To the Graduate Council:

I am submitting herewith a thesis written by Sara Jane Tinker entitled "Aerobic Fitness and Stress Perception." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Physical Education.

Don Franks, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:

The Graduate School

AEROBIC FITNESS AND STRESS PERCEPTION

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Sara Jane Tinker

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ABSTRACT

The purpose of this study was to determine if low, moderate, and high fit males and females would rate stressful life events with different intensities. Healthy volunteer college students (N = 60) were placed into one of six cells based on 1.5 mile run time and gender: (a) low fit males, (b) moderate fit males, (c) high fit males, (d) low fit females, (e) moderate fit females, and (f) high fit females. Stress perception was quantified by a "Perception of Stress" questionnaire assessing original and present stress for experienced events and projected stress for events not experienced. The questionnaire consisted of questions related to school, work, love and marriage, having children, family, residence, crime and legal matters, finances, and miscellaneous events. All ratings were based on a scale of 0-10, with 0 representing no stress and 10 representing very, very high stress. The results of the study indicated that females rated stressful life events significantly higher than males and that students with low and moderate levels of fitness had significantly higher stress ratings than those with the highest aerobic fitness level. The moderate fit subjects had significantly lower original stress ratings but were not significantly different on present and projected stress than the low fit subjects. In general there were no interactions between fitness and gender levels. However, females had a significantly greater decrease in ratings of stress events from the occurrence of the events until the present time.

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CHAPTER I

INTRODUCTION

The relationship between stress and illness is well accepted. For example, stress is typically viewed as one of the risk factors for coronary heart disease. Nevertheless, it is realized that one cannot build a life completely free from stress; it is therefore important to develop healthy ways of dealing with stress.

Stress has been defined as "the non-specific response of the body to any demand" (Selye, 1974, p. 27). According to the American Heart Association (AHA, 1977) it should not be inferred that stress is harmful or beneficial. On the other hand, Simeons (1961) supports the theory that the brain has not adapted to deal with the stress of twentieth-century life. Thousands of years ago an appropriate reaction to a great deal of life stress was the fight-or-flight response (Cannon, 1914). Consequently, to prepare the body for this fight-or-flight response certain physiological adjustments are made by the brain and central nervous system. The final result of these adjustments is a secretion of hormones which inevitably increase heart rate, blood pressure, sweat production, breathing rate, glucose production, and visual perception by dilation of the pupils (Morse and Furst, 1979). These physiological reactions by the body were appropriate when an individual encountered a wild bear. However, in today's world neither fighting nor running away are appropriate responses to many stressful events. Consequently, the body has made physiological adjustments

for a "coping response" which is no longer acceptable. When this situation exists frequently and for extended periods of time, the unused stress products may cause disease or irreparable damage to the body.

The primary focus of this study was one's perception of unpleasant stress events. For simplification purposes the solitary term "stress" was used. It is widely held that perception of an event affects emotions and reactions to that event. One could deduct that perception would influence the reaction to stress (i.e., if we perceive some event as stressful, then the event is stressful for us). Accordingly, any event such as physical activity which might alter one's perception of stress should be closely evaluated.

Authors of fitness textbooks (Sharkey, 1979) frequently list better ability to cope with stress as a benefit of regular exercise. Cooper (1982) also supports this concept, and this same benefit is often subjectively cited by the exercising population. However, there has been little data collected on physical exercise and our ability to cope with stress or physical activity and our perceptions of stress.

It has been reported (Reuven and Lazarus, 1975) that a change of focus is an effective means of dealing with stress. It seems this change of focus has some influence on our perception of the situation. Furthermore, the literature repeatedly suggests physical exercise as a beneficial means of using stress products produced by the body, and also as a change of focus away from the stress. It is therefore assumed that individuals who exercise on a regular basis and

demonstrate a relatively high degree of cardiovascular fitness would objectively perceive stress with less magnitude when compared with individuals who do not exercise regularly and exhibit a poor level of cardiovascular fitness.

Researchers (Horowitz et al., 1977; Dohrenwend et al., 1978; Dohrenwend, 1973) interested in stress and its relationship to illness have collected quantitative data with life event questionnaires. The experimenters indicated that in all items women rated events more stressful than men. It was hypothesized that this result may have been a reflection of social roles, in which women are encouraged to admit the stresses of life more openly than men.

Purpose

The purpose of this study was to assess differences in perception of stress of males and females with low, moderate, and high aerobic fitness. Subjects rated original and present stress for experienced events and projected stress ratings for unexperienced events. For the purposes of this study aerobic fitness was measured by the Cooper (1982) 1.5 mile run and perception of stress was measured by a questionnaire adapted from previous studies (Horowitz et al., 1977; Dohrenwend et al., 1978). (See Appendix A.)

Hypotheses

The hypotheses tested were as follows:

1. Females would exhibit higher scores than males on original, present, and projected stress with less change over time.

2. Low fit subjects would score higher than high fit subjects on original, present, and projected stress with less change over time.

No hypotheses were originated with reference to moderate fit subjects, the number of stresses experienced or the amount of time since the stresses occurred.

Significance of the Study

Many researchers (McPherson et al., 1967; Blair et al., 1979; and Selye, 1974) agree that one's perception of an event has an influencial role in the individual's stress reaction. Other experimenters (Collingwood and Willett, 1971; Folkins, 1976; Folkins, Lynch, and Gardner, 1972; Jasnoski and Holmes, 1981; and Knowal, Patton and Vogel, 1978) interested in chronic activity and psychological changes, have offered support for anxiety, tension, and depression reduction along with improvements in self-assurance, easy-goingness, confidence, self-concept, self-acceptance, body attitudes, state anxiety, self-esteem, and assertiveness with aerobic training. These studies have focused on aerobic fitness and anxiety scales, profile of mood states, personality inventories, and numerous beneficial indexes of psychological fitness. Although these psychological benefits of exercise are related to stress perception, the influence of aerobic activity on one's perception has not been the concentration of past studies. One intention of this study was to determine if there was support for differences in perception of stress between different fitness levels.

Other researchers (Horowitz et al., 1977; Dohrenwend et al., 1978; and Dohrenwend, 1973) interested in life event stress and its relationship with illness have collected stress ratings from a variety of populations. They concluded that females rated the life events more stressful than males. A second aspect of this study was to determine if there was additional support for differences in perception of stress between gender groups, and to determine if there were gender/fitness level interactions.

CHAPTER II

REVIEW OF LITERATURE

An investigation into the literature suggests there is a relationship between an individual's perception of emotional stress and his/her stress response. In fact, Sharpe and Lewis (1977, p. 32) define stress as "an individual's perception and assessment of the environment." It has been reported the physiological adaptations made by the body when exposed to stress are under the influence of the brain and central nervous system. The central hemispheres of the brain are presumed responsible for consciousness and thinking (Morse and Furst, 1979). It was implied that our thought processes and/or perceptions have an influence on the brain's activation of the stress response. Accordingly, it seems factors which affect stress perception need to be evaluated objectively.

Further investigation indicates physical exercise as a valid diversion from stress, thus changing our focus and influencing perception of the stressful event. Physical exercise has also been reported as a substitution for our ancestors' fighting and/or fleeing response. Accordingly, the influence of perception on the stress response, acute physical activity and chronic physical activity as appropriate sources of coping with stress will be discussed.

Perception and Response to Stress

Most people, professionals and the public, agree stress/anxiety cannot be eliminated from our lives; however, we can alter perception

and physiologic responses to reduce stress (Udelman, 1982). There is a general consensus that perception is the beginning of our emotions. Advocates of the cognitive behaviorism theory contend that human response is related to the way one visualizes or imagines he or she may respond. These theorists also profess that thoughts may be altered in a systematic and deliberate fashion (Williams and Long, 1983). According to these concepts, it appears an individual may modify an inappropriate stress response by visualizing a more suitable reaction. Barry (1967) asked 26 postinfarction patients, 350 college graduates, and 115 men in occupations considered highly creative to complete the Myers-Briggs Type Indicator. It was theorized that there are two reactions when using the mind. An individual either has some perception or awareness of the situation or a judgment or conclusion. Judging attitudes lead to a orderly, overcontrolled lifestyle while spontaneity and openness to experiences are afforded through the perceptive attitude. Data indicated that 88% of the postinfarction group was dominated by judging, while 74% of the college graduates and 55% of the creative men preferred perceptive attitudes.

Barry (1967) also examined two contrasting ways of perceiving (a) sense perception, awareness directly through the senses and (b) intuition, perception by the unconscious through assessment of the possibilities. Ninety-six percent of the postinfarction patients preferred sense perception, college graduates had no preference, and 97% of the the creative men preferred intuitive perception. The author further hypothesized that judging and sense perception lead to

inflexible, stereotype responses in emotionally arousing situations where more relenting behavior may be beneficial. These results concluded that the important consideration should be the way the world seems to be, and not the way it is in reality. Harland (1981) provided that one's perception of the situation determines or reflects the degree of threat of anxiety caused by the circumstances. Also, the way in which one "looks at" the circumstances determines how the individual may react to them.

Further evidence which supports the theory that perception affects an individual's response/adaptation to stress is presented in a study (Blair et al., 1979) evaluating the relationship between health states and stressful life events. Five hundred and four employees of the Liberty Corporation were evaluated by (a) the Cornell Medical Index (b) Stressful Life Events Questionnaire and (c) Body and Self-Cathexis Questionnaire which measured health states, stressful life events, and body/self concept, respectively. All measurement procedures were shown to have acceptable correlations of validity and reliability. The results indicated that life event stress has an influence on an individual's health, and this influence varied with the individual. Overall, subjects who reported higher frequency of stressful life events scored lower on the health state questionnaire, particularly if the stress had occurred within one year. However, it was suggested that the stress could have been predisposed by the illness and not a cause of the ill health state (Holmes and Rahe, 1967). In view of this fact, it may not necessarily be the frequency an

individual is exposed to stress or that individuals in ill health experience more life event stress, but the fact that these same individuals have a different perception of the situation.

Morse and Furst (1979, p. 44) state in Stress for Success that "trained perception can change potential distress in eustress" (i.e., healthy or good stress). Certainly there are stressful life-events which require all our coping abilities; however, when confronted with minor daily stress individuals frequently respond inappropriately, elevating the situation into a major stress event. The difference in responses is largely determined by a positive or negative perception (Morse, Furst, 1979). The importance of perception in responding to stress is further supported by the authors (1979, p. 370) when they state, "The stressor effects depend not so much upon what we do or what happens to us but on the way we take it."

Greenberg (1983) supported the theory that an individual can alter perceptions of emotional stress by de-emphasizing the negative and focusing on the positive aspects of the situation. He used the term selective awareness. The underlying theory that perception affects our stress response is supported. Accordingly, it seems an individual's attempt at reducing stress responses should focus on altering perceptions of the event since stress is an inevitable part of life we can escape only by death (Selye, 1976b).

Acute Exercise and Response to Stress

Greenberg in Comprehensive Stress Management (1983) suggests exercise as a source of stress management. He presents exercise as a

method for "using" the stress products before they have negative effects on an individual's health. Furthermore, Greenberg indicates exercise redirects your attention from the stress to the exercise.

Reuven and Lazarus (1975) also reported diversion and/or distraction of an individual's attention away from the stress as a successful means of coping. Activity unrelated to the stress was named as a primary source of diversion and also as a means of discharging the physiological products mobilized by the body due to stress. It has been stated in American Pharmacy (1979) that in order for exercise to be an effective mode of reducing stress a person's perception of exercise must fit that description. In other words, one must believe exercise is an effective source of stress reduction and that they feel better when exercising. Accordingly, individuals feeling their exercise program is a real chore may not be reducing their stress at all.

The National Institute of Mental Health suggested activities such as running and playing tennis as methods for "working off stress" (NIH, 1977). Others (American Pharmacy, 1979) suggested that individuals under stress generate extra amounts of adrenalin and catecholamines. The muscular activity in exercise serves to attach the free-floating hormones to the muscle receptor sites--producing relief of tension.

A single dose of exercise of low intensity may reduce electrical activation of the muscles by 20 to 25%. In a double-blind study, DeVries (1982) tested different exercise intensities (40% and 60% of maximum) and a 400 mg dose of a tranquilizer and placebo. Ten

elderly subjects who considered themselves to have problems with anxiety and tension were randomly chosen from sixty volunteers. Each subject received all treatments at random on three different occasions. Exercise consisted of walking at a heart rate of 100 and 120 beats per minute. While tranquilizer treatment consisted of a 400 mg intake of meprobamate and 400 mg of a placebo. The results indicated that exercise of the appropriate type and intensity had greater effects on relaxing the musculature than the tranquilizer. In summation DeVries stated, "Clearly exercise can bring about a very significant tranquilizer effect--one which may do much to alleviate the uptight state which seems to have become such an ubiquitous problem in the overstressed society in which we live today" (DeVries, 1982; p. 5).

Thaxton (1982) has also looked at physiological and psychological effects of short-term exercise addiction on habitual runners, and assessed positive changes in anxiety/stress levels. He used 33 subjects from college faculty, staff, and students who ran regularly. The subjects were divided into a control group (habitual runners who continued to run) and an experimental group (habitual runners who were deprived of running). Both were pretested and then posttested for vigor, fatigue, depression, and anxiety by the Profile of Mood States and GRS while performing a mental task. The results indicated that on an objective anxiety/stress test scores decreased for the group who continued to run and anxiety levels increased for the experimental group who were deprived of running. The authors concluded that running might serve as a positive outlet for the release of tension.

Chronic Physical Activity and Response to Stress

Several studies (Hoagland, Bergen, Bloch, Elmadjian, and Gibree, 1955; Docktor and Sharkey, 1971; Raymond, Sode, and Tucis, 1972) support the theory that habitual physical exercise trains an individual's stress adaptation mechanism. Docktor and Sharkey (1971) evaluated catecholamine excretion in five nonathletic males during a five week treadmill training program. It was hypothesized that catecholamine levels would increase as the stress of the physical exercise increased and would tend to decrease as training progressed. This decrease would reflect a decrease in the adrenaline levels and mental stress aspect of the work load. Subjects were required to walk on the treadmill at 3.5 mph, with the grade increasing 1% per minute, until the heartrate reached 180 beats per minute. Effort was subjectly evaluated with a rating scale of perceived exertion. Vanilmandelic acid was taken as a measure of urinary catecholamine excretion by 3 hour post exercise samples. The data inferred that catecholamine excretion was reduced with progressive exercise training.

Hoagland et al. (1955) has conducted studies related to adrenal stress response in men performing a pursuit meter task. This testing protocol involved an airplane type stick and rudder pedals which direct a 3½ inch bar of light. The task required the subject to keep a moving target eight feet away covered by this bar of light. A great degree of coordination is required for a good score which is determined by what percent of time the operator is on target. Adrenal response was measured by 17 ketosteroids with a pretest control and

posttest urine sample. Four teams of five men were tested once per week in performances lasting 2 or 3 hours for eight to ten weeks. The results indicated that more active, less fatigued men have a more appropriate adrenal response to stress.

Raymond, Sode, and Tucis (1972) interested in adrenocortical response to nonexhaustive exercise, had 12 fit men walk on a treadmill for thirty minutes at 3 mph and 5% grade. Pre and post urinary samples indicated a reduction in serum cortisol in ten of the subjects. In contrast, two subjects, with apprehension about the exercise, had an increase in serum cortisol. All changes produced by the exercise where evident 1 hour after the exercise. From this study it appears one's attitude or perception concerning the activity is an important factor underlying adrenocortical response to the exercise. Non-fatiguing exercise appears to lower serum cortisol at least in individuals who feel comfortable and exhibit little emotional discomfort with exercising.

It has been concluded from these studies (Michael, 1957), that physical exercise seems to increase the sensitivity of the adrenal glands to secrete these same hormones with a lower stimulus, and thus lessens the response and the adjusting time frame. As a result, there appears to be some "carry over" from adaptation to physical exercise to emotional stress coping. Consequently, the subjective sense of "well-being" or "better coping ability" reported by exercising individuals may have some objective basis; there is certainly a need for further study in this area.

Others (Heywood, 1978) report that physical activity may be classified as relaxing since it serves to reduce tension, and the stress of everyday life. Selye (1976a) advised physical activity as a diversion away from the stress. He suggested a voluntary alteration in activity when completion of a task is impossible. For example, swimming would be an appropriate alternative when completing a math problem is unlikely.

Trained individuals respond to emotional stress with less hormonal release by the adrenal glands as opposed to untrained individuals (Morse and Furst, 1979). Selye (1976a) also cites this as a "cross-resistance effect" in that an individual's hormonal defense system is conditioned to resist the stress of exercise, and thus other stress such as emotional stress. Furst (Morse and Furst, 1979) reported he does more positive things to counter stress, such as running six miles every day. He further listed exercise as a method of stress diversion in the Personalized Assessment Stress System.

A study conducted at Cooper's Institute for Aerobics Research (Cooper, 1982) reported that subjects who began a regular aerobics program, along with diet alteration, rated their new ability to handle job stress more positively. Furthermore, this same group of subjects were rated with a significant improvement in dealing with job stress by their employers, compared to the nonexercising control group.

A study by Schwartz, Davidson, and Goleman (1978), broke anxiety/stress down into two components, cognitive and somatic, and attempted to evaluate such a breakdown by assessing physical activity

(a somatic process) as opposed to meditation which is a cognitive procedure. The researchers wanted to look at the reduction of each component of anxiety and its relation to two modes, activity and meditation, for reducing these anxious feelings. Seventy-seven subjects were divided into two experimental groups. Forty-four subjects in group one regularly attended exercise class three times a week while 33 subjects in the second group consistently practiced passive meditation once a day. The median time of participation in these activities was 6 months. All subjects were asked to complete the Cognitive-Somatic Anxiety Questionnaire. The study concluded that the regular practice of physical exercise was an effective mode for reducing somatic anxiety.

McPherson et al. (1967) looked at cardiac patients, "normals", and a control group to assess psychological changes such as mood states and anxiety levels before and after an exercise program. Subjects were broken down into five groups: Cardiac Exercisers, Cardiac Control Group, Normal Exercisers, Normal Controls, and Experienced Exercisers. Prior to the 24 week exercise program began all subjects were objectively assessed on such parameters as personality, mood state, anxiety, tension, depression, and aggression. The cardiac subjects were more tense, emotional, aggressive, and hurried, which may have been due to the trauma of the myocardial infarction often depriving one of a strong self-image. Forssman and Lindegard (1958) have suggested that such an infarction causes one to suffer from severe and prolonged anxiety, depression, and neurotic symptoms due to this crush of the self-image. These psychological measures

were readministered to all subjects after the program. Scores were assessed for both short term and long term changes. The following conclusions were made from this evaluation: All three exercising groups experienced a reduction on anxiety scores, with the cardiacs experiencing the greatest change; the exercise groups were more carefree, with the nonexercising groups reporting more anxiety/stress. Although the cardiac exercisers showed greater changes, all exercising groups demonstrated an increase in happiness, confidence, optimism, self-assertiveness, and cheerfulness. In contrast, the normal controls showed either an increase in anxiety or remained unchanged. The researchers felt the increase in self-confidence led to a reduction in tension, stress, and anxiety as the subjects reported they felt better, had a better outlook on life, were more tolerant, experienced less tension, and were less anxious after the exercise program. However, the authors also suggested that the recreational group activity and not the actual exercise itself could have also been a factor in reducing the anxiety levels of the subjects.

These findings are further supported by Jasnoski and Holmes (1981) who conducted a study on aerobic training and changes on personality functioning. One hundred and three undergraduate students were placed in a fifteen-week aerobic conditioning class at the University of Kansas. The purpose was to assess aerobic capacity and personality change due to the described protocol. The results indicated that better personality functioning, increased self-assurance and decreased tension were reliably connected with changes in fitness

levels. These authors also suggested that the socialization of the aerobic class could have influenced the positive psychological changes.

Other studies have also looked at fitness levels and its relationship to stress in individuals. However, changes in heart rate, muscle tension, and blood pressure are often used as objective measures for change in stress levels as opposed to questionnaires. One such study (Cox, Evans, and Jamison; 1979) evaluated aerobic power and its relationship to psychosocial stress response. Forty-one male and 29 female subjects age 18-26 were given a submaximal bike test to determine aerobic capacity and informed that the purpose of this experiment was to investigate relationships among fitness, intelligence, and heart rate. At a designated time subjects returned to complete modifications of the arithmetic, comprehension, and information subtests from the WAIS. Upon arrival subjects were asked to complete a researcher evaluation questionnaire. This questionnaire was designed to measure subject aggression toward the experimenter. Next, subjects were seated and connected to a polygraph for objective heart rate measurement. Following a five minute rest, the WAIS was completed. Afterwards, subjects were told they did poorly regardless of how they performed. The Stroop Color-Word Task was also incorporated to frustrate the subjects. This exercise consists of naming the colors of ink in which different colors are printed. For example, the word "blue" printed in red ink required the response "red." Subjects were informed it would be easy to complete in the allotted time but periodically were stopped and verbally reprimanded by the experimenter for slowness, wasting

time, and unconcern for his experiment. This task concluded with the researcher yelling at the subjects as he exited through the door.

Heart rates were counted for three one minute periods: the last minute of rest, last minute of the Stroop test, and the last minute of recovery after testing. The results suggested that aerobic power was significantly ($p < .001$) related to how quickly subjects recover from stress. The stress heart rate was highest for all subjects, but subjects with high aerobic power recovered more quickly from the effects of the stressors than those with low aerobic power. Subjects who were more stressed also required more time to recover. The researcher suggested that it is reasonable to assume a person who recovers quicker will experience less stress over a long period of time. For individuals living a life which includes repeated exposure to stress faster recovery would have considerable benefits. Consequently, it would appear that increasing aerobic power would be a valuable asset for recovering and dealing with stress.

In addition, a study by Petrie and Rotheran (1982) has revealed that (at least in firefighters) self-esteem and assertiveness were significantly related to one's ability to handle stress. One hundred and six men employed by the Fire Department were asked to complete the Anxiety Scale Questionnaire, Tennessee Self-Concept Scale, and Adult Self-Expression Scale. The purpose of the study was to identify personal characteristics which may assist the employee in coping with a highly stressful job. The analysis of data indicated a strong correlation ($p < .01$) between a person's self-esteem, assertiveness, and

experiences of stress. Apparently assertiveness contributed to self-esteem and self-esteem is directly related to stress. It would appear that if physical activity is a useful tool for improving assertiveness and self-esteem and these are important factors in dealing with stress one could lower his or her stress level through physical activity.

Other studies (Collingwood and Willett, 1971; Folkins, Lynch, and Gardner, 1972; Folkins, 1976; and Kowal, Patton, and Vogel, 1978) support the hypothesis that various forms of physical activity may lead to relieved tension, increased energy level, higher self-esteem, increased assertiveness, and better mood states.

Collingwood and Willett (1971) studied the effects of physical training on body attitude, self-acceptance, and positive self-attitude. Obese males age 13 to 16 were administered the Bills Index of Adjustment and Values and Body Attitude Scale along with a series of physical fitness assessments. After completing an intense (e.g., ten hours per week) fitness program of jogging, swimming, and calisthenic exercises, the subjects were posttested by the same pretest criteria. Comparison of the first and second scores demonstrated a significant increase on the self-concept dimension and self-acceptance scale, along with a more positive body attitude. A significant improvement in fitness was also evident in all subjects.

Another investigation (Folkins, Lynch, and Gardner, 1972) interested in the possibility that improvements in physical fitness could be associated with positive psychological changes included 84 subjects enrolled in physical activity classes: male joggers, female joggers,

male control, and female control. All subjects were issued two scales from the Adjective Check List; the first scale measured self-confidence and personal adjustment and the second scale assessed anxiety and depression. Also, scores from the Multiple Affect Adjective Check List were used to determine ability to handle work. The experimental group was assessed for fitness measures by the 1.75 mile run time and resting heart rate. The control group was enrolled in golf or archery; there was an assumption that no fitness change would be acquired by these subjects. After 29 sessions of jogging by the experimental group, posttest measures were conducted. It was inferred from these data that cardiac efficiency was improved and running times decreased for the experimental group. Also, resting heart rate decreased for the experimental females. Psychological profiles suggested a high correlation between the improvements in physical and psychological fitness. Experimental females were less physically fit, more anxious, depressed, less self-confident and less well adjusted according the between group comparison of the pretest scores. Consequently, improvement was higher in all areas for this particular group. Those individuals with the greatest improvement in running time demonstrated the least depression, most confidence, greatest personal adjustment, most efficiency at work and most restful sleep. Also, as heart efficiency increased the subjects become less anxious. It was hypothesized by the researchers that these changes may be due to feedback from the musculature due to reduced muscle activity and tension in the exercising subjects. Further speculation

suggested that physically fit individuals respond to stress with an increased stroke volume as opposed to increased heart rate. This method of accommodating stress is associated with lower levels of adrenalin in the bloodstream and fewer stress-associated cues such as a racing heartrate.

In another study Folkins (1976) examined the relationship between improvements in physical and psychological fitness in high risk coronary heart disease males. Forty subjects were matched on age, occupation, and risk factors and placed in either an exercise group or control group. Physical fitness was measured according to blood pressure, lipid measurements, and cardiovascular functional capacity. Psychological measure were taken according to the anxiety and depression scales from the Multiple Affect Adjective Checklist. Self-confidence, personal adjustment, and body cathexis were also assessed. The exercise group participated in activity 3 times a week for 12 weeks. All subjects were asked not to alter diet, smoking, or treatment of hypertension and controls were asked to refrain from an increase in exercise. Data analysis revealed a significant increase for the exercising group in physical work capacity and maximal oxygen intake. There was also a high correlation between reduced anxiety and depression for this group.

Kowal, Patton, and Vogel (1978) investigated psychological states before and after basic training in 200 male and 200 female recruits. Half of the subjects were randomly chosen for pretesting and the remainder were posttested. Fitness was measured by skinfold, weight,

and submaxal bike ergometer test and psychological states were determined by (a) Spielberger State-Trait Anxiety Inventory (b) Profile of Mood States (c) Eysenck Personality Inventory (d) Physical Estimation and Attitude Scale and (e) Personal History Inventory. Improvements in aerobic fitness, anxiety, mood states, and self-concept for males were significantly greater after training. It appeared the training program for females was not intense enough to produce change since there were no improvements in their fitness or psychological states.

The majority of studies focusing on anxiety/stress and fitness levels have been carried out on humans with some sort of pretesting/posttesting questionnaire and/or heart rate response, muscle tension change, or blood pressure change. However, one study (Tharp and Carson, 1975) evaluated changes in the emotionality of rats following chronic exercise. It was hypothesized that animals subjected to physical exercise would be less emotionally upset when faced with the stress of some novel environment. Accordingly, five groups, Controls, Runners, Walkers, Swimmers, and Waders, were studied to look at the effect of endurance training on stress reactions. The Runners and Swimmers were trained for eight weeks, one hour per day, five days per week, on programs which resulted in cardiac hypertrophy and cardiac bradycardia. The Runners were progressively trained on a motorized rodent treadmill until they were running 1 mph and the Walkers walked at .1 mph for ten minutes. The Swimmers were attached with an additional overload of 29% of their body weight and forced to swim in a 55 gallon aquarium filled with

16 inches of water. The Waders, on the other hand, were placed in 4 feet 2 inches of water for ten minutes a day. The Walkers and Waders received the same psychological stimulation as if actually walking or swimming, but were not physically trained. After the eight week period, a tunnel emergence test and an open field test were given to determine the stress reaction of these rats. The Tunnel Emergence Test consisted of a 36 inch long, black hallway with a cage much like the rat's home at the end. Total emergence was determined by the number of seconds it took the subject to move his or her entire body down the hallway and outside the tunnel. The purpose behind these tests was to assess emotional reaction to stress by observing the rat in a dark, unknown, frightening environment and timing for emergence and exploration. The exercised rats explored more area in a novel environment and took less time to begin exploration than control rats. The results of this study concluded that physical exertion allows greater adaptive resources to deal with the stress of a novel environment.

It would seem, as reported by Mobily (1982), that exercise can be a useful coping strategy in dealing with apprehensive feelings for exercise may tend to reduce the symptoms of the stress. Furthermore, it could be implied that physical exercise is an appropriate form of unrelated activity which both diverts attention away from the stress and also aids in discharging the products secreted by the body as a part of the stress response. Most any fitness related book lists "better ability to deal with stress" as a benefit from regular exercise,

exercising individuals cite on numerous occasion "stress reduction" as an underlying factor in their decision to indulge in physical activity, and many researchers, professionals, and lay-persons alike support these subjective statements. Other researchers (McPherson et al., 1967; Blair et al., 1979; and Selye, 1974) noted the important role one's perception of the event has in determining the individual's stress reaction. However, there has been little evidence in the literature which suggests physical exercise reduces the stress response by altering one's perception of the event. This lack of objective support is not due to lack of interest, however, but primarily related to the need for an infallible, objective, quantitative measure of the subjective feelings.

Objectifying the Measurement of Stress

Studies (Holmes and Rahe, 1967; Ruch and Holmes, 1971; Dohrenwend et al., 1978) interested in a quantitative measure of stress and its relationship to onset of illness have used questionnaires where subjects rate life stress on a numerical scale. However, certain methodological questions were raised as to the validity in terms of individual variation, reliability of the reports, and the significance of recency or remoteness and occurrence of the stressful event.

As a result, Horowitz et al. (1977) conducted a sequence of studies to answer these questions. The first study of the series focused on the time variable and involved a 34 item form completed by 119 subjects. The statements were subdivided into seven groups as

follows: deaths, separations, arguments with important persons, major threats to self or self-image, minor threats to self or self-image, threats to material well-being, and residual life changes or critical moments not other wise categorized. The major change in this form from previous forms was the addition of columns for time. Subjects indicated if the event had occurred within one week, one month, six months, one year, or three years from the present time. Events experienced by the subjects were circled and rated first with unexperienced events left for last evaluation. The objective was for the subject to estimate how stressful an event was for them now with reference to occurrence at a given time in the past. It was concluded from this first study that stress scores decrease in a gradual slope as time passes after the stressful event. Further conclusions are as follows: women rated all items as more stressful than men; younger persons rated deaths, separations, and major threats to self-image more stressful than older subjects (i.e., over thirty years of age); experience of an event was significant only with reference to minor threats to self-image and threats to material well-being; deaths, separation, and major threats to self were not statistically significant with reference to experienced or not experienced in the initial time period; nevertheless, subjects who had experienced these events rated the event more stressful over time (i.e., individuals experiencing an event such as breakup with a lover believed it was more stressful one year later as opposed to those individuals who had never experienced this event).

The third study of this series was designed to measure test-retest reliability of these life event forms. Four different sample groups (i.e., psychiatric outpatients, medical personnel, subjects of coronary risk factors study, and legal parents of child psychiatric outpatients) were used in the study. Each group was asked to complete the 34 item short form, or 143 item long form, or both. Retesting was done six weeks later, or one year later, or at both intervals. Three of these studies reported moderately high correlations for reliability (i.e., .71, .82, and .81 with $p < .001$). However, the last study which compared responses of married couples concluded that many statements such as argument with spouse and financial problems were to ambiguous for consensus with reference to items checked as experienced, not experienced, and at what time interval(s).

The researchers further reported the deflections from a 1.0 level are due to subjects' forgetting, deception, and/or inaccuracy in completing the forms and not due to the instrument itself. For this reason reliability may vary from study to study and these high correlations reported should be regarded with caution. Furthermore, these scores are reliable for group means only and not for comparison between individual subjects. Future studies may control for forgetting and ambiguity by grouping items in logical sets which tend to probe memory and also by using longer questionnaires respectively.

CHAPTER III

METHODOLOGY

Subjects

Volunteer subjects, with no known cardiovascular disease, enrolled in the activity program at the University of Tennessee, Knoxville, were selected based on two assigned variables: (a) high, moderate, or low aerobic fitness and (b) gender. These variables resulted in six different cells: (a) low fit males (b) low fit females (c) moderate fit males (d) moderate fit females (e) high fit males and (f) high fit females. The cell frequency of ten resulted in a total of sixty subjects with an age range of 18-25.

In an attempt to reduce performance bias, all participants were under the impression testing was aimed at obtaining fitness and stress norms for college students. Following data collection, individual results were available to interested subjects.

Assessment of Aerobic Fitness

Subjects participated in the 1.5 mile run adapted from Cooper (1982) for fitness assessment. Testing was continued until 30 females and 30 males met the required fitness criteria (Table 1).

The run took place at Tom Black Track at the University of Tennessee with time recorded to the nearest second. After completing the run all subjects recorded his or her name and run time with the researcher. Each volunteer fulfilling the assigned variable criteria was

Table 1

Aerobic Fitness Criteria

Fitness category	Gender	Age
		18-25
Low	Men	14:00 or longer
	Women	17:00 or longer
Moderate	Men	11:00 - 13:00
	Women	14:00 - 16:00
High	Men	10:00 or less
	Women	13:00 or less

then assigned a code number (see Appendix C). This code was used for the duration of the study in an attempt to retain the confidentiality of the subjects' identities. All subjects were aware of this procedure and realized their names and code numbers would be retained in researcher's advisor's office unaccessible to any other individual except the researcher.

Assessment of Stress Perception

Subjects completed a 75 item questionnaire (Appendix A) rating perception of stress. Prior to completing the questionnaire the subjects were read a synopsis on stress (Appendix B) and reminded that their identity would remain confidential. The questionnaire consisted of six columns. The first column lists the "Topic Area and Event" and is subdivided into nine categories: School, Work, Love and Marriage, Having Children, Family, Residence, Crime and Legal Matters, Finances, and Miscellaneous. The next column is

"Experienced," followed by "If Yes, recency (months)," "Stress Rating 0-10," and "If no, projected Stress."

Subjects were given a brief description of the various physiological and psychological reactions to a stressful life event and then asked to complete the questionnaire. The statement under "Topic Area and Event" was read first; the subject then indicated if he/she had experienced this particular event by circling "yes" or "no" under the "Experienced?" column. If the individual had experienced the event he/she proceeded to the third column and indicated in months approximately how long ago it occurred. At this time the subject advanced to the Stress Rating Column 0-10 and rated how stressful the event was for him/her when it happened under "then," and how stressful he/she continues to be due to this same event under "now." If the individual had not experienced an event, he/she moved to the last column (e.g., "If no, projected stress") and indicated how stressful he/she feels it would be for him/her if it occurred now or in the near future. Rating was on a scale from 0-10, with zero representing no stress, 1 representing very, very low stress, and 10 representing very, very high stress.

The task was to quantitatively estimate (a) how stressful these life events were when they occurred, (b) how stressful they continue to be, or (c) how stressful these life events would be if experienced in the future. The number of months since the stress event was included based on the assumption that the stress rating would decrease over time (Horowitz et al., 1977). The only identification on the

questionnaires was the preassigned code number given to each subject after the fitness assessment.

Statistical Procedure

The effects of gender and aerobic fitness on past and future perceptions of stressors was determined by a 2x3 analysis of variance on the ratings of stress at the time the event happened and the rating of unexperienced stressors. The gender and aerobic fitness effects of present ratings of stress for experienced stressors were determined by a 2x3 analysis of covariance, with the rating of present stress being the criterion measure and the number of months since the event being the covariate. The effects of gender and aerobic fitness on change in ratings of stress from the time event occurred until present was also determined by a 2x3 analysis of covariance, with the present rating of stress (e.g., "now") being the criterion measure and the original stress rating (e.g., "then") being the covariate. Gender and aerobic effects of original ratings of stress were also determined by a 2x3 analysis of covariance, with the rating of original stress being the criterion measure and the number of months since the event occurred being the covariate. When a significant difference was found for the fitness main effect the Newman-Keuls Post Hoc comparison was conducted to reveal where the differences were located. Generalizations from this study were made at the $p < .10$ level.

CHAPTER IV

RESULTS AND DISCUSSION

Results

The purpose of this chapter is to present the analysis of collected data. Mean scores were calculated for each subject (N = 60) on all of the stress ratings in the following categories: (a) original stress of experienced events, (b) present stress due to the same event, (c) projected stress for events the subject had not experienced, (d) the number of stresses experienced, and (e) time since the stress occurred (Table 2). Each of the three fitness groups (i.e., low, moderate, and high fit) contained 10 females and 10 males. The raw data are included in Appendix D.

Original Stress

There was not a significant interaction present for the ratings of original stress, but there were significant main effects of gender and fitness (Table 3). Analysis of the fitness differences (Table 4) revealed that low fit and moderate fit groups had significantly higher stress ratings than high fit subjects, and that the low fit group had a significantly higher rating than moderate fit groups.

Because original stress scores were considered to be influenced by the recency of the stresses, the analysis of covariance seemed most appropriate as a statistical control for differences in time since the

Table 2

Means and Standard Deviations for Reported Stress Ratings

Fitness Level	Original Stress	Present Stress	Projected Stress	Number Stress Experiences	Time Lapse of (months)
Low					
Females (n = 10)	7.93 ± .94*	2.55 ± 1.84	8.10 ± .75	10.60 ± 5.97	10.35 ± 9.63
Males (n = 10)	7.38 ± 1.48	2.49 ± 1.74	7.61 ± 1.11	13.70 ± 6.80	25.41 ± 20.31
Moderate					
Females (n = 10)	7.62 ± 1.07	2.09 ± 2.16	7.83 ± .72	15.10 ± 6.28	13.22 ± 6.76
Males (n = 10)	6.02 ± 1.40	3.42 ± 2.41	7.01 ± .67	16.30 ± 9.64	10.44 ± 9.74
High					
Females (n = 10)	6.02 ± 1.06	1.20 ± .89	7.10 ± .78	13.80 ± 3.58	19.32 ± 13.83
Males (n = 10)	5.59 ± .99	1.64 ± 1.04	6.38 ± 1.18	12.20 ± 4.39	15.15 ± 6.70
Total (n = 60)					

*Mean ± Standard Deviation.

Table 3

Analysis of Variance for Original Stress

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F	P
Fitness (A)	34.380	2	17.190	12.421	<.001
Gender (B)	11.590	1	11.590	8.374	.005
A x B	4.620	2	2.310	1.669	.196
Error	74.737	54	1.384		
Total	125.327	59			

Table 4

Newman-Keuls Test for Comparison of Original Stress between Fitness Levels

Means	A Low Fit	B Moderate Fit	C High Fit
	7.66	6.85	5.81
A--7.66		3.07*	7.03*
B--6.85			3.95*
C--5.81			

*p < .10.

stresses occurred. This procedure showed the same results (Tables 5 and 6); thus the gender and fitness differences could not be attributed to differences in time since the stress event occurred.

Present Stress

There was not a significant interaction or gender difference for present stress scores (Table 7). There were no significant differences between male and females on present ratings of stress, but females had greater reduction in stress ratings from original to present than did males.

The low and moderate fitness groups were significantly higher than the high fit group but not different from each other (Table 8). These same results were found when time since the stresses occurred was statistically controlled (Tables 9 and 10).

When analyzing present stress ratings controlling for original stress ratings (Table 11), females had a greater reduction in stress ratings from original to present than did males. Generally there were decreasing changes in stress ratings with increasing levels of fitness except for moderate males, who had very low change, which caused a significant interaction.

Projected Stress

There was not a significant interaction for projected stress, but significant gender and fitness main effects were disclosed (Table 12). Females rated stress events significantly higher than males.

Table 5

Analysis of Covariance for Original Stress and Time

Source	Adjusted Sum of Squares	Adjusted Degrees of Freedom	Mean Squares	F	P
Fitness (A)	34.367	2	17.188	12.190	<.001
Gender (B)	11.475	1	11.475	8.138	.006
A x B	4.514	2	2.257	1.601	.209
Error	74.734	53	1.410		
Total	125.099	58			

Table 6

Newman-Keuls Test for Comparison of Original Stress/Covariate Time between Fitness Levels

Means	A Low Fit	B Moderate Fit	C High Fit
	7.66	6.85	5.81
A--7.66		3.05*	6.97*
B--6.85			3.92*
C--5.81			

*p < .10.

Table 7

Analysis of Variance for Present Stress

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F	P
Fitness (A)	20.009	2	10.005	3.210	.047
Gender (B)	4.665	1	4.665	1.497	.224
A x B	5.303	2	2.651	.850*	
Error	168.303	54	3.117		
Total	198.280	59			

* P value not reported for F < 1.0.

Table 8

Newman-Keuls Test for Comparison of Present Stress between Fitness Levels

Means	A Low Fit	B Moderate Fit	C High Fit
	2.49	2.75	1.42
A--2.49		.66	2.71*
B--2.75			3.37*
C--1.42			

*p < .10.

Table 9

Analysis of Covariance for Present Stress and Time

Source	Adjusted Sum of Squares	Adjusted Degrees of Freedom	Mean Squares	F	P
Fitness (A)	19.080	2	9.540	3.009	.056
Gender (B)	4.368	1	4.863	1.534	.218
A x B	4.368	2	2.184	.689*	
Error	168.037	53	3.171		
Total	196.348	58			

*P value not reported for F < 1.0.

Table 10

Newman-Keuls Test for Comparison of Present Stress/Covariate Time between Fitness Levels

Means	A Low Fit	B Moderate Fit	C High Fit
	2.50	2.73	1.43
A--2.50		.57	2.69*
B--2.73			3.57*
C--1.43			

*p < .10.

Table 11

Analysis of Covariance for Present Stress and Original Stress

Source	Adjusted Sum of Squares	Adjusted Degrees of Freedom	Mean Squares	F	P
Fitness (A)	7.180	2	3.590	1.432	.246
Gender (B)	17.561	1	17.561	7.005	.010
A x B	12.834	2	6.417	2.560	.085
Error	132.872	53	2.507		
Total	170.447	58			

Table 12

Analysis of Variance for Projected Stress

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F	P
Fitness (A)	12.654	2	6.327	7.979	.001
Gender (B)	6.794	1	6.794	8.567	.005
A x B	.287	2	.143	.180	
Error	42.840	54	.793		
Total	62.575	59			

The low and moderate fit groups were significantly higher than the high fit group, but were not different from each other (Table 13).

Mean Time Since Stress

An analysis of variance (Table 14) revealed no significant main effects for this variable, however, there was an interaction. This resulted from the extremely high score reported by the low fit males and the very low score indicated by the low fit females evidenced in Table 15.

Number of Stress Experiences

There were no significant main effects or interaction for the number of stress experiences. Results are disclosed in Table 16.

Summary of Results

As originally hypothesized, females rated original stress higher than males regardless of their fitness level. Also, the low fit subjects reported the highest original stress score when compared with the moderate and high fit subjects. The moderate fit group also reported a higher original stress score than the high fit group. These hypotheses were further supported when the same results were found on original stress scores adjusted to account for differences in recency of stresses. The hypotheses that females would rate original stress higher than males and low fit would rate original stress higher than high fit groups are accepted.

Table 13

Newman-Keuls Test for Comparison of Projected Stress between Fitness Levels

Means	A Low Fit	B Moderate Fit	C High Fit
	7.85	7.42	6.74
A--7.85		2.16	5.58*
B--7.42			3.42*
C--6.74			

*p < .10.

Table 14

Analysis of Variance for Time Since Stress

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F	P
Fitness (A)	441.136	2	220.568	1.501	.230
Gender (B)	109.485	1	109.485	.745*	
A x B	1149.531	2	574.766	3.910	.025
Error	7937.681	54	146.994		
Total	9637.833	59			

*P value not reported for F < 1.0.

Table 15

Mean Scores for Time

Fitness Level	(N)	Time (months)
Low		
Females	10	10.35 ± 9.63
Males	10	25.41 ± 20.31
Moderate		
Females	10	13.22 ± 6.76
Males	10	10.44 ± 9.74
High		
Females	10	19.32 ± 13.83
Males	10	15.15 ± 6.70

Table 16

Analysis of Variance for Number of Stress Experiences

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F	P
Fitness (A)	137.433	2	68.717	1.674	.195
Gender (B)	12.150	1	12.150	.296*	
A x B	55.900	2	27.950	.681*	
Error	2216.701	54	41.050		
Total	2422.184	59			

*P value not reported for F < 1.0.

There were no significant differences in scores for present stress between males and females. When analysis of covariance was used to statistically control for initial differences in time these same results were supported. A second covariate, original stress, was next included in the analysis. This resulted in significant gender effects with females consistently exhibiting a greater reduction in stress ratings from original to present than males.

Present stress was significantly higher for the low and moderate fit groups when originally compared to the high fit group and also when the covariate of time was introduced. When original stress was partialed out present stress scores came closer together for all groups, and there was no significant difference for fitness effects. Consequently, there appeared to be a general decrease in stress ratings as fitness levels increased except for moderate fit males who had very little change and caused the interaction.

The hypothesis that females would rate present stress higher than males and low fit would have a greater change in present stress are not supported. The hypothesis that low fit would have a higher rating on present stress than the high fit group was supported. The hypothesis that females would have less change in stress over time was rejected.

Females consistently rated projected stress higher than males. Also low fit and moderate fit subjects rated projected stress higher than the high fit group. The hypotheses that females would rate projected stress higher than males and low fit would rate projected stress higher than high fit groups are accepted.

Discussion

Stress Perception and Gender

Investigators (Horowitz et al., 1977; Dohrenwend et al., 1978) interested in stress and its relationship to illness have indicated that females rate items on life event questionnaires more stressful than males. The collected data from this study generally supported these results. Although the hypothesis that females would rate present stress higher than males was not supported, ratings of both original and projected stress were significantly higher for females than males. Horowitz et al. (1977) suggested that females were more acknowledging of their cognitive and emotional responses to stressful life events. The differences in gender response to stress, therefore, were not presumed to be due to a greater vulnerability to life event stress by females, but primarily due to the different social roles encountered by males and females.

Evaluation of present stress ratings and gender effects suggested that females had a greater reduction in stress ratings from original to present than did males. This observation could be related to the assumption that females are more avowing concerning their reactions to the stressful events they encounter. If females are, in fact, more acknowledging of their responses to stressful events, this candor may function as a catalyst for relieving the stress response.

Stress Perception and Aerobic Fitness

One intention of this study was to determine if there was support for differences in perception of stress between different fitness levels.

The results suggested there are differences in stress perception with different fitness levels. Many researchers (Collingwood and Willett, 1971; Folkins, Lynch, and Gardner, 1972; McPherson et al., 1967; and Knowal, Patton and Vogel, 1978) have reported improved psychological states as a result of chronic activity. Cox, Evans, and Jamison (1979) supported faster physiological recovery from stress with chronic activity. Others (Reuven and Lazarus, 1975; and Selye, 1976b) have reported activity as a diversion away from the stressful event. The results of this study may be related to improved psychological and/or physiological responses to the stressful life event. Another possibility may be related to the probability that individuals with high levels of aerobic fitness are participating in activity more frequently than individuals with low levels of aerobic fitness. This habitual occurrence of activity may keep the mind distracted away from the stress repeatedly and thus reduce the stress response.

McPherson et al. (1967) has indicated that subjects were more confident, assertive, and less tense after an exercise program. Petrie and Rotheram (1982), after studying occupational stress, stated that assertiveness contributed to a high self-esteem and self-esteem was directly related to low stress. A difference in the self-esteem for different fitness levels may possibly contribute to their different perceptions of stressful events revealed in this study.

Zarski, West, and Bubenzer (1982) conducted the Social Interest Index and Bell Adjustment Inventory on individuals who run a minimum of ten miles per week and nonrunners. The adjustment inventory

provides measures of personal and social adjustment for home, health, social, emotional, and occupational areas. Runners reported significantly higher life adjustment scores than nonrunners. The researchers felt running stabilized positive aspects of one's personality, increased confidence and self-esteem, and resulted in greater life adjustment. Possibly more individuals than we realize have a greater potential for coping with extreme frequencies and levels of stressful life events, but it is partly through frequent aerobic activity that this aspect of one's personality is developed and perfected.

Other experimenters (Nowlis and Greenberg, 1979; DeVries, 1982) found a single session of physical activity to be an appropriate source for reducing and in some cases eliminating anxiety. It would seem suitable to assume that higher levels of anxiety may heighten the perceived stressfulness of a situation. If this is, in fact, a true relationship, physical activity may reduce one's perceptions of stress by reducing his or her anxiety level.

Another possible explanation for these results may be related to feelings of control. Stern, McCants, and Pettine (1982) reported that events which were perceived as uncontrollable were rated as significantly more stressful than events perceived as controllable. Often when an individual begins exercising on a regular basis, feelings of control over one's own health and vigor follow. It may be that these feelings of control over one's health transfer over to other areas of one's life. Possibly the individual feels he or she has more control over stressful life events and reactions to those same events when feeling control over his or her health and rate of biological aging.

Cox, Evans, and Jamison (1979) revealed that how quickly subjects recovered from stress was significantly related to aerobic power. Faster recovery from stress may have considerable beneficial influence on one's perception of the stressful event. When the physiological symptoms (e.g., racing heart or muscle tension) disappear quicker one may feel less stressed by the event. Possibly the high fit group was influenced by this cue, as it would seem they would have the fastest physiological recovery from the stress.

Reuven and Lazarus (1975) have reported activity as an effective diversion away from stress. American Pharmacy (1979) also supports this but professes that the individual must believe exercise is an effective source of stress reduction and that they feel better when exercising. This may be one explanation for the differences in the stress perception data collected between fitness groups. Possibly the high fit group has a different attitude toward exercise. Conceivably this attitude may be an extension of the frequency with which a highly fit individual engages in aerobic activity. Although no information was obtained from subjects on their activity levels, it seems reasonable to assume that the high fit group engages in some form of aerobic activity on a regular basis. This regularity may be promoted by feelings of pleasure and stress reduction surrounding the activity. The moderate and low fit groups may not share this reverent attitude toward aerobic activity and nonexistent and/or sporadic participation may reflect this. Individuals with these equivocal beliefs related to activity and its benefits may be immune to the payoffs of aerobic exercise due to this attitude or lack of frequent practice or both.

Certainly physical activity is an appropriate diversion from stress, and many times functions as a temporary distraction away from the stress. However, the focus of this study related to altering thoughts and perceptions related to stressful life events, not merely temporary removal of one's self from the stress. The difference is possibly related to frequency, intensity, and duration of the physical activity. The unpleasant feelings surrounding a stressful life event may certainly be reduced with physical activity. Something as pleasant as a walk in the park or as strenuous as a six-mile jog may have the same distracting qualities. Alteration of perception of the stressful life event, however, may require higher intensity activities which are performed frequently for longer periods of time. Essentially, the same fitness variables required to produce a high aerobic capacity may be necessary before perception of stress is influenced.

When supervising the 1.5 mile run for fitness classification, the researcher noted that many male subjects were capable of meeting the time requirement to be categorized as moderate fit, despite the fact that many were not regularly practicing any type of aerobic activity. This may have been influenced by learned behaviors or environmental cues for competition and performance, due to both males and females running together in an organized class setting. One consideration when choosing the 1.5 mile run as a testing protocol is psychological motivation. For some subjects the actual distance traveled may be influenced either positively or negatively by the degree the subject is motivated to perform well. Whether the moderate fit male category is a

true reflection of that respective aerobic capacity or a magnification of aerobic fitness is debatable. As noted earlier there was a low change in stress for moderate males from original to present stress. However, there was no other statistical support to indicate that moderate fit males were inappropriately classified.

Future studies are necessary and should be directed at disclosing what variables individuals with high aerobic fitness have in common, which may or may not affect one's perception of stressful life events. It would be beneficial to evaluate low fit individuals before and after chronic aerobic activity to determine if there is a cause and effect relationship between aerobic fitness and stress perception. One such study might include varying intensities, durations, and/or frequencies of aerobic activity and other activities which are not aerobic in nature to reveal their effect(s) on perception of stressful life events.

CHAPTER V

SUMMARY AND CONCLUSION

Summary

The purpose of this study was to determine effects of gender and aerobic fitness on perception of stress. College students enrolled in the activity program at the University of Tennessee, Knoxville, were selected as subjects based on assigned variables of gender and fitness and categorized into six cells: (1) low fit females, (2) low fit males, (3) moderate fit females, (4) moderate fit males, (5) high fit females, and (6) high fit males. Aerobic fitness was determined by specific time requirements for the 1.5 mile run adapted from Cooper (1982).

The dependent variables were original and present ratings of stressful events, time since the stress occurred, the number of stresses experienced, and projected stress for unexperienced events. The questionnaire (Appendix A) used to measure perception of stress was adapted from questionnaires used in previous studies (Horowitz et al., 1977; Dohrenwend et al., 1978) interested in the relationship between stress and illness. The tests of hypotheses produced the following findings: females consistently rated original stress and projected stress higher than males. There was no significance between males and females on present stress; although when original stress was statistically controlled females exhibited a significantly greater reduction in stress ratings from original to present than males.

The analyses infer that as aerobic fitness increases ratings of events as stressful decrease. Low fit groups scored significantly higher on original, present, and projected perception of stress. The inference for differences in original stress perception between different fitness levels was further supported when statistical control for time differences of the events did not change the significant difference revealed between the low, moderate, and high fitness groups. Post hoc testing indicated that those differences were evident between all fitness groups on original stress. Analysis of covariance and post hoc testing also revealed significant differences between moderate and high and low and high fitness groups for present stress when time was incorporated as the covariate. In both instances the high fit scored lowest on their stress ratings. Invariably there were decreasing changes in stress ratings with increasing levels of fitness except for moderate fit males who had very little change when original stress was partialed out.

Conclusions

Within the limits of this study, it was concluded:

1. Females rate original stress due to stressful life events higher than males.
2. Females rate projected stress for unexperienced events which may occur in the future higher than males.
3. Females have a greater reduction in the ratings of stress from the time the event occurred until a later time.

4. Low and moderate fit groups rate stressful life events higher than high fit groups.
5. Low fit groups rate original stress due to stressful life events higher than moderate fit groups.

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APPENDICES

APPENDIX A

STRESS PERCEPTION OF LIFE EVENTS
-DIRECTIONS-

1. Topic Area & Event: READ EACH STATEMENT CLEARLY

2. Experienced: CIRCLE YES IF THIS PARTICULAR EVENT HAS HAPPENED TO YOU

   CIRCLE NO IF THIS PARTICULAR EVENT HAS NOT HAPPENED TO YOU

3. If Yes, Recency: IF THIS EVENT HAS HAPPENED TO YOU INDICATE HOW LONG AGO IT HAPPENED IN MONTHS (e.g., 1 mo., 2 mo., 6 mo., 12 mo. . . .)

4. Stress Rating: RATE HOW STRESSFUL THE EVENT WAS FOR YOU WHEN IT HAPPENED UNDER "THEN" AND HOW STRESSFUL YOU CONTINUE TO BE DUE TO THIS EVENT UNDER "NOW"

5. If No, Projected Stress: IF THIS EVENT HAS NOT HAPPENED TO YOU, RATE IT BASED ON HOW STRESSFUL YOU FEEL IT WOULD BE FOR YOU IF IT OCCURRED TO YOU NOW OR IN THE NEAR FUTURE

All Stress Ratings should be based on the following scale:

0 = No Stress
1 = Very, Very Low Stress
2 =
3 = Low Stress
4 =
5 =
6 = Moderate Stress
7 =
8 = High Stress
9 =
10 = Very, Very High Stress

CODE NUMBER _____

STRESS PERCEPTION OF LIFE EVENTS

TOPIC AREA & EVENT	EXPERIENCED?	IF YES, RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH THEN	NOW	IF NO, PROJECTED STRESS
SCHOOL:					
1)Started school/training program after not going to school for a long time.	Yes No	_____	____	____	____
2)Had problems in school/training program	Yes No	_____	____	____	____
3)Failed school/training program	Yes No	_____	____	____	____
4)Did not graduate from school/ training program	Yes No	_____	____	____	____
5)Failed major exam in school/ training program	Yes No	_____	____	____	____
6)Failed minor exam in school/ Training program	Yes No	_____	____	____	____
7)Had frequent absences from school/ training program due to illness	Yes No	_____	____	____	____
8)Had personality conflict with a major professor/instructor at school/training program	Yes No	_____	____	____	____
9)Had two or more final exams on the same day at school/training program	Yes No	_____	____	____	____
WORK:					
1)Changed jobs for a worse one	Yes No	_____	____	____	____
2)Had trouble with a boss	Yes No	_____	____	____	____

TOPIC AREA & EVENT	EXPERIENCED?	IF YES, RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH	IF NO, PROJECTED STRESS
			THEN NOW	
3)Got demoted at work	Yes No			
4)Found out that was not going to be promoted at work	Yes No			
5)Laid Off	Yes No			
6)Fired unexpectedly	Yes No			
7)Took on a greatly increased workload without increase in pay	Yes No			
8)Suffered a business failure	Yes No			
9)Had an argument with co-worker	Yes No			
10)Place of employment went out of business	Yes No			
LOVE AND MARRIAGE:				
1)Had an affair with someone who was married	Yes No			
2)Relations with spouse changed for worse, without separation/divorce	Yes No			
3)Married couple separated	Yes No			
4)Divorce	Yes No			
5)Marital infidelity	Yes No			
6)Trouble with in-laws	Yes No			
7)Spouse died	Yes No			
8)Broken engagement by your fiance	Yes No			

TOPIC AREA & EVENT	EXPERIENCED?	IF YES RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH THEN	NOW	IF NO, PROJECTED STRESS
9)Broken engagement to your fiance	Yes No				
10)Relationship with lover changed for the worse	Yes No				
11)Relationship with lover dissolved when you did not want it to	Yes No				
12)Lover died	Yes No				
HAVING CHILDREN:(Males omit 1-3) (Females omit 4-6)					
1)Had an abortion	Yes No				
2)Miscarriage or stillbirth	Yes No				
3)Became pregnant when did not wnat to	Yes No				
4)Lover/spouse had an abortion	Yes No				
5)Lover/spouse had miscarriage or stillbirth	Yes No				
6)Lover/spouse became pregnant when you did not wish to have a child	Yes No				
7)Found out cannot have children when badly wanted children	Yes No				
8)Child died	Yes No				
9)Mothered/fathered physically limited child	Yes No				
10)Mothered/fathered mentally disabled child	Yes No				

TOPIC AREA & EVENT	EXPERIENCED?	IF YES, RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH		IF NO, PROJECTED STRESS
			THEN	NOW	
FAMILY:					
1)Someone very close moved out of the house	Yes No	_____	___	___	___
2)Someone stayed in the household after he/she was expected to leave	Yes No	_____	___	___	___
3)Serious family argument other than with spouse	Yes No	_____	___	___	___
4)Close family member other than spouse/parent died	Yes No	_____	___	___	___
5)Parent died	Yes No	_____	___	___	___
6)Parent hospitalized for serious illness	Yes No	_____	___	___	___
7)Sibling died(whom you were very close	Yes No	_____	___	___	___
8)Sibling became seriously ill	Yes No	_____	___	___	___
RESIDENCE:					
1)Moved to a worse residence or neighborhood	Yes No	_____	___	___	___
2)Unable to move after expecting to be able to move	Yes No	_____	___	___	___
3)Lost a home through fire	Yes No	_____	___	___	___
4)Lost a home through flood	Yes No	_____	___	___	___
5)Lost a home through other disaster	Yes No	_____	___	___	___

TOPIC AREA & EVENT	EXPERIENCED?	IF YES, RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH		IF NO, PROJECTED STRESS
			THEN	NOW	
CRIME AND LEGAL MATTERS:					
1)Assaulted	Yes No	_____	____	____	____
2)Robbed	Yes No	_____	____	____	____
3)Accident in which there were no injuries	Yes No	_____	____	____	____
4)Involved in a law suite	Yes No	_____	____	____	____
5)Accused of something for which a person could go to jail	Yes No	_____	____	____	____
6)Lost drivers license due to traffic violation	Yes No	_____	____	____	____
7)Arrested	Yes No	_____	____	____	____
8)Went to jail	Yes No	_____	____	____	____
9)Got involved in a court case	Yes No	_____	____	____	____
10)Convicted of a crime	Yes No	_____	____	____	____
FINANCES:					
1)Foreclosure of a mortgage/loan	Yes No	_____	____	____	____
2)Took a cut in wage/salary without a demotion	Yes No	_____	____	____	____
3)Bounced a check	Yes No	_____	____	____	____
4)Repossession of a car, furniture or other items bought on the installment plan	Yes No	_____	____	____	____
5)Did not get an expected wage/salary increase	Yes No	_____	____	____	____

TOPIC AREA & EVENT	EXPERIENCED?	IF YES, RECENCY (MONTHS)	STRESS RATING LOW 0 1 2 3 4 5 6 7 8 9 10 HIGH		IF NO, PROJECTED STRESS
			THEN	NOW	
6)Suffered a financial loss of property not related to work	Yes No	_____	____	____	____
MISCELLANEOUS:					
1)Pet died	Yes No	_____	____	____	____
2)Broke up with a friend	Yes No	_____	____	____	____
3)Had major argument with roommate	Yes No	_____	____	____	____
4)Suffered minor illness	Yes No	_____	____	____	____
5)Suffered major illness	Yes No	_____	____	____	____
6)Suffered minor injury	Yes No	_____	____	____	____
7)Suffered major injury	Yes No	_____	____	____	____
8)Unable to get treatment for an illness or injury	Yes No	_____	____	____	____

APPENDIX B

Stress is your reaction to a stimulus or situation. It may cause you to be aroused, excited, keyed up, afraid, mad, sad, happy, nauseous. It may cause your heart to beat faster, your face to be flushed, an upset stomach, low back tension, or headache. You may be nervous, unable to stay still, bite your nails, cry, laugh nervously, or in some other way show that your are in a stressful condition.

Each person has a different degree of stress response to a specific stressor. The purposes of this questionnaire are to determine:

1. Which stressors you have experienced, and how recently.

2. How severe your stress response was to each individual stressor.

3. How strong you would predict your stress response would be to stressors you have not experienced.

Your answers will NOT be shared with anyone and you will not be identified in any reports, so that you can be completely candid. It is very important that your answers are accurate and honest. Thanks.

APPENDIX C

Each cell for the study was preassigned code numbers as follows:

Low Fit Males = 1-10

Low Fit Females = 11-20

Moderate Fit Males = 21-30

Moderate Fit Females = 31-40

High Fit Males = 41-50

High Fit Females = 51-60

Any subject meeting the assigned variables of a cell was assigned to the appropriate number. For example, a male completing the run in ten minutes or less was randomly assigned to a number in the high fit male category (e.g., 41-50).

This code number was used on the Stress Perception Questionnaire in lieu of the individual's name. The use of these number codes allowed the researcher to retain the confidentiality of the subjects' names and also guided the researcher to the respective group for statistical analysis. Concurrently, this confidentiality of names served as an aid for control against individuals who might have felt they needed to submit false information as a measure of self-protection.

APPENDIX D

Table D-1

Individual Mean Scores for Original Stress*

Low Fit Females	Low Fit Males	Moderate Fit Females	Moderate Fit Males	High Fit Females	High Fit Males
8.54	6.35	7.50	6.53	4.69	5.93
9.00	4.20	8.41	5.50	6.33	4.00
7.00	7.73	9.40	5.00	6.25	5.14
9.20	8.13	8.50	7.35	4.57	5.71
7.42	6.00	8.70	7.33	7.10	4.36
8.28	8.69	7.40	5.66	7.11	6.80
8.23	9.25	7.27	3.42	6.11	5.90
7.00	7.50	7.38	8.30	6.90	6.85
8.28	8.07	6.05	5.86	6.71	4.80
6.35	7.92	6.22	5.27	4.46	6.44

*All scores are based on a scale of 0-10.

Table D-2

Individual Mean Scores for Present Stress*

Low Fit Females	Low Fit Males	Moderate Fit Females	Moderate Fit Males	High Fit Females	High Fit Males
1.63	.64	.33	7.23	.23	1.06
4.00	.70	6.23	5.50	.66	2.28
4.41	4.93	1.00	2.88	1.25	1.28
1.80	2.46	4.50	3.07	.14	2.00
1.36	4.00	4.41	5.91	2.94	1.00
5.14	1.92	1.33	.88	1.77	0.00
.82	5.37	1.63	1.28	1.88	1.20
1.16	2.00	.22	5.43	1.45	3.38
4.85	1.15	1.10	.93	1.35	1.10
.28	1.21	.11	1.11	.30	3.11

*All scores are based on a scale of 0-10.

Table D-3

Individual Mean Scores for Projected Stress*

Low Fit Females	Low Fit Males	Moderate Fit Females	Moderate Fit Males	High Fit Females	High Fit Males
8.57	6.67	7.92	6.93	6.82	7.43
7.71	7.05	8.89	6.79	6.57	4.66
7.80	8.57	8.26	6.43	7.08	5.91
9.11	7.53	8.67	7.19	6.52	7.26
6.55	5.21	7.67	7.39	7.10	6.20
8.13	8.44	6.36	8.48	8.21	7.50
8.96	8.44	7.32	6.25	5.95	6.09
7.69	7.58	7.70	7.19	8.23	5.61
8.60	7.67	7.46	7.23	7.91	4.90
7.83	8.93	8.03	6.24	6.56	8.22

*All scores are based on a scale of 0-10.

Table D-4

Mean Number of Stresses Experienced

Low Fit Females	Low Fit Males	Moderate Fit Females	Moderate Fit Males	High Fit Females	High Fit Males
11.00	15.00	6.00	14.00	13.00	15.00
1.00	10.00	19.00	4.00	12.00	7.00
12.00	14.00	10.00	34.00	8.00	14.00
5.00	15.00	27.00	28.00	13.00	15.00
20.00	1.00	17.00	11.00	18.00	11.00
14.00	26.00	17.00	9.00	18.00	9.00
17.00	8.00	9.00	7.00	10.00	10.00
6.00	21.00	19.00	24.00	19.00	22.00
14.00	13.00	17.00	15.00	14.00	10.00
6.00	14.00	10.00	17.00	13.00	9.00

Table D-5

Mean Time (Months) Since Stress

Low Fit Females	Low Fit Males	Moderate Fit Females	Moderate Fit Males	High Fit Females	High Fit Males
10.09	20.67	16.00	4.85	6.15	10.87
6.00	8.00	7.42	5.25	12.00	19.29
5.25	3.71	17.30	14.00	53.63	27.36
7.60	36.70	8.33	20.00	29.08	10.27
36.85	72.00	8.94	4.60	14.56	11.91
12.00	17.19	8.65	9.25	21.00	21.00
5.77	18.75	18.22	1.70	20.10	15.30
4.50	44.00	11.32	31.88	8.42	19.87
5.79	15.46	7.65	3.47	17.57	11.10
9.70	17.57	28.40	13.41	10.71	4.56

VITA

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After studying toward an Associate of Science degree at Roane State Community College, she transferred to the University of Tennessee, Knoxville, where she received the Bachelor of Science degree in March 1983. In the fall of 1983 she entered the Graduate School at the University of Tennessee. She was a graduate teaching assistant in the School of Health, Physical Education and Recreation, Division of Physical Education. She received the Master of Science degree with a major in Physical Education, specializing in exercise physiology in the summer of 1984.

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