLE XVI

POSTTEST PHYSICAL FITNESS SCORES

Subject Number	P/No-P	Max VO2 ml/kg/min	Flex	Grip Strength lbs	% Body fat nomogram	% Body fat sum of fours	Weight Residual	VC	MBC	Blood Pressure Systolic	Blood Pressure Diastolic	Resting Heart Rate	Fit Cat	SRT	VJRT	Double Product/10
01	P	45	1	140	13	13	00	114	124	132	88	60	4	17	28	3627
02	N	38	5	114	17	17	5	118	123	138	78	66	3	17	29	3813
03	N	34	8	122	19	24	13	119	131	175	110	78	2	17	27	4116
04	P	47	9	108	20	24	10	118	115	130	85	60	5	18	31	3690
05	N	35	8	103	22	24	15	120	94	126	78	66	2	18	31*	2880
06	N	22	9	84	23	37	23	73	135	162	102	90	1	21	--	3075
07	P	37	11	143	23	25	21	113	104	132	88	60	3	18	33	4416
08	N	35	11	145	15	18	7	116	84	118	68	84	2	17	31	3306
09	N	37	8	125	15	19	7	106	115	138	90	78	3	17	24	2880
10	N	32	10	119	23	27	13	124	126	108	66	78	2	15	27	2871
11	P	42	11	91	22	20	8	102	111	135	90	54	4	18	29	3240
12	P	42	13	91	17	21	12	112	97	140	80	60	4	17	33	3630
13	P	35	9	147	21	24	15	115	111	140	80	102	2	15	26	3240
14	P	40	2	127	23	22	14	117	118	135	90	78	3	14	27	3456
15	P	38	11	107	19	27	16	117	130	135	90	66	3	14	19	2916
16	P	45	3	112	15	16	00	106	114	140	85	72	4*	15	21	3672*
17	N	--*	10	114	19	29	10	102	94	146	98	84	--*	19	35	----*
18	N	--*	11	105	18	25	13	121	98	170	108	72	--*	18	33	----*
19	P	39	9	116	20	25	13	110	106	170	96	84	3	17	30	3510
20	N	40	8	121	18	17	6	116	115	128	78	78	3	16	27	3663
21	P	44	9	157	17	22	5	119	152	136	90	60	4	16	29	3420
22	N	37	5	120	12	13	00	121	129	144	88	66	3	15	22	2610
23	N	21	12	101	28	40	47	94	81	180	106	72	2	17	34	2880
24	N	27	14	105	26	29	25	102	98	120	78	60	1	16	36	3393

* Did not take test: No data available.

APPENDIX C

SIGNIFICANT CORRELATIONS

TABLE XVII

SIGNIFICANT CORRELATIONS AS VARIABLES CHANGES (ENTIRE GROUP)

Variable 1	Variable 2	N	r	Prob	R
Max Oxygen Intake	Self Satisfaction	22	-.426	.048*	
Fitness Category	Self Satisfaction	22	-.428	.046*	
Fitness Category	Family Self	22	-.429	.046*	
% Body Fat (Sum 4's)	Social Self	24	.441	.031*	
Weight Residual	Family Self	24	.486	.016*	
Weight Residual	Self Satisfaction	16	.504	.046*	
Max Breathing Capacity	Social Self	24	.463	.022*	
Diastolic BP	Self Criticism	24	-.404	.049*	
SRT	Identity	24	.445	.029*	
% Body Fat (Sum 4's)	Flexibility	24	.511	.017*	
Weight Residual	VJRT	23	.505	.014*	
Systolic BP	VJRT	23	-.523	.014*	
Fitness Category	VJRT	21	-.528	.013*	
SRT	VJRT	23	.503	.014*	
Max Oxygen Intake	VJRT	21	-.673	.0008***	
Max Oxygen Intake	Weight Residual	22	-.425	.048*	
Systolic BP	Vital Capacity	24	.543	.006**	

* significant at .05 level
** significant at .01 level
*** significant at .001 level

TABLE XVIII

SIGNIFICANT CORRELATIONS AS VARIABLE CHANGE (PARTICIPANTS)

Variable 1	Variable 2	N	r	Prob R
Flexibility	Self Criticism	11	-.662	.026*
Rest Heart Rate	Family Self	11	-.648	.031*
SRT	Total P	11	.841	.0012**
SRT	Behavior	11	.745	.008**
SRT	Identity	11	.658	.020*
SRT	Moral Ethical	11	.603	.049*
SRT	Personal Self	11	.662	.026*
SRT	Family Self	11	.661	.026*
SRT	Social Self	11	.651	.030*
VJRT	Personal Self	11	.607	.047*
% Body Fat (Nomogram)	Total P	11	.673	.023*
Max Oxygen Intake	% Body Fat (Nomogram)	11	-.641	.033*
Fitness Category	% Body Fat (Sum 4's)	11	-.745	.008**
Fitness Category	% Body Fat (Nomogram)	11	-.796	.003**
Max Breathing Capacity	% Body Fat (Sum 4's)	11	-.883	.0003***
Vital Capacity	Systolic BP	11	.703	.015*
Vital Capacity	Diastolic BP	11	.693	.018*
Fitness Category	VJRT	11	-.612	.045*
SRT	% Body Fat (Nomogram)	11	.735	.010**
VJRT	% Body Fat (Nomogram)	11	.640	.034*
VRJT	% Body Fat (Sum 4's)	11	.644	.032*
VJRT	Weight Residual	11	.606	.048*
Max Oxygen Intake	VJRT	11	-.727	.011*
Fitness Category	Max Breathing Capacity	11	.607	.047*

* significant at .05 level
** significant at .01 level
*** significant at .001 level

TABLE XIX

SIGNIFICANT CORRELATIONS AS VARIABLE CHANGE (NON-PARTICIPANTS)

Variable 1	Variable 2	N	r	Prob R
Flexibility	Personal Self	13	-.604	.028*
Rest Heart Rate	Total Variation	13	-.563	.045*
% Body Fat (Sum 4's)	Social Self	13	.603	.028*
Grip Strength	Double Product	11	.618	.042*
Max Breathing Capacity	Diastolic BP	13	.583	.036*
Grip Strength	VJRT	12	.629	.028*
Fitness Category	VJRT	10	-.638	.046*
Max Oxygen Intake	VJRT	10	-.819	.003**

* significant at .05 level
** significant at .01 level
*** significant at .001 level

VITA

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Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTS OF AN EXERCISE PROGRAM ON SELF CONCEPT AND PHYSICAL FITNESS ON OKLAHOMA STATE UNIVERSITY COMMISSIONED PEACE OFFICERS

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