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The Effects of a Sudden or Gradual Withdrawal from a Chronic Exercise Pattern on Anxiety Levels of Well Conditioned Athletes

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Due to increasing numbers of people developing high levels of cardiovascular (CV) fitness there are correspondingly more leaving these elevated states for varied reasons. The present investigation explored the possible need for a taper from a chronic exercise program. Anxiety was used as a possible indication of behavioral adaptations to a decreasing level of cardiovascular and muscle endurance levels. Eighty-two conditioned subjects and thirty unconditioned subjects were pre-tested for cardiovascular levels and A-State levels of anxiety to three groups each detraining at different rates and styles. All 112 subjects were post-tested for CV and A-State levels after a two week interval. The unconditioned group showed low pre and post levels of CV fitness and low pre-levels of A-State anxiety. This low level of A-State took a large upward directional shift on A-State post-tests (37.6 to 40.8). The conditioned groups, who were detrained, dropped in levels of CV condition as per their level of modification of detraining. Their levels of A-State anxiety dropped slightly over the two week detraining interval. Significance was found at the .05 level between and among subjects for the changes in CV levels. No significance was found for the changes in A-State anxiety levels. Some directional trends could be seen as well as a possible buffering effect on A-State levels from elevated levels of CV fitness.

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TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd.)

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LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION

Modern life and high technology have removed many "natural" avenues for pursuing and, most importantly, maintaining optimum levels of somatic and cardiovascular (CV) fitness. Walking, as an example, is used as a last resort, mode of transportation or as a specific tool in a fitness program. Walking, enough to allow the body to maintain a "fit" level and prevent a valuable part of the body's organization to weaken as a result of disease (Cannon, 1963) is no longer a part of most daily routines. Time and distance restraints serve to heighten this dilemma regarding walking as well as other possible avenues of daily exercise patterns.

Recently there has been renewed interest in many areas of physical conditioning programs. This elevation of importance or concern may in part be laid to reasons such as, weight reduction, possible decreases in cardiovascular disease (unproven) and self-reported increases in vitality from trained individuals. The result is varying levels of CV fitness and an increasing number of people starting or restarting programs as some may have had to stop programs due to injury or time restraints. Each of these areas, as well as others, create unique requirements both of a physiological and psychological nature, for starting programs, their structure, progression, intensity, mode, duration, warmups and cool-downs.

Considerable emphasis has been directed toward the reasons for warming up and cooling down but the majority of interest has been directed, in part, at acute exercise to fill the information void to the

general public and experts in the field. Warming up and cooling down are very important fundamental concepts when engaging in acute exercise. The theory is most sound, a gradual entrance into and exit from exercise.

When dealing with chronic exercise the basic premise is the same; at the onset, start slow and gradually increase. However the similarity can end there. There are profound systemic changes that occur during long-term CV and exercise programs. These changes are of a chemical, structural, and enzymatic nature (Holloszy, Rennie & Hickson, 1977). When the body has made adaptations to long-term physical stress there may be a need for a correspondingly longer "cooling down" to allow the body systems sufficient time to readjust psychophysiologically. When this "chronic taper," as it will be referred to, is eliminated and a chronic strenuous CV and exercise sequence stops suddenly, as with injury or last game, the body systems are still prepared for the continued physical and paralleling psychological stressors. There exists a possibility that body systems may respond together to a sudden cesation of long-term exercise and therefore elicit and/or reinforce state anxiety. This interaction may be a result of improved fitness, learned pleasurable responses generated in the brain and somatic areas through exercise. Likewise, systemic reactions maybe initiated by the sudden stopping of long-term exercise as the body systems begin to readjust in maintaining overall body system interbalance and homeostasis.

DEFINITION OF TERMS

1. Acute exercise- the functional activity of the voluntary and involuntary muscles for a short duration and high intensity.

2. Adenosine triphosphate (ATP)- is the universal intracellular carrier of chemical energy (Clarke, 1975.)

3. Alpha effect- a sympathetic nervous excitatory stimuli (Taber, 1977.)

4. Anerobic- the process whereby ATP is produced in the muscle cell, and is therefore available as an immediate source of energy for metabolism. These initial processes do not require O_2 for their functioning (Clarke, 1975.)

5. Anxiety- a label denoting a complex sequence of responses characterized by subjective feelings of apprehension and tension along with physiological arousal eg. tremor, sweating, and palpitation (Borkovec, 1976.)

6. Arteriovenous oxygen difference ($a\text{-}vO_2$)- the difference in oxygen content between the blood entering and leaving the pulmonary capillaries (Clarke, 1975.)

7. Autonomic nervous system (ANS)- the part of the nervous system that is concerned with control of involuntary bodily functions. It controls the function of glands, smooth muscle tissue, and the heart (Taber, 1977.)

8. Beta effect- a sympathetic nervous inhibiting stimuli (Taber, 1977.)

9. Cardiac output- is the amount of blood discharged from the left or right ventricle per minute (Astrand, 1970.)

10. Cardiovascular (CV)- is pertaining to the heart and blood vessels (Taber, 1977.)

11. Cardiovascular and exercise program- combines the chronic exercise pattern with specific exercises for strength gain as well as specific muscular endurance improvement.

12. Catecholamines (CAS)- biologically active amines, epinephrine and non-epinephrine, derived from the amino acid tyrosine. They have a marked effect on the nervous and cardiovascular systems, metabolic, temperature, and smooth muscle (Taber, 1977.)

13. Central nervous system (CNS)- is the brain and spinal cord, with their nerves and end organs that control voluntary acts (Taber,

1977.)

14. Chronic bracing- long term and constantly elevated levels of muscular tension both general and in specific areas.

15. Chronic exercise pattern- a continuous; 12 to 16 weeks; min. 3 days/week, max 5 days/week; 30-60 min; of endurance type activities; using large muscle areas in a rhymical and repeating manner.

16. Chronic exercise- the functional activity of the voluntary and involuntary muscles of varying duration and intensity, with a high frequency over time.

17. Chronic taper- is the gradual reduction of frequency, intensity and duration of exercise from a chronic cardiovascular and exercise program or pattern.

18. Cognitive anxiety- is a conscious awareness of unpleasant feelings about self or external stimuli (Schwartz, 1978.)

19. Cool down- low intensity (a gradual decline activity, sport specific and/or of a general nature, including stretching done at the conclusion of elevated levels of physical activity.

20. Creative phosphate (CP)- is used for the resynthesis of the adenosine triphosphate from adenosine diphosphate and phosphate (Astrand, 1970.)

21. Detraining- the gradual exit from a chronic cardiovascular and exercise program. Decreasing the intensity, duration, frequency and possibly the mode of the existing exercise program.

22. End diastolic volume- is the amount of blood in the left ventricle at the end of the relaxation phase (Taber, 1977.)

23. Endorphins- are naturally occurring peptides with opiate like properties (Jackler and Steiner, 1979.)

24. End systolic volume- is the amount of blood in the left ventricle at the end of the contraction phase (Taber, 1977.)

25. Epinephrine (E) & norepinephrine (NE)- belong to a group of chemicals known as catecholamines and are frequently referred to as sympathomimetic amines because they have the same physiological effect as the sympathetic nervous system. Norepinephrine is more effective in vasoconstriction and epinephrine has a more pronounced effect on carbohydrate metabolism. Both are secreted from the adrenal medulla. Epinephrine affects all structures of the body innervated by the sympathetic nervous system and thereby reinforces its actions (Kimber and Gray, 1966.)

26. Exercise pattern- is the intensity, duration, frequency and mode for physical activity.

27. Experimental interval- will consist of a two week time period 14 days.

28. Golgi bodies- are nerve endings distributed among the fascicles of a tendon and cause reflex inhibition of the muscle to which they belong. The Golgi tendon organs monitor muscle tension, rather than length and inhibit alpha neuron discharge (Clarke, 1975.)

29. Homeostasis- a state of equilibrium of the internal enviroment and relative constancy of the body fluids (blood, lymph, tissue fluid) as to their chemical and physical properties (Taber, 1977.)

30. Hyperactive neuromuscular states- are elevated muscular tension levels.

31. Hypothalamus- it contains neurosecretions which are of importance in the control of certain metabolic activities, such as maintenance of water balance, sugar and fat metabolism, regulation of body temperature and secretion of endocrine glands. It is the chief subeortical region for the intergration of sympathetic and parasympathetic activities (Taber, 1977.)

32. Limbic system- is an older portion of the cerebrum related to ancient olfactory regions which are particularly associated with emotion provoking stimuli. This region seems to coordinate sensory data with bodily needs, with the requirements of the viscera (Taber, 1977.)

33. Maximal oxygen consumption ($MaxVO_2$)- is the maximum aerobic capacity; it implies the stage where the greatest amount of oxygen can be used in cellular reactions (Clarke, 1975.)

34. Non-conditioned- individuals who are not presently involved in a chronic cardiovascular or exercise program. Also any individuals who have been out of such a program for a minimum of 8 weeks.

35. Oxygen (O_2)- it is the only element that enters the organism in a free state and used in the process of oxidation (Taber, 1977.)

36. Parasympathetic nervous system (PNS)- is the craniosacral division of the autonomic nervous system. Stimulating of this system generally produces vasodilation of the part supplied, general fall in blood pressure, contraction of the pupil, capious secretion of thin siliva, increased gastrointestinal activity and slowing of the heart (Taber, 1977.)

37. Physical stress- is the result produced when a structure, system or organism is acted upon by a stressor (Taber, 1977.)

38. Physical stressor- is an agent or condition exercise capable of producing stress (Taber, 1977.)

39. Psychophysiology- the physiology of the mind; science of the correlation of body and mind (Taber, 1977.)

40. Reticular formation- is groups of cells and fibers arranged in a diffuse network throughout the brain stem. These both fill the spaces and connect the tracts which ascend and descend through the area. They are important in controlling or influencing alertness, waking, sleeping and various reflexes (Taber, 1977.)

41. Self-stimulation- is demonstrated learning through the stimulation of brain areas rather than biological deficit for drive or reduction of a drive with a biological satisfier (Olds and Forbes, 1981.)

42. Somatic tension- is the condition of strain or stretching of body wall structures such as the muscles.

43. State anxiety (A-State)- is a transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity. A-State may vary in intensity and fluctuate over time (Spielberger, 1970.)

44. Steady state- condition denotes a work situation where oxygen uptake equals the oxygen requirement of the tissues; consequently there is no accumulation of lactic acid in the body (Astrand, 1970.)

45. Stroke volume (SV)- is the amount of blood ejected by the left ventricle at each beat. Amount varies with age, sex and exercise (Taber, 1977.)

46. Sympathetic nervous system (SNS)- is the thoracolumbar division of the autonomic nervous system. Stimulating this system produces vasoconstriction in the part supplied, general rise in blood pressure, erection of the hair, goose-flesh, pupillary dilation, secretion of small quantities of thick saliva, supression of grastrointestinal activity, and acceleration of the heart (Taber, 1977.)

47. Trained individuals- in the general sense, are those who are presently partispating in a chronic cardiovascular and exercise program and stressing systems to 75 to 85% of maximum. [With regard to this study it is a score of 9 or better on the Ohio State Step test.]

48. Trait anxiety (A-Trait)- refers to relatively stable individual differences in anxiety proneness, that is, to differences between people in the tendency to respond to situations perceived as threatening with elevations in A-State anxiety (Spielberger, 1970.)

49. Ventilation (V_E)- the amount of air moved by the lungs (Clarke, 1975.)

50. Warm Up- low intensity activity, sport specific and/or of a general nature, including stretching, done prior to intense physcical activity.

DELIMITATIONS

The levels of fitness and anxiety under study in this investigation were delimited to 112 male volunteer subjects ranging in age from 14 to 23 with a mean age of 16.2 years.

The levels of condition were generated through participation on a sports team for the full season. The sports teams involved were; cross country, basketball, football, track and field, golf and wrestling.

All subjects were uninjured and participating in all facets of their sport at the time of testing.

LIMITATIONS

The following aspects are looked upon as limiting factors concerning this research:

1. There may have been outside influences affecting levels of A-State anxiety.

2. The levels of fitness were retrospective.

3. Adherence to exercise curtailment was difficult to monitor even though verbal commitments were established.

4. Adherence to exercise stress levels, high enough and when specified, to effect the detraining process.

5. Errors in counting pulse rates during the OSU step test for CV levels may have occurred.

PROBLEM

Should alternative programs be utilized when a long-term CV and exercise program is suddenly terminated? Can a sudden exit from chronic exercise be modified, thus reducing any psychophysiological shock to conditioned systems of the healthy (uninjured) athlete?

PURPOSE

The purpose of this study will be to explore the need for a chronic taper from long-term CV and exercise programs. Levels of state anxiety will be utilized as a possible indicator of cognitive, physiological and behavioral adaptations to the decreasing levels of cardiovascular and muscular endurance when exiting a strenuous, chronic CV and exercise regime. Further, possible modifications for the chronic taper will be explored in relation to their effect on state anxiety levels.

HYPOTHESES

Several research hypotheses were formulated relative to state anxiety levels and the stopping of a chronic exercise program and the corresponding decline in cardiovascular states:

1. State anxiety indicies for non-conditional individuals will show a high and stable levels of a state anxiety for the experimental interval.
2. State anxiety indicies of well-conditioned individuals would be expected to rise significantly when they stop a chronic exercise pattern suddenly and perform only daily living activities with no additional exercise patterns for the experimental interval.
3. State anxiety indicies of well-conditioned individuals would be expected to rise less significantly when they stop a chronic exercise pattern but taper with a personal choice of physical exercise mode but at a predetermined frequency of three days per week (Mon-Wed-Fri) for the experimental interval.

4. State anxiety indicies of well-conditioned individuals would remain close or rise only slightly from levels measured at the conclusion of their chronic exercise pattern, if they performed a structured and directed tapering program at a frequency of three days/week (M-W-F-) for the experimental interval.

Chapter II

REVIEW OF LITERATURE

ACUTE EXERCISE

The study of anxiety in relation to long-term effects of some of the acute exercise treatments, has been long neglected (Franks 1969). The psychophysiological changes created by acute exercise are indeed many (Astrand, 1970; Clarke, 1975; de Vries, 1966; Jensen, 1979; Cureton, 1971; Morgan, 1973; Windmer, 1978; Barnard, A. J., 1973; Barnard, R. J., 1976; Morten, 1975; Wilson, 1981; Perconnet, 1981; Hartley, 1972; de Vries, 1968) and a substantial clarification of these changes along with the effects of warming up and cooling down are necessary to establish a base line and frame of reference.

Warming up and cooling down are important concepts with regard to exercise (Astrand, 1970; Clarke, 1975; de Vries, 1966; Jensen, 1979; Cureton, 1971; Morgan, 1973: Windmer, 1978; Barnard, A. J.. 1973; Barnard, R. J., 1976; Morten, 1975; Wilson, 1981; Peronnet, 1981; Hartley 1972; De Vries, 1968). Still, the practice of warming up is wide spread but is surrounded with some controversy. It must be kept in mind that the following possible benefits of warming up may, at least in part, depend on an elevated body temperature of a belief that a temperature increase is important (Clarke, 1975).

Warming up may: 1. increase the speed and force of muscle contraction, 2. improve necessary coordination (activity

related-especially accuracy dominated activities), 3. help prevent injury to muscles, tendons and ligaments, 4. bring on the steady state more readily, 5. contribute to greater 0_2 consumption and thereby relieves dependence upon the anaerobic process, and 7. increase blood flow in the vascular beds of working muscles and decreases in skin and viscera.

Cooling down from acute exercise may even be more important than warming up (Jensen 1979). The cool down process allows: the large muscles to assist blood flow back to the heart, the muscles to alleviate lactic acid build up and, a key element, the body systems to slowly regain normal activity levels (Astrand, 1970; Jensen, 1979). Stretching routines are being utilized, as well as sport specific exercises, to facilitate the aforementioned benefits.

The physiological responses to acute exercise are ones of support for the increased system demand for O_2 and nutrients (Astrand, 1970; Jensen, 1979). To logically illuminate these changes I will look at the organ, system or responses involved and relate the specific changes: 1. Heart Rate increase from approx. 60 beats per min. to approx. 200 beats per min. These paramaters are influenced by age, condition, attitude, heat and cold to name a few. The heart rate will increase with increased work up to the maximum for the particular individual. 2. Stroke volume will increase until approx. 40 percent of max. heart rate. 3. Cardiac output will rise from 4-6 1/min to approx. 20-30 1/m (untrained). 4. Arteriovenous oxygen difference (a-VO_2 diff.) at rest is approx. 50 ml of O_2 per liter of blood and during exercise rises to approx. 150-160 ml of O_2 per liter of blood. 5. Oxygen consumption (VO_2) increases with increased work load. 6. Respiratory response to exercise is a fairly linear response, as exercise increases so does the amount of air (V_E) moved by the lungs. Resting levels are

approx. 5 to 7.5 l per min. to exercise generated levels of 100 to 200 l/min depending on the individuals vital capacity. 7. Blood pressure response is a rising systolic pressure with increased work and a stable or slightly decreased diastolic pressure. 8. Circulatory response is one of shunting blood to areas of the body where it is needed most. Large amounts of blood are redirected from gut and other nonessential areas to the working muscles. The heart is accelerated through sympathetic regulation to inc., blood flow and blood flow to surface skin capillaries is adjusted for internal temperature regulation. 9. Blood response to exercise is a hemo concentration (inc. O_2 carrying capacity), inc. in temperature and a decrease in PH. These three changes plus low O_2 tension levels at the cell cause an O_2 dissociation curve shift to the right, therefore more O_2 is available to the working muscles. 10. The fuel for high intensity work is carbohydrates. Lower intensity work for longer duration will depend more on fat.

The sympathetic section of the autonomic NS is directly involved in system reactions to acute exercise (Peronnet, 1981). Some of these autonomic reactions have been set forth previously (HR inc etc) but there are others that are acute but also may be implicated in many chronic psychophysiological adapations. Stimulation of the autonomic nervous systen (ANS) during exercise brings on the following reactions (among others) to varying degrees: diaphoresis, salivary vasoconstruction, glucose released from the liver, decreased urine flow from the kidneys, decreased peristalsis, sphincter construction,

metabolism increases and an increased mental activity. The adrenal glands both cortex and medulla increase secretions (Kimber, Gray & Stackpore, 1966). These secretions, epinephrine (E) and norepinephrine (NE), are very important. They effect the structures innervated by the sympathetic nervous system (SNS) (Kimber, et al 1966).

Muscular exerction of an acute and aerobic nature was found to reduce anxiety levels by 85 percent (Morgan, 1973; Wilson, Berger, and Bird, 1981). Vigorous physical exercise has also been shown to provide significant relief from hyperactive neuromuscular states (de Vries, 1968; de Vries, 1972; Hollandsworth, 1979). These reduced levels of muscle tension occur because of changes in the proprioceptive feedback patterns as the exercise interferes with the chronic bracing patterns in the skeletal muscle (de Vries, 1968). The idea being that behavioral systems only have so much space. Noxious affects, such as anxiety, can occupy this space as an ongoing event in the somatic and cognitive systems. An activity of a neutral type, exercise being one, can be entered into the system and it will compete, for system space, with the ongoing activity and cause the cycling activity to decrease (Schwartz, Davidson & Goleman, 1978).

CHRONIC EXERCISE

Those whose "daily routine involve working until he sweats may be keeping fit" (Cannon, 1963, p. 199) because he is not allowing vital system organization and development to atrophy. The concept of chronic exercise is much more diverse and complex than "sweating" daily but this does give us a concept to consider as well as a reference point to work from.

A chronic exercise pattern, to be effective in producing changes, must have certain components. Patterns must be continuous, 12 to 16 weeks and at least 3 days to an optimum of 5 days. Thirty minutes or more of strenuous (systemic stressing: CV and muscular) exercise of the endurance type and using large muscle areas in activities of a rhymical and repeating nature (Ismail, 1977; Jensen, 1979; Astrand, 1970). Programs of this type will affect physical fitness measures. These fitness paramiter shifts are vital to allow coupling of a physiological component to the concept of anxiety (Franks, 1969).

It becomes very important at this juncture to clearly delineate the physiological changes manifested through chronic exercise. Since the body responds specifically to training stress (Jensen & Fisher, 1979) I will address changes in strength, CV system and the muscles as a result of a chronic CV and exercise program.

Jensen et. al. (1979) and Astrand (1970) begin by explaining how the nerve pathways and impulse transmissions are improved through aerobic and strength training. The neurological changes allows dormant muscle fibers to become active. The increase is approx. 30 percent from 60 percent of the muscle fibers to 90 percent. Fibers also increase in size (thickness) and the amount of muscle proteins such as actomyosin as well as glycogen and water they contain. Stress in training causes a thickening of ligaments and tendons because of an increase in primary cellular multiplication as well as an increased supply of capillaries within the muscle. Fat within the muscle is also reduced, increasing muscle efficiency in aerobic programs.

Muscle chemistry is altered through chronic aerobic training. The effectiveness of enzymes and coenzymes increase with regard to the

decomposition of reserve nutrients in muscles, allowing more energy for work. Lactic acid production is decreased per muscle work load.

Inhibitory mechanisms of muscle contractions may also be reduced through extensive training. This allows the Golgi organs within the muscle fiber to be somewhat shielded (because of thickened connective tissue) and permit higher muscle tension levels to be developed.

Endurance type activities bring about changes in the CV system as well as the muscles. Total heart volume as well as muscle mass of the trained heart increases. The larger heart volume leads to an increased stroke volume both at rest and during work. There is an increased end diastolic volume, inc. contractility of the heart and a corresponding smaller end systolic volume during work. Resting heart rate decreases as well as rates during submaximal work loads.

Younger people appear to inc. their a-VO_2 difference but this does not appear to be so in aging individuals (50+). There may be a decrease in resting blood pressure through conditioning. There is 20 percent to 30 percent increases in maximal oxygen consumption (max VO_2). Lactic acid build up at submaximal levels of work is decreased. Also the ability to work at a higher percent of max VO_2 and tolerate elevated levels of lactic acid have been demonstrated.

Biochemical changes are also substantial. Total muscle myoglobin is increased allowing a faster rate of diffusion for O_2 through muscle cell cytoplasm to the mitochondria. An increase in number and size of mitochrondria. Enzymes in the Krebs cycle and hydrogen-electron transport system increase in activity and number thus allowing the skeletal muscle to elevate its capacity to oxidize glucose and fat for energy.

Glycogen stores are increased in the muscle and are used up at a slower rate during work because of an increased oxidative capacity for fatty acids. Stores of adenosine triphosphate (ATP) in the muscle may inc. by 25 percent with training. Creatine phosphate (CP) also increase as well as the systems glycolytic capacity.

This is by no means an all inclusive list of physiological changes but it is a brief but clear presentation of the varied adaptations made by the body to chronic physical stressors. Actually these changes may be viewed as movements toward the optimal or proper functioning patterns of the human body (Van Toller, 1979).

Chronic training also induces modifications of the autonomic nervous system (Hahner, 1968). Physically trained individuals may be parasympathetically dominant, but under stressors they are capable of greater sympathetic stimulation than the untrained (Hahner, 1968 & Peronnet, F., Clerous, J., Perrault, H., Cousineau, D., DeChamplain, J., Nadeau, R., 1981). Hahner (1968) also showed that the sympathetic section of the autonomic nervous system (ANS) may also be toned in these individuals and would exert control if the proper stimuli were imparted. It has been further demonstrated by Peronnet (1981) that there is a reduced sympathetic drive and heart sensitivity to sympathetic stimulation after training. These aspects of ANS change may be important when looked at in relation to a link with the central nervous system (Rescorla & Solomon, 1967).

Long-term physical activity has been shown to have a substantial role in developing and sustaining ones mental health and mood states (Morgan, 1973; Morgan and Pollock, 1977; Jones & Smith, 1980; Ishmial & Young, 1977; Silva & Schultz, 1981; Paxton, 1981; Jette, 1971;

Folkins, 1981; Wilson & Morley, 1980: Young, 1979). It was reported by Morgan (1977) and V.E. Wilson (1980) that elite marathon runners have a positive mental state. This state is looked on as a result of training and competition since these runners were equatable with other psychological traits of the general public. Also the amount of training for a class marathon (Male-under 2 hr. 20 min. and female 2 hr. 35 min) means many months of strenuous CV and exercise training thus giving the body the time and stressors for system changes to occur (Franks, 1969). Wilson (1980) also reported better mood states between marathoners and joggers and the joggers and non-exercisers thus alluding to not only exercise itself but also the quality, quantity and duration over time may be important in effecting mental and mood state. It has been further demonstrated that physical fitness training allows for a generalized reduction in somatic tension levels (Lazarus, 1975 & de Vries, 1972). With the psychophysiological changes just discussed there also appears to be a heightened awareness of physcological responses and perceptions of effort (Pollock & Schmitt, 1979; Hollandsworth, 1979).

The psychophysiological changes that have been discussed support the concept of a somatopsychic phenomena which states that body changes may alter mental attitudes (Folkins & Amsterdam, 1977). All of such changes have been in the positive direction as the body increased its fitness levels. Cureton (1963) demonstrates a possible negative directional influence with decreasing fitness. Cureton (1963) showed that decreasing physical work capacity may have a role in the development of psychiatric depression. Certain specific factors were found to be correlates of personality deterioration. These factors

were, accumulation of fat, loss of muscular strength, slowing of reaction time and a decrease in ventilation.

Holmes & Masuda (1973) have shown that life change events working adaptive efforts by the body, that are faulty lower body resistance and increase the probability of disease. The body may have lost its advantage, physiologically, to combat disease.

Cannon (1963) states that when homeostasis can be shifted in one direction there may very well be automatic controlling factors that will be activated to supply an opposing force. It may be that as the body moves away from the physically conditioned and possibly the psychologically uplifted levels that heightened anxiety levels are either triggered or perhaps amplified to as a result of the conditioned physical state.

ANXIETY

Anxiety may be viewed as a label denoting a complex sequence of responses characterized by subjective feelings of apprehension and tension along with physiological arousal eg. tremor, sweating and palpitation (Borkovec, 1976; Speilberger, 1966 & Speilberger, 1972). Along with this anxiety must be envisioned to manifest all of three separate but interacting response components. Cognitive behavior, motor behavior and physiological behaviors. These three factors may be separately influenced by different environmental conditions at different moments in time and could even display different learning principles (Borkovec, 1976; Schwartz, Davidson & Goleman, 1978; Lazarus, 1975 & Martin, 1975). The cognitive can be further broken down into right vs left hemispheres mediated and motor can be broken down into skeletal and autonomic (Schwartz et. al. 1978).

As anxiety is elicited and measured it is considered to be a function of external and/or internal cues: (Borkovec, 1976).

External Cues= Environment and past history of learning= fear response*

Internal Cues= Verbal and non verbal images, physiological activity and propreoceptive or perceptual feedback from skeletal behavior.

It must be further recognized that individuals will vary greatly in their own personal history in regard to each of the three components. These differences will result in varying levels of intensity and/or importance of the response from each component in reaction to a certain feared stimulus (Borkovec, 1976).

As example of how this differential in learning and history may apply is as follows. A cognitive appraisal could be that the subject was or is in very good physical shape. He or she understands this from prior knowledge and the physiological manifestations of improved condition realized from a personal part history of repeated physical endeavors, both in poor physical condition and in superior condition. Levels of information within a component and manipulation of components may affect later changes in the response of one or both of the remaining components (Borkovec, 1976). This multidimensional structure of anxiety can mirror meaningful patterns of physiological processes that are tied to particular behavioral and experiential states (Schwartz et. al., 1978).

*[Since the response patterns of fear and anxiety have not been shown to differ the terms will be used interchangeably (Borkovec, 1976 & Speilberger, 1972).]

There is little doubt that physiological and visceral activity can contribute to the quality and intensity of emotions experiences (Kelly, 1980). Portions of the central nervous system (CNS) responses when stimulated also elicit behavioral changes which would normally be associated with CV adjustment (Kelly, 1980).

Exercisers report less somatic and more cognitive anxiety (Schwartz, et. al, 1978). With this exercise induced decrease in somatic anxiety levels, behavior may be directed either by movements to eliminate disturbing or annoying stimulation [interruption of an exercise pattern] or by movements to prolong or renew agreeable stimulations [exercising and its psychophysiological manifestations] (Rescorla, 1967; Goldiamond, 1973; Thorsen, 1976; Borkovec, 1976; Cannon, 1963 and Kelly, 1980).

CATECHOLAMINES

Many of the adaptive changes resulting from chronic exercise are mediated through the endocrine system (Hartley, Mason, Hogan et. al., 1972). One of the compounds most frequently associated with emotional states and their intensity are the catecholamines (CAS). This was reported by Ismial and Young, (1977). These neurotransmitters epinephrine (E) and norepinephrine (NE) are released into the perpheral body via the sympathoadrenal system and have an effective role in central, autonomic NS as well as in the normal homeostatic functions of the body (Van Toller, 1979; Kimber, Gray and Stackpore, 1966; Kelly, 1980). The neurotransmitters are the principle means by which neurons affect each other and therefore a logical focus for correlating brain chemistry with psychophysiological events (McGeer & McGeer, 1980).

Most blood E comes from the adrenal medulla and most NE from sympathetic nerve terminals (Robertson, Johnson, Robertson, R.M. Nies, Shand & Oates, 1979). Epinephrine has both alpha and beta effects, causing an increase in heart rate (HR), a rise in systolic blood pressure, no change or a fall in diastolic BP, mobilization of glycogen reserves, skin vasoconstriction, inc. blood sugar level in the body and a release of fatty acids in the blood stream. Norepinephrine has almost pure alpha activity and causes a decrease in HR and a rise in systolic and diastolic BP, arteriole vasoconstriction and facilitates blood shunting to highly active areas such as the muscles during exercise, (Ross, 1972; Van Toller, 1979). NE excretion is associated with active aggressive action while E excretion is associated with apprehension and anxiety (Goodall, 1962).

Both E and NE valves have been found to increase during heavy exercise (Svante Von Euler, 1974). Dimsdale and Moss (1980) showed a three fold inc. in NE levels with physical exercise and a two fold increase in E levels with public speaking.

Physical training leads to reduced NE response to moderate and heavy work loads (Ismail & Young, 1977; Hartley et. al., 1972; Winder, Hagbert, Hickson, Ehsam & McLane, 1978; Robertson et. al., 1979). This reduction in output for NE after training is important since NE is on of the principle effector mechanisms of sympathetic innervation and plays a major role in mediating peripheral effects of emotion and changing mood (McGeer et. al, 1980; Morgan, 1977).

Ismail & Young (1977) reafirm the interrelationship between physiological, biochemical and personality domains. They also demonstrated that a high CA excretion rate may be related to neuroticism

and somatic tension states. The behavior patterns and feelings that accompany, the presence of or absence of CAs, may through conditioning and learning come to accentuate if not actually produce a linking of CA production and behavior (Van Toller, 1979; Miller & Neale, 1969). The drop in CA levels could be demonstrating a bottom or optimal level for CA production and system interbalance.

One should not lose sight of the fact that what is happening perepherally is tied to the central nervous system (CNS). Kelly (1980) speaks to the areas in the brain, hypothalamus and reticular formation, that exhibit some control over CA secretion. He also explains that CNS may perceive stress and the limbic system may then trigger the hypothalamus which can have an effect on the adrenal medulla through sympathetic innervation. Kelly goes on to link the intensity of an emotional reaction to the amount of E produced and states that the quality of an emotional response is related to cognitive factors and the circumstances this individual may find himself in. These facts along with what has been stated concerning the physiology and the multidimensionality of anxiety lead one to the final and syncronizing organ the brain.

BRAIN-SELF-STIMULATION

In the brain there is a general mechanism thought to modulate motivated behavior and is referred to as intracranial self-stimulation (SS). Demonstrated learning through the stimulation of brain areas rather than biological deficit for drive or reduction of a drive with a biological satisfiers (Olds & Fobes, 1981; Olds, J. & Milner, 1954). The existance of CA pathways have been confirmed in the human brain and

their course has been matched to a large degree by the distribution of SS reward sites from froebrain through midbrain to hindbrain (Olds & Fobes, 1981; Routtenberg, 1978). It has been further postulated by Olds, Fobes (1981) and Routtenberg (1978) that there was a connection between mood altering drugs and the CAs and also between the CA and the brain reward system thus developing a relationship between the brain-reward system, mood and personality. Morgan (1973) suggests that levels of CA and their metabolism may be important factors in post exercise affective states.

The brain has been shown to have opiate receptors and naturally occurring peptides with opiate like properties (endorphins) and have been shown to have reinforcing qualities as well to facilitate self-stimulation (Jackler & Steiner, 1979 & McGeer et. al., 1980). Endorphins and NE are increased through physical exercise as well as subvert CNS activity and stimulate reward-sites or pleasure centers in the brain (Jones & Smith, 1979; Van Toller, 1979). Kline (1977) established that B-endorphin may possess an antidepressent effect. These occurrences may demonstrate a link between SS phenomena and biological activities of the brain thus developing an explanation for the euphoria experienced by runners and their seeming addictive behavior to the activity. Routtenberg (1978) also adds depth to the theory when he demonstrated that brain reward pathways were important in learning and memory as well as SS exerting a possible dominant influence on behavior. Findings by Olds & Fobes (1981) showed a clear overlap between homeostatic mechanisms in the hypothalamus and SS reward mechanisms.

There are areas in the brain such as the hypothalamus and diencephalon that contain circuits responsible for properties of behavior we call motivated (Larson, 1954). Another area of the brain is the limbic system whose endocrine function is looked on as a link between emotion and the autonomic NS (Kelly, 1980). An important connection recently made was the presence of NE system axons in the cerebral cortex of the brain thus linking the cortex to primitive structures (mid brain hind brain) and produces the possibility that complex intellectual activity may be influenced by primitive CA systems (Routtenberg,1978).

Van Toller (1979) draws it together by expressing the likelihood that autonomic learning will always be enhanced by active involvement of the cognitive centers. The brain may then have an awareness of autonomic functions and any factors that assist cognitive area and the hypothalamus will aid autonomic learning. Thus symptoms due to sympathetic activation may themselves reinforce anxiety when there has been a previously learned association between the mental and autonomic system (Briggin, 1966).

The connection is thus drawn between a multidimensional approach to anxiety and how the three anxiety components (cognitive, physiological and behavioral) may be joined to and react with the highly trained human organism, demonstrating a system reaction to a movement away (detraining) from the optimal state of physical fitness (conditioned).

Chapter III

PROCEDURES

One hundred and twelve male subjects were utilized in this study. Subjects were randomly assigned to one of four possible groups.

All written tests and cardiovascular tests were given immediately after their sports season and again two weeks later. The tests given were pen and pencil anxiety tests and a modified step test. One of the experimental groups was specifically detrained during the two week experimental interval. All subjects were debriefed following the post-testing procedures.

SUBJECTS

There were a total of 112 volunteer male subjects utilized in this study. Eighty-two were included in the three experimental conditioned groups and thirty in the non-conditioned control group. The subjects ranged in age from 14 years to 23 years of age, with a mean age of 16.2. Their grade levels ranged from ninth grade through fourth year of college with a mean grade level of 10.8.

Subjects were selected from rural high school and colleges of Western New York and North Eastern Iowa. Subjects were involved in a sports season at their respective schools. The sports included were football, cross country, golf (one subject), track and field, basketball and wrestling.

All of the sports, by their nature, with the possible exception of golf, demand strength and/or cardiovascular components to be utilized and developed during the season. All seasons were a minimum of 12 weeks

and a max. of approx. 16 weeks. Since this is a retrospective study the quality and quantity of these components is not completely known but is assumed to be present because of the nature of the sport and length of season.

Coaches of the respective teams were contacted near midseason and at that time, the study and the need for subjects was explained. The coaches were asked not to mention the terms anxiety, depression or hostility during their explanations. The coaches basically asked their players if any individuals would be interested in participating in a study concerning psychological states and levels of fitness that would last 2 weeks and require up to 6 meetings. If they were interested they were given a consent form to fill our and sign (if 18 yrs old) or they had a parent or guardian sign. This consent form explained procedures and responsibilities. The coaches collected and returned these to the investigator (See Appendix A).

GROUPS

All 112 subjects received pre and post-treatments and comprised four groups. When the pretesting was completed, the conditioned subjects were randomly assigned to one of three conditioned groups for the two week duration and given all necessary instructions at this time. Group one subjects were non-conditioned subjects and used as a control for the three remaining groups. Subjects assigned to group two were told to just go about a normal living pattern but not to add additional exercise patterns on daily or even every other day sequence. They were not to engage in any repetative exercise pattern over the two week period.

Group three was told to engage in some form of exercise of their own choosing to "elevate their HR and bring on perspiration" on Mondays, Wednesdays and Fridays for at least 30 min. for the two week period.

Group four, the experimental group, was to be detrained with a specific program on the Wed and Friday of the first week and the Mon-Wed and Friday of the second week. The detraining program was designed around the Universal Weight machine to allow a detraining of a strength factor, specific muscle endurance factor and the CV factor. The purpose of the sessions was to keep the subjects HRs up to 25 beats in 10 sec (150 BPM) for approximately 30 min. during wk 1, down to 20 min. on Fri of Wk 2.

TEST ADMINISTRATION

The investigator administered all tests. The first meeting for pretesting was the first school day after their last game. The post-testing was the Monday following the Friday of the second week of work (detraining), or no cardiovascular activity.

All written tests (STAI and MAACL) were taken in a gymnasium on the floor or in a hallway on the floor. The Ohio State University. (OSU) step test was given in the gymnasium using the bleachers for stepping.

The commands for the step test were on tape and the tape recorders usually produced both sufficient volume and clarity to deliver proper audio for the subjects in the gym setting.

The administration was the same for pre and post-tests with one exception. The STAI (Trait) was not given at the post-test session since this test was not designed to register change. (See Appendix B)

MATERIALS

STAI Test- The first test used was the Spielberger State Trait/Anxiety Inventory [Spielberger, Garsuch and Lushene, 1970; (See Appendix C)]. It and consists of two separate self-report scales for measuring two different anxiety concepts. The first is state anxiety (A-State), "a transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity." The second concept is trait anxiety (A-Trait), "is a measure of relatively stable individual differences in anxiety proneness, that is, to differences between people in the tendency to respond to situations perceived as threatening with elevations in A-State intensity" (Spielberger, 1970).

The A-State segment of the STAI is comprised of 20 statements that ask subjects how they feel at a particular moment in time. The A-Trait also has 20 statements but asks how the person generally feels. The A-State is referred to as x-1 and A-Trait as x-2 in administration directions.

The subjects respond to the 20 statements by rating themselves on a four point scale. The four categories for the A-State are: 1. Not at all; 2. Somewhat; 3. Moderately so; and 4. Very much so. The A-Trait responses are: 1. Almost never; 2. Sometimes; 3. Often; and 4. Almost always.

Some statements are so worked that a high score indicates a high level of anxiety while some are designed so that a high score indicates a low level of anxiety. An example of the later is "I feel pleasant." If the score for the statement is designed to show a high score, such as "I am tense" the scores (1,2,3,4) are left the same. But if the

statement is designed to show low anxiety, as the aforementioned example, the scoring weight are reversed (4,3,2,1). The range of scores, on both tests, if from a minimum of 20 to a maximum of 80. All of the tests were hand scored with the use of template.

Test retest reliability on the STAI A-Trait are high ranging from ,73 to .86. A-State are relatively low ranging from .16 to .54 (Spielberger, 1970). But these low r's for the A-State can be anticipated because a valid measure of A-State should reflect the transitory nature of factors at the time of testing. The alpha coefficient, a measure of internal consistency, was applied to A-State scales and showed a range of .83 to .92 (Spielberger, 1970).

Current research with the STAI indicates that the A-Trait scale is highly correlated with other measures of trait anxiety-IPT Anxiety Scale; 1983 Taylor Manifest Anxiety Scale (1953) and the Zuckerman Affect Adjective Check List (1960). The A-State scale is particularly useful when measuring state anxiety (Spielberger et al 1970).

M.A.A.C.L Test- The second test used was the Multiple Affect Adjective Check List (MAACL) (Zuckerman and Lubin, 1965). Again this test is a self-report instrument to measure the negative affects of anxiety, depression and hostility. (See Appendix D) The MAACL is brief, approximately 5 min. to complete, and can be flexible as to time reference without changing items.

There are two forms of the MAACL differing only in the instructions given. This study used the "Today" form for state anxiety and used the instructions that asked how you feel now at this moment. The "General" form was not used in this study. The test is a three column list of 132 adjectives listed in alphabetical order.

When scoring the test plus items are scored if the subjects checks them while minus items are scored if the subject does not check them. This test was also hand scored with the assistance of a template.

Restest reliabilities were found to be relatively low for the today form (.00 to .40) for basicly the same reasoning as for the A-State. But group means were found to be stable over three days of testing (Zuckerman et al 1965). This group mean stability may relate to the assumption that changes in affect are random within a group unless the entire group is exposed to some sort of stressor.

The validity of the MAACL has been scrutinized with many good studies (7th Mental Measurements Year Book) and has shown that stress typically raises the scores on the Anxiety scale.

O.S.U. Step Test- The modified Ohio State Step Test (Cotten, 1971) was used to test the cardiovascular fitness of all subjects in the study. This test was utilized because it allowed for large group testing at submaximal work levels with a minimum of equipment and training for subjects as well as those administering the test.

The test is based on research (Cotten, 1971) that indicates maximum work rate (maximum aerobic capacity) could be predicted fairly accurately from submaximal work load and heart rates. The subjects worked (stepping) at predetermined rates and heights (16 to 18 in) until heart rates reached 150 beats per min. (BPM). The rates of stepping increased three times during the test and these are referred to as phases (See Appendix E). Within each phase the subject checked his heart rate six different times, for 10 sec, and his partner recorded it.

Each check is referred to as an inning. When HR reached 25 (150 BPM) he discontinued his stepping and the test was concluded for the subjects. There was a maximum of 18 possible innings. If a subjects HR was still below 25 (150 BPM) at 18 he was given a score of 19.

Compliance- The submaximal test was important to foster a high subject compliance to retesting. This did occur since subject retest compliance was calculated at 93% for this study.

Equipment- The Universal Weight lifting machine (multiple station) was used for the detraining group. The stations used in the circuit were: slant board (sit ups), leg press, curls (regular and reverse), Press (facing the machine and facing away), Bench press, "Lat" pulls (behind and in front of the head), leg extensions and leg curls.

Heart Rates- Heart rates were monitored at a particular station during each circuit. A circuit consisted of each station for 15 secs. and 10 secs. to change stations.

Written Tests- The written tests were given in a particular order. The STAI Trait was given first followed by the STAI State and then the MAACL Today. This was done to allow the general levels of Trait anxiety to be assessed first. Then "at the moment anxiety levels (State) were assessed without changing instructional sets but once by coordinating instructions for STAI-State and MAACL Today to read alike, "how you feel right now, at this moment."

Cardiovascular Tests- At this time the step test was generally explained. The first item was to explain, demonstrate and practice taking heart rates (HR). This was done at the carotid arteries by a partner while the subjects checked his own raidal pulse. The raidal

pulse was done to detect any problems in counting, while they were learning, and as a double check during the actual test.

The second item was to listen to the tape of the rhythm for stepping, the sound to stop stepping, the sound to being to count HR, the sound to stop counting and the sound to continue stepping (There is a 5 sec pause to get ready to count HR and to get ready to begin stepping). After listening to one full cycle a full cycle was demonstrated for the groups by the person or person administering the test.

Information on the HR sheets was checked (all sheets had been handed out at the beginning) for completeness and pre-test HRs were now taken. This again allowed for a check on how well subjects were taking HRs. If any seemed unusual (high or low) they were checked for accuracy and problems with the counter were corrected.

The first half of the group was ready to begin the test. Testing continued until all subjects had reached a 25 count in an inning or the 18th inning was completed. The second half of the group then completed their testing.

Detraining- Subjects in the detrained group were warmed up for approx. 5 min. with stretching and light CV work related to their sport (See Appendix F for a clarifying example). Their HRs were checked each 2 min. and the final min. of the warm up. They then went into the weight room or area to begin work on the machine. The stations utilized for a trip (circuit) were: slant board (sit ups), leg press, arm curls (regular and reverse), military press (facing the machine and facing away), bench press, "Lat" pulls (behind the head and in front), leg extensions and leg curls. If a station had two exercises one was done

on the first trip then the next on the second. On the third and 4th trips the pattern was repeated. If there was only on exercise it was done on each trip. Each station was worked 15 sec. with 10 sec. to change. The repititions were between 8-12 with low weight. The warm down consisted of the same sequence as the warm up but slowly bringing down the HR's to near resting levels. No other exercising was to be done on their own.

Wed and Fri of the first week the subjects performed six trips with a short rest after 4. On Mon. and Wed. of the second week five trips were done with no rest and on Friday there were 4 trips with no rest. The subjects HR's were taken at the leg extension and curl station during each trip and recorded.

Debriefing- After all post-testing was completed all subjects were given a full debriefing concerning the study. The subjects who completed the study were also promised an abstract of the study.

Chapter IV

ANALYSIS OF DATA

There are two main sections to be found in this chapter. The first will deal with the CV changes and the second with A-State changes.

A post-hoc analysis was generated to investigate possible relationships between A-State anxiety levels and participation on an individual (wrestling) or team (basketball) sport. This type of relationship could be a substantial source of a Type II error.

Differences within or between groups were determined by an analysis of variance with a significance level of .05. An acceptance of the null hypothesis would indicate that the independent variables (detraining time and styles) have no effect (have an effect-the size of zero) on the means of the dependent variable (A-State anxiety levels and CV levels of condition).

DESIGN

A repeated measures design was selected for this study. Pre and post-test scores were taken for state anxiety and cardiovascular levels of conditioning on all 112 subjects.

The dependent variables were anxiety, measured with STAI form x-1 and the MAACL, the "Today" form, and levels of cardiovascular fitness were determined from the Ohio State Univ. (O.S.U.) Step Test. The independent variables were the time interval of the study, (two weeks) and the method of leaving the chronic CV and exercise program. The variables were treated as interval data.

Subjects were randomly assigned to a group at the conclusion of all pre-tests. They were all given general and group specific instructions at this time.

There were two control groups utilized. Group one acted as a control against all other groups because of their unconditioned state. Group one subjects were not (for at least 16 weeks) involved in a chronic CV and exercise program. They were involved in only normal daily living routines. [If a subject was involved in a CV program in physical education class they explained the circumstances and were excused.] Group one was incorporated to demonstrate pre-test differences in A-States and CV levels between the trained subjects (groups 2,3 and 4) and the untrained group one subjects.

The second control group (#2) is also an experimental group in that these subjects are trained and drop from trained levels (above inning #9 on the OSU test) over the two week experimental interval. The control aspect of group 2 is that they did no chronic exercise pattern or taper for the two week interval. This sudden and complete absence of all

chronic exercise will provide a control for comparison against groups 3 and 4 who were detrained from their chronic exercise patterns in different ways.

Group two [no exercise] will be compared to group three [exercise 3 day/wk own selection] and group 4 [specific and supervised detraining program].

Cardiovascular Analysis

The pre and post CV levels are illustrated in Table I and Figure 1. Group 1 (unconditioned) was a minimum of 4.03 innings below the conditioned groups (2,3 and 4) on pre-tests and 2.94 innings on the post-test. Group one was below the 9th inning (mid point) pre and post. Groups 2, 3, and 4 were equal to or above the 9th inning pre and post. Clearly groups 2, 3, and 4 demonstrated higher levels of CV fitness on the O.S.U. step test.

All groups demonstrated a drop in CV levels. This movement was hypothesized in groups 2, 3, and 4 but not in group one. The magnitude of drop in group one may be attributed, at least in part, to errors in counting pulse rate.

Group 2, 3, and 4's levels of condition dropped at different rates. As hypothesized group 2 (no exercise) dropped (2.19 innings) more than group 3 (1.83 innings: Exercise choice 3 days/wk frequency) and group 3 dropped more than four (1.23 innings: detrained-structured).

The changes in CV levels were analyzed (Table II) and showed significance at the .05 levels between and within groups. The significance of this CV movement was important to establish, to allow any changes in A-State levels of anxiety to be associated with the

TABLE I

O.S.U.-CUA Levels of Condition

GROUP	$\bar{x}$ Pre	STD	$\bar{x}$ Post	STD
1-Unconditioned	7.16	2.50	6.06	2.54
2-Conditioned No Exercise	11,19	4.25	9.00	4.36
3-Conditioned Choice of Ex. Taper	12.88	3.38	11.05	4.17
4-Conditioned Detrained Taper	13.45	4.1	12.22	4.04

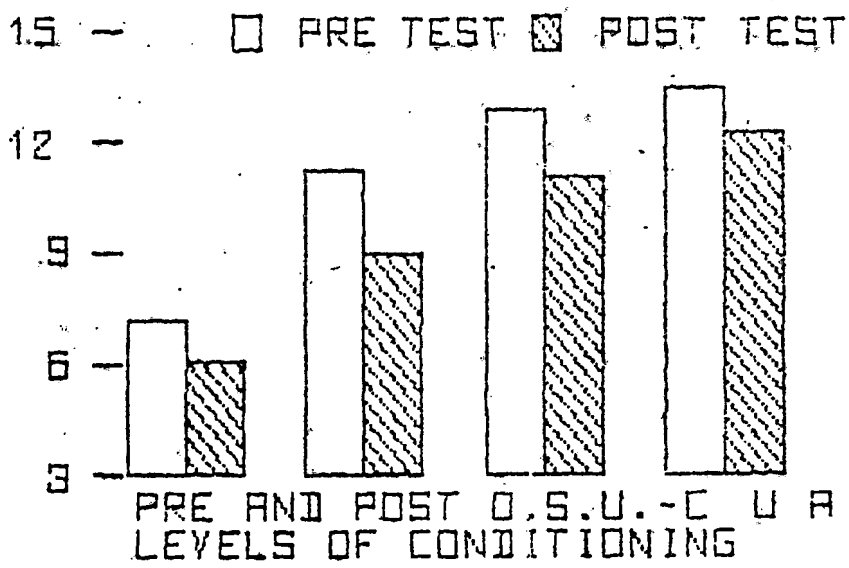

15
12
9
6
3
PRE TEST
POST TEST
PRE AND POST O.S.U.-C U A
LEVELS OF CONDITIONING

Figure 1

TABLE II

Summary ANOVA OSU-CUA Conditioned Levels

	SS	df	MS	F
Among Subjects				
Group Member	1289.86	3	429.95	18.6*
Within Subjects				
Trials	143.04	1	143.04	36.98*
Group x Trials	10.68	3	3.56	0.92
Error	417.77	108	3.87	

*Significant .05 level

varying changes in CV levels of fitness. Figure 2 graphically represents these movements and relationships.

A-State

Levels of A-State anxiety were documented through paper and pencil test. The main source of data will come from the Spielberger State-Trait Anxiety Inventory (STAI). The second source, used as an internal check of validity, was the Multiple Affective Adjective Check List (MAACL). Discussions will be centered on the STAI but the results for the MAACL, though non-significant at .05, will be presented for some comparisons and general references (Tables V, VI and Figures 5, 6).

A-State level changes are illustrated in Table III and Figure 3. Groups 2, 3, and 4 all showed moderate drops in A-State levels while group one's post levels rose substantially from pre-test levels (37.60 to 40.80). Table IV illustrates that there was no significant difference between or within groups at the .05 for A-State anxiety changes.

These movements, though non-significant, were in the opposite direction to what was hypothesized. Group one was hypothesized to remain stable and it rose substantially (Figure 3 and Figure 4) over this two week interval.

The same general patterns of movement were demonstrated on the MAACL test (Figure 5) for groups 1, 2, and 3. Group 4, however, demonstrated a rise on MAACL levels. This was an interesting occurrence since the number 4 group showed the lowest A-State levels, pre and post, on both tests for anxiety as well as the highest levels of CV fitness pre and post. Also the downward shift on the STAI test was the smallest. Figure 4 and 6 graphically represent these movements.

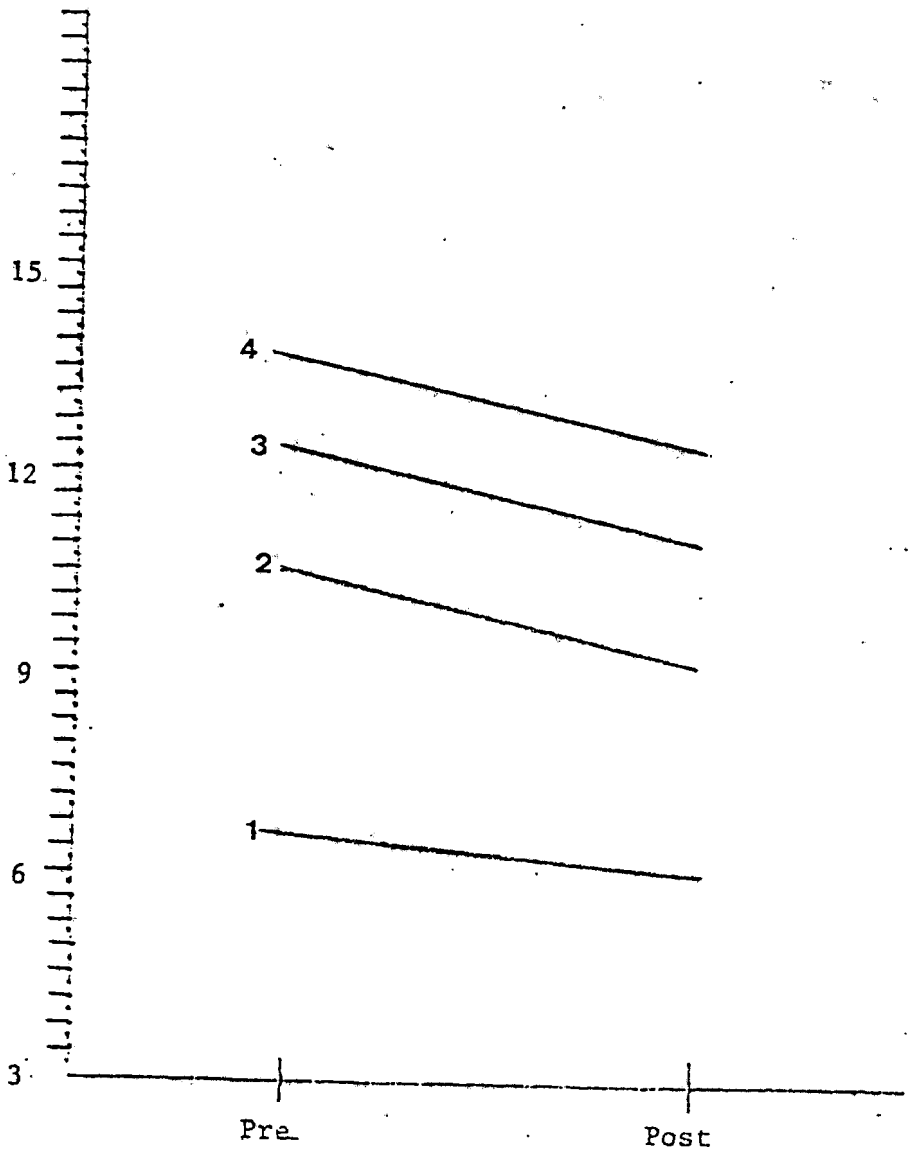


Figure 2. Pre and Post O.S.U. - CUA
Levels of Conditioning

TABLE III

A-State Anxiety-STAI

GROUP	$\bar{x}$ Pre	STD	$\bar{x}$ Post	STD
1-Unconditioned	37.60	8.72	40.80	7.16
2-Conditioned No Exercise	41.30	9.46	39.42	8.56
3-Conditioned Choice of Ex. Taper	39.58	8.44	38.82	7.8
4-Conditioned Detrained Taper	37.45	5.90	36.86	6.6

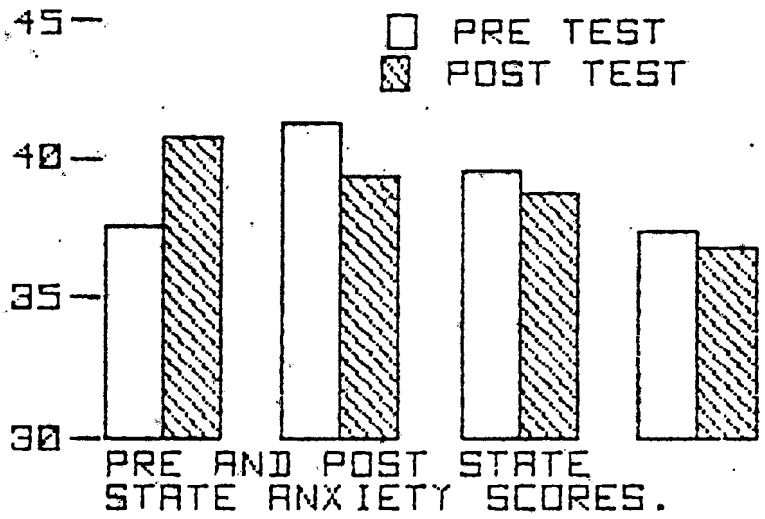

45
40
35
30
PRE TEST
POST TEST
PRE AND POST STATE
STATE ANXIETY SCORES.

Figure 3

TABLE IV

Summary ANOVA - A-State Anxiety - STAI

	SS	df	MS	F
Among Subjects				
Group member	250.13	3	83.38	1.04
Error	8643.75	108	80.03	
Within Subjects				
Trials	.30	1	.30	.01
Group x Trials	213.20	3	71.07	1.48

*Significant at .05 Level

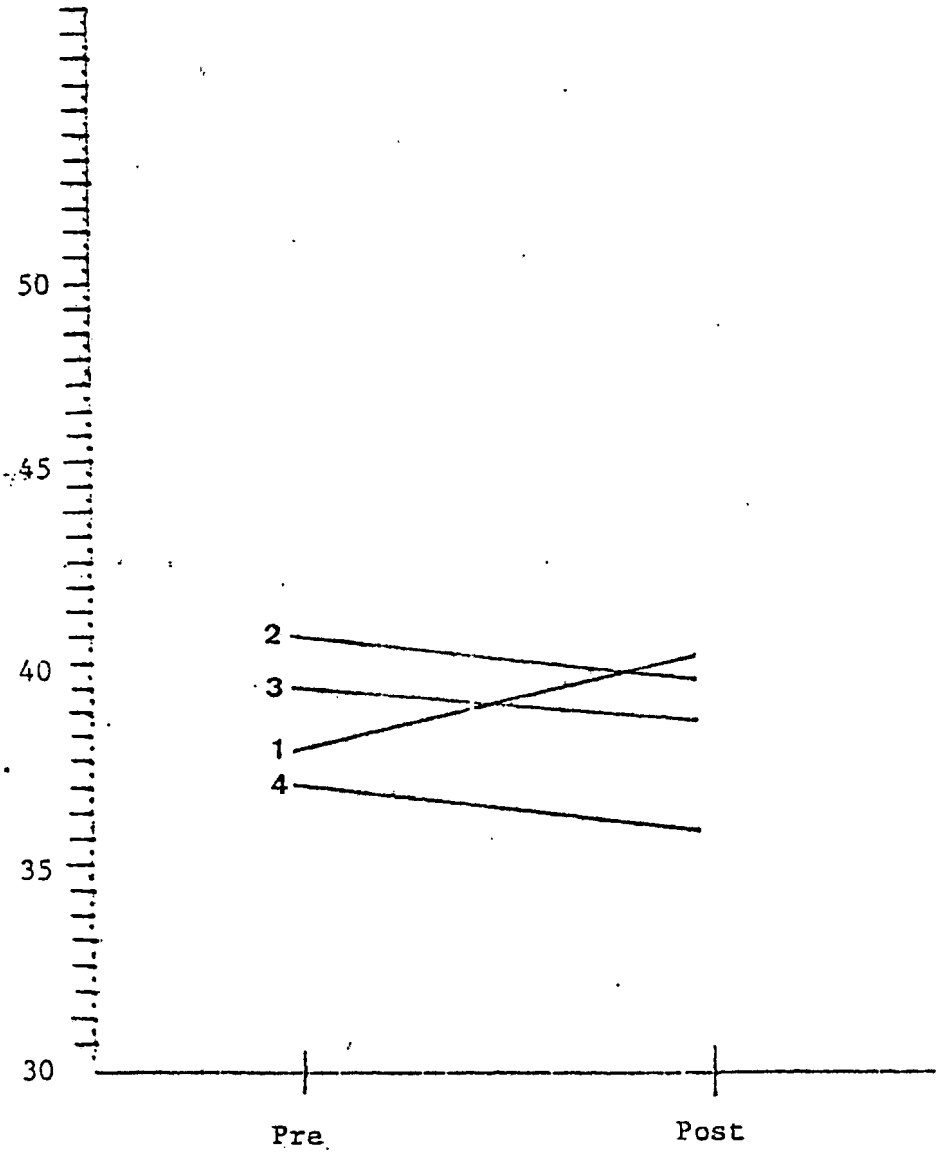


Figure 4. Pre and Post State Anxiety Scores STAI

TABLE V

A-State Anxiety- MAACL

GROUP	$\bar{x}$ Pre	STD	$\bar{x}$ Post	STD
1-Unconditioned	5.70	3.17	6.5	3.74
2-Conditioned No Exercise	6.38	2.74	5.46	3.48
3-Conditioned Choice of Ex. Taper	6.91	3.20	6.50	2.84
4-Conditioned Detrained Taper	4.90	2.67	5.68	2.51

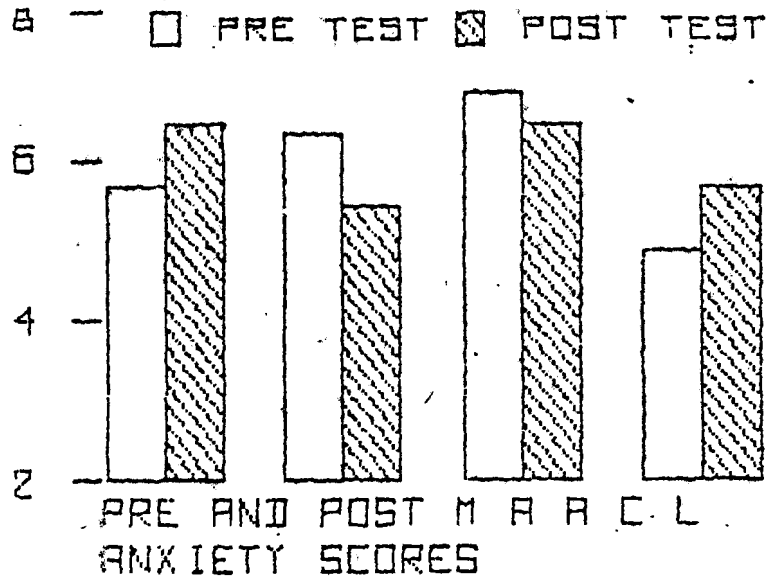


Figure 5

TABLE VI

Summary ANOVA - A-State Anxiety - MAACL

	SS	df	MS	F
Among Subjects				
Group member	55.02	3	18.34	1.29
Error	1530.87	108	14.17	
Within Subjects				
Trials	.04	1	.04	.01
Group x Trials	30.09	3	10.03	1.97
Error	549.37	108	5.09	

*Significant at .05 Level

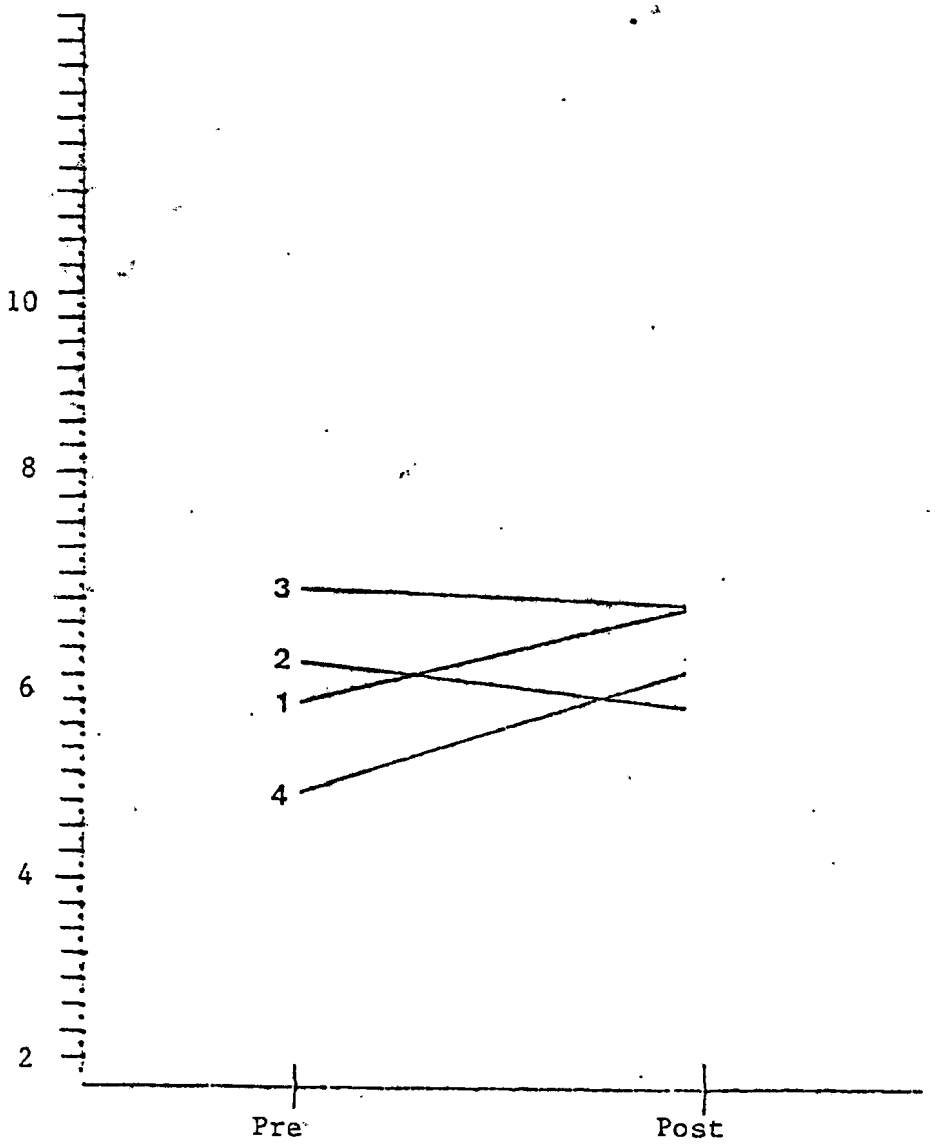


Figure 6. Pre and Post MAACL Anxiety Scores

Post Hoc

Table VII represents the post-hoc split plot analysis looking at sport as a possible factor influencing A-State levels. Figure 7 is a graphic representation of the A-State shifts of team and individual sports for group three. The two team sports represented (football and basketball) showed a marked difference to a modified detraining schedule. A significant finding here would help to explain the large A-State confidence levels (Figures, 8-11). This type of influence could work to elevate pre levels because of the nature of the sport (aggressive) or lower post states because of the absence of aggressive participation. This aspect increases in relevance since there is some evidence that MAACL measures of anxiety hostility and depression are intercorrelated (Kelly, 1972). Correlations generated in this study (See Appendix G) showed some significant correlations between the above mentioned variables. The analysis in Table VII shows no significant variance between or among groups at the .05 level. But there does appear to be some variance between and within subjects in trial by sport. The F value is 3.66 and P= 0.596. Although not significant at .05 this variance does raise some questions concerning the effect of participation in a particular sport on A-State anxiety levels. The random mixing of sports may be a source of error and increase the probability of Type II error. The dynamic aspect of anxiety may also be another source of error to be aware of.

TABLE VII

Summary ANOVA - Split Plot

	SS	df	MS	F
Among Subjects				
Group member	190.68	2	95.34	1.15
Sport	38.94	1	38.94	.47
Group x Sport	160.66	2	80.33	.97
Error	6277.16	76	82.59	
Within Subjects				
Trials	32.55	1	32.55	.71
Trials x Group	8.60	2	4.30	.09
Trials x Sport	167.51	1	167.51	3.66
Trials x Group x Sport	5.91	2	2.96	.06
Error	3481.35	76	45.81	

*Significant .05 Level

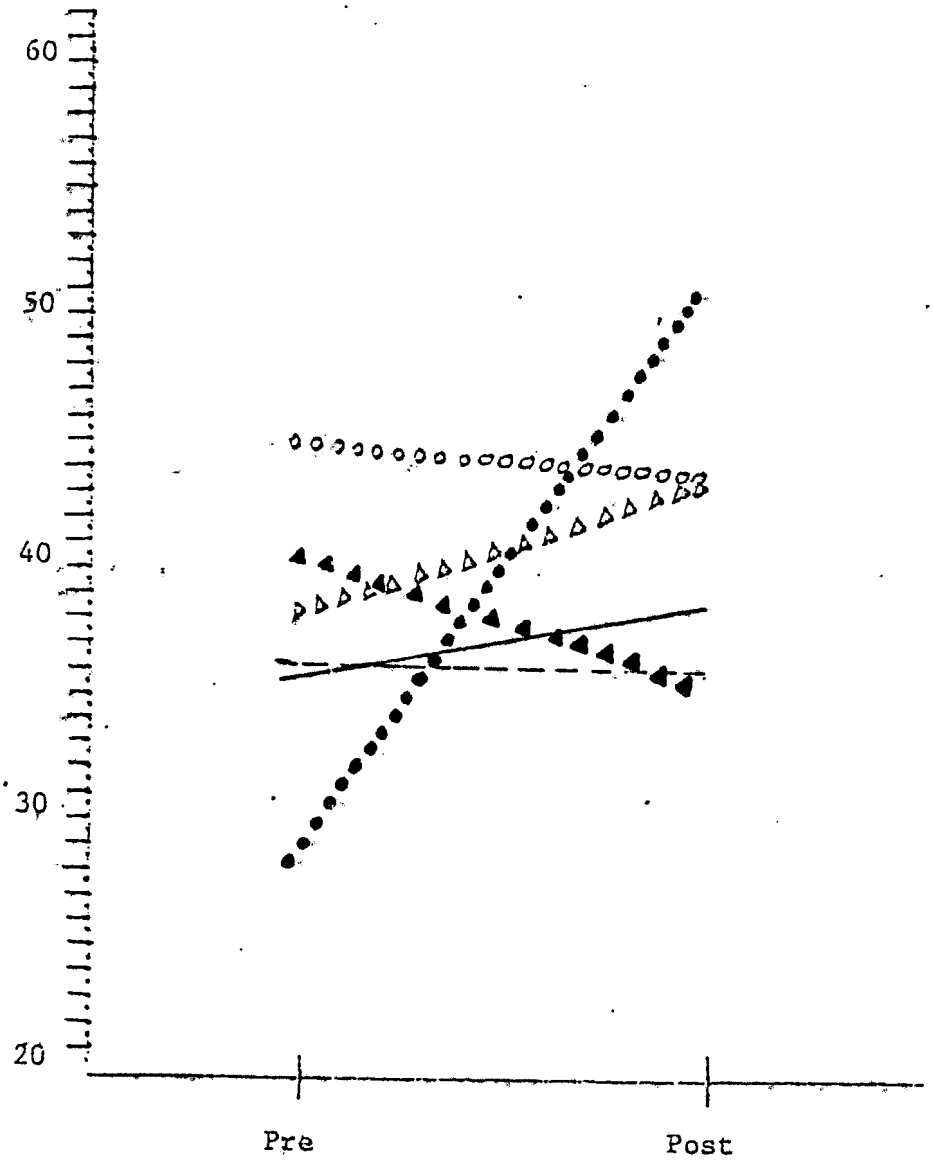
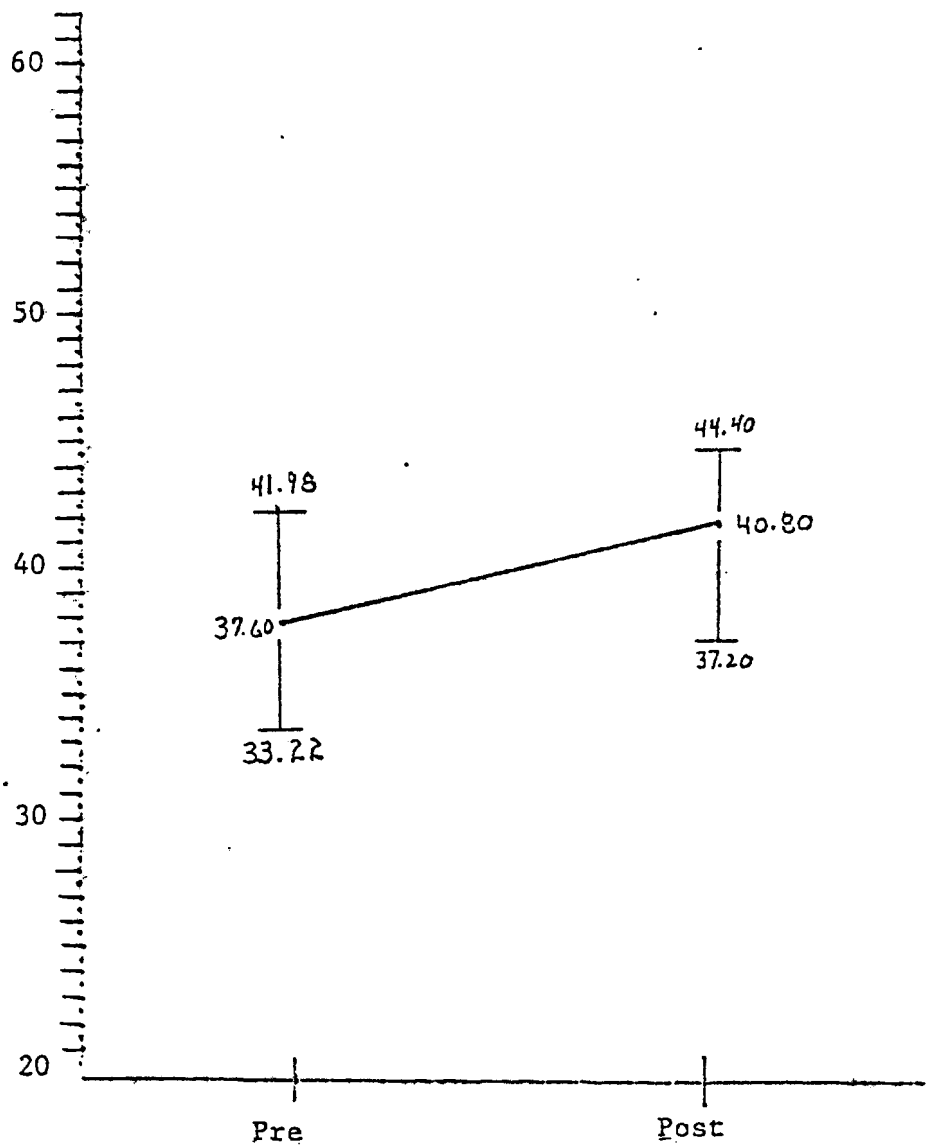
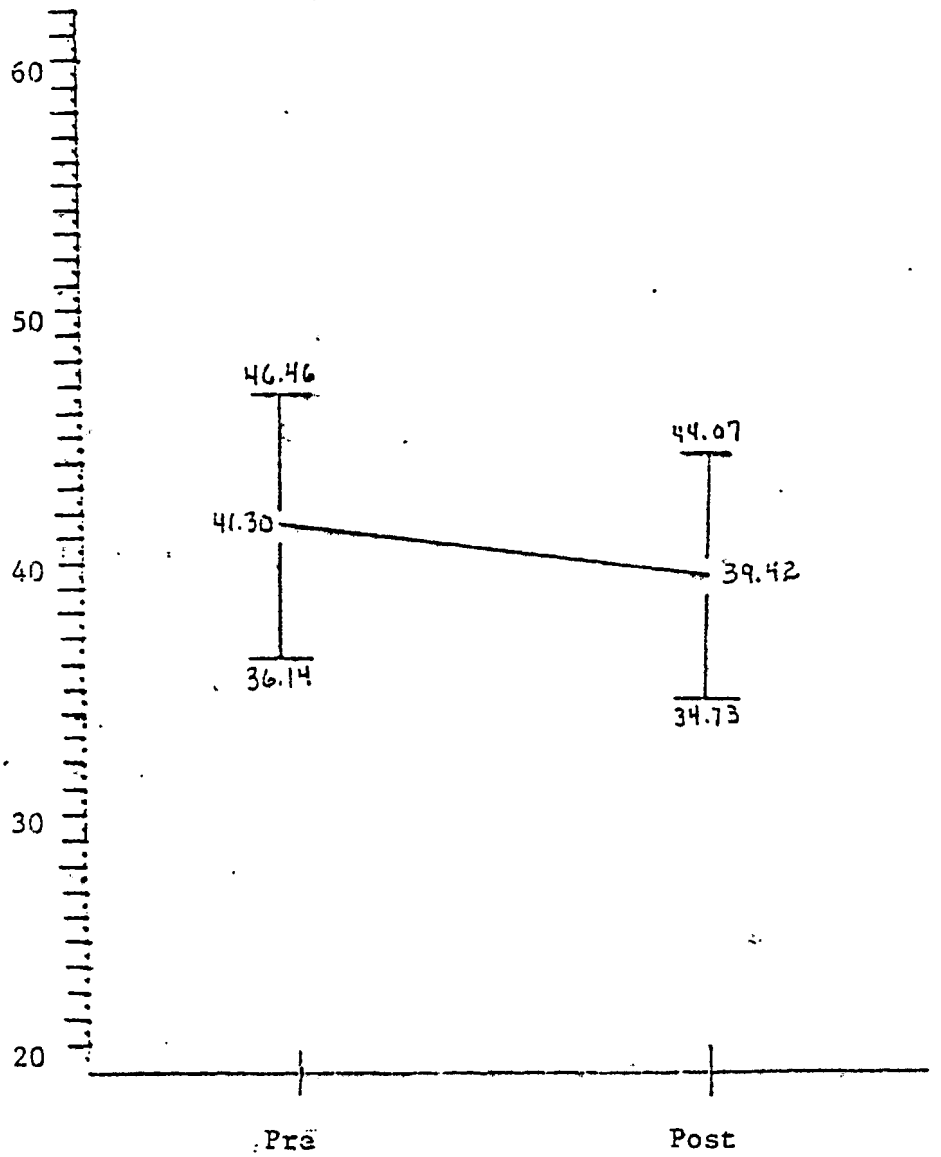

60
50
40
30
20
Pre
Post
TEAM SPORTS
BASKETBALL (16)
FOOTBALL (4)
INDIVIDUAL SPORTS
CROSS. COUNTRY (5)
TRACK & FIELD (2)
WRESTLING (6)
GOLF (1)

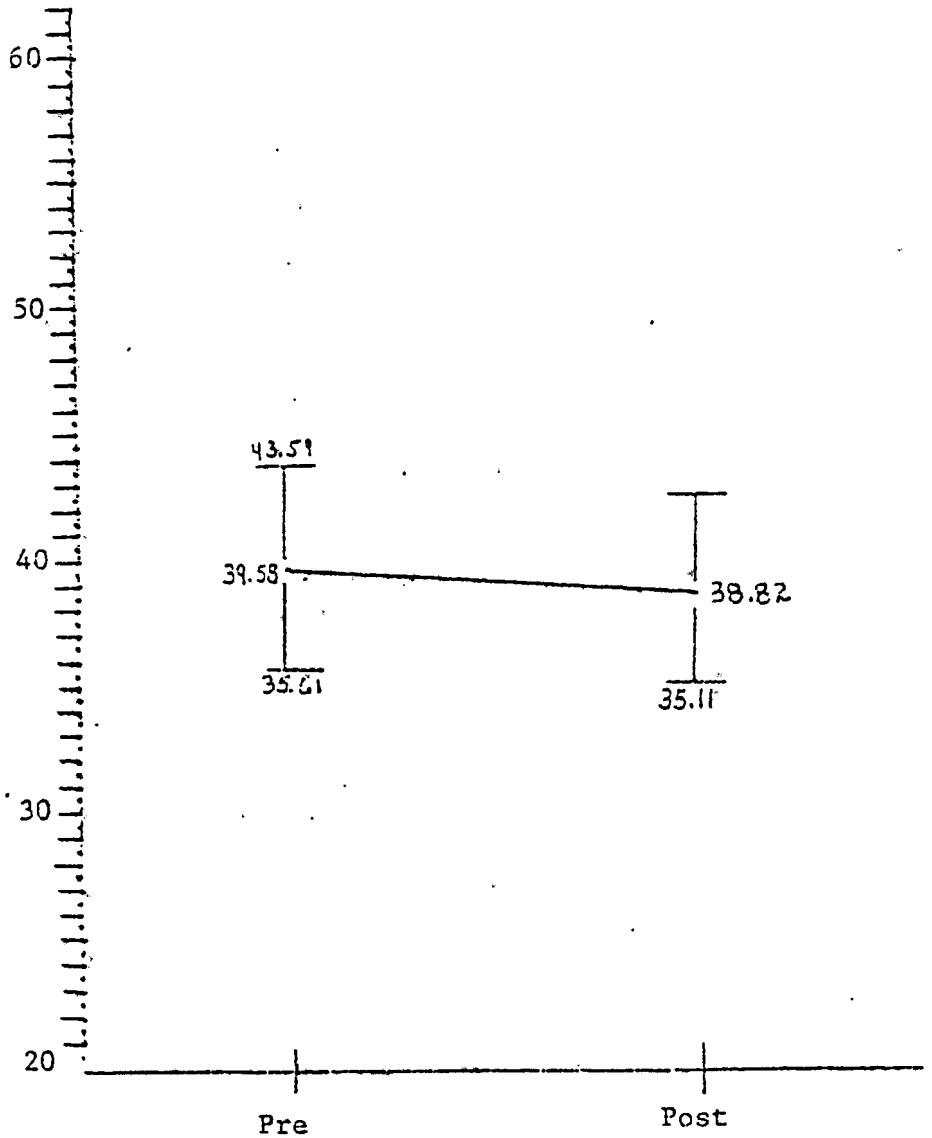
Figure 7



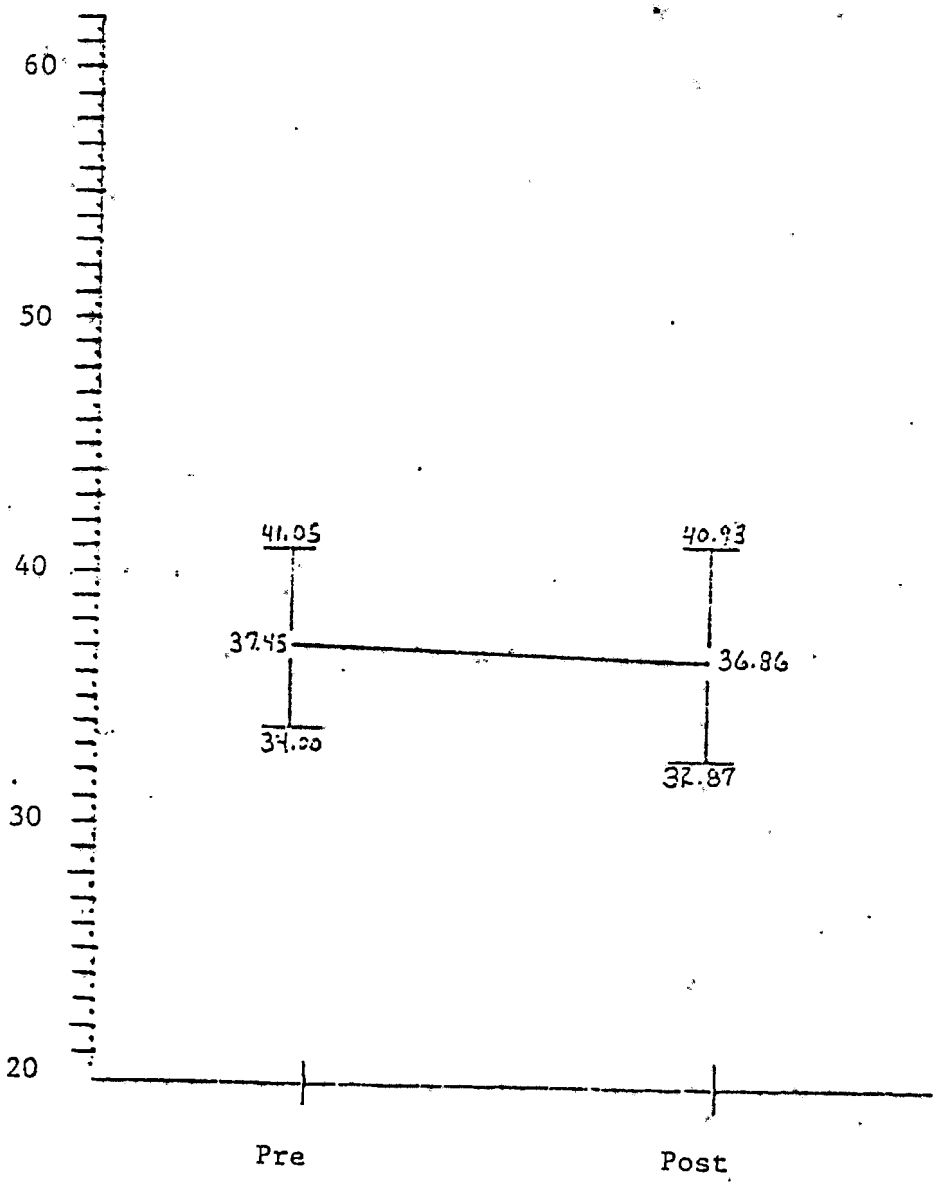
Group 1
Figure 8. CONFIDENCE INTERVAL
STAI - ANXIETY



Group II
Figure 9. CONFIDENCE INTERVAL
STAI - ANXIETY



GROUP III
Figure 10. CONFIDENCE INTERVAL
STAI - ANXIETY



GROUP IV
Figure 11. CONFIDENCE INTERVAL
STAI - ANXIETY

TYPE II ERROR

The aforementioned sources of error as well as the loss of some control because of the retrospective nature of the CV data compounds the possibility of Type II error.

Further evidence of a Type II error is the low (.39) power analysis of the F test at the .05 level of significance (Cohen, 1969). Thus the F test's probability of rejecting the null hypothesis under the given circumstances is not very high. (See Appendix H)

The low pre A-State levels of group one may be a result of the dynamic nature of anxiety or a combination of factors many of which will not be apparent. This multidimensional nature of anxiety (Schwartz, et al 1978) makes this a very real possibility. This may also account for the shift upward on the post test.

This radical movement of groups on (on STAI and the MAACL) does highlight the fact that the 3 conditioned groups, who were hypothesized to move up did not and actually moved down over the two weeks. There are several possibilities to account for this reversal of hypothesized directional shift. As mentioned sport may have had a direct relationship to anxiety levels. But other more subtle factors may have also been at work.

One of the basketball teams was very good and was picked to win all post season tournaments. They lost their first play off game and were tested the very next day. If levels of anxiety measurement show a correlation with hostility and depression (Kelly, 1972) there may be a blending of measures and this would show in elevated pre-levels of A-State anxiety. Along this same line of reasoning some of the sports (wrestling and football) require direct physical contact and an apparent

aggressive nature or developed attitude for participation and or success. This factor may have been working during pre-testing and helped to elevate pre-levels of A-State anxiety. These factors as well as presently unknown factors may have acted to maintain an artifically high level of pre-test A-States.

The three conditioned groups movement down in levels of A-State anxiety does raise still another possibility. Even though this movement was in a direction opposite to what was hypothesized it was graduated in the hypothesized amount for each group. Group 2 showed the greatest shift then three and finally group four. These movements were not of substantial magnitude as was group one's. These two factors may be reflecting a possible buffering effect of elevated levels of CV fitness (Morgan and Pollock, 1977; Young, 1979). There does appear to be some stabilizing factor working in the three conditioned groups.

Chapter V

Summary Conclusion Recommendations

The purpose of this research was to explore the possible need for a taper from a chronic exercise program. Anxiety was used as a possible indicator of behavioral adaptations to a decreasing level of CV and muscle endurance levels. Modifications of this taper were also explored.

Eighty-two conditioned subjects and thirty unconditioned subjects were pre tested for CV levels of condition and A-State levels of anxiety. The conditioned subjects were randomly assigned to three groups each detraining at different rates and styles. All 112 subjects were post tested for CV and A-State levels after a two week interval.

The unconditioned group showed low pre and post levels of CV fitness and low pre levels A-State anxiety. This low level of A-State took a large upward directional shift on the post test for A-State Anxiety.

The conditioned groups, who were detrained, dropped in levels of CV condition as per their level of modification of detraining programs. Their levels of A-State anxiety dropped slightly over the two week detraining interval. Significance was found at the .05 level between and among subjects for the changes in A-State anxiety levels. Some directional trends could be seen as well as a possible buffering effect on A-State levels from elevated levels of CV fitness.

CONCLUSIONS

The findings of this investigation form the basis for the following conclusions:

1. The unconditioned subjects showed substantial shifts in levels of A-State anxiety over a two week time span.

2. Conditioned subjects who suddenly stop a chronic exercise routine, with no further exercise, demonstrated a larger drop in anxiety levels than the two groups who continued some exercise.

3. Conditioned subjects who detrained with an exercise pattern of their own on limited days showed a directional shift toward reduced levels of A-State anxiety. This shift was less than that of group 2 who did no exercise at season's end.

4. Conditioned subjects who were detrained on a structured program for two weeks showed a small decline in A-State levels.

RECOMENDATIONS

During the course of this research several questions and suggestions arose which seem to warrant further investigation:

1. The research could be aimed at specific sports, individual versus team.

2. The multidimensionality of anxiety could be evaluated through use of the Cognitive-Somatic Anxiety Questionnaire (QSAQ). CV condition and cognition of CV changes could be individually analyzed.

3. Aggressive versus non aggressive sports could be evaluated as to effect on A-State levels in relation to the fitness generated during that sport season.

4. The research could be directed at a higher age range to allow for emotional maturity and a possible stabilization and clarification of psychological states.

5. Specific levels of CV, strength and muscle endurance could be developed and detrained to look at A-State changes.

6. When pre testing team member allow a few days "grace" from the last game or competition to reduce emotional effects.

7. Incorporate more sophisticated and/or multiple measures of CV levels of conditioning.

References

Astrand, P. O., & Rodahl, K. Textbook of work physiology. New York: McGraw Hill Book Co., 1970.

Axeliod, J., & Weinshilboum, R. Catecholamines. The New England Journal of Medicine, 1972, 287, 237-242.

Barnard, A. J., et al: Cardiovascular response to sudden strenuous exercise on heart rate, blood pressure and ECG. J. Appl. Physiol. 34:833, 1973.

Barnard, R. J.: The heart needs warm up time. The Physician and Sports Medicine, 4:40-41, 1976.

Borkovec, T. D. Consciousness and self-regulation. Physiological and cognitive processes in the regulation of anxiety. In G. E. Schwartz, and D. Shapiro. New York: Plenum Press N. Y. p. 261-312

Bradbury, M. The Concept of a Blood Brain Barrier, New York: John Wiley & Sons, 1979.

Breggin, P. R.: The psychophysiology of anxiety with a review of the literature concerning adrenaline, J. Nerv. Ment. Dis, 139:558, 1964.

Burnstock, G., & costa, M. Adrenergic neurons. London: Chapman and Hall Ltd., 1975.

Cannon, W. B. Wisdom of the Body, Norton, N. Y. 1963.

Clarke, D. H. Exercise physiology. Englewood Cliffs, N.J.: Prentice Hall Inc., 1975.

Cohen, J., Statistical Power Analysis for the Behavioral Sciences. New York: Academic Press, Inc. 1969.

Cotten, D. J. A modified step test for group cardiovascular testing. Research Quarterly, 1971, 42, 91-95.

Cureton, T. K. Improvement of psychological states by means of exercise-fitness programs. Journal Association of Physical and Mental Rehabilitation, 1963, 17, 14.

de Vries, H. A. Physiology of exercise. Dubuque, Iowa: Wm. C. Brown Co., 1966.

de Vries, H. A. Immediate and long term effects of exercise upon resting muscle action potential level. The Journal of Sports Medicine and Physical Fitness, 1968, 8, 1-11.

de Vries, H. A. & Adams, G. M. Electromyographic comparison of single doses of exercise and meprobamate as to the effects on muscular relaxation. American Journal of Physical Medicine, 1972, 51, 130-141.

Dimesdale, J. E., & Moss, J. Plasma catecholamines in stress and exercise. Journal of American Medical Association, 1980, 243, 340-342.

Diskman, R. K., & Gettman, L. R. Psychobiologic influences on exercise adherence. Journal of Sport Psychology, 1980, 2, 295-310.

Engel, G., & Schmole, A. H.: Conversion - withdrawal: a primary regulatory process for organismic homeostasis. In Porter, R. & Knight J. (Eds.) Physiology, Emotion and Psychosomatic Illness, Ciba Foundation Symposium 8. Amsterdam, Elsevier, 1972 p. 57.

Engleman, K., Portnoy, B., & Sjoeidsma, A. Plasma catecholamine concentrations in patients with hypertension. Circulation Research,

1970, 27, 141-145.

Folkins, C. H., & Amsterdam, E. A. Control modification of stress emotions through chronic exercise. In Amsterdam, E. A., Wilmore, J. H., & DeMaria, A. N. (Eds.) Exercise in Cardiovascular Health and Disease. New York: Yorke Medical Books, 1977.

Folkins, C. H., & Sime, W. E. Physical fitness training and mental health. American Psychologist, 1981, 36, 373-389.

Frankenhaeuser, M. Catecholamines and behavior. Brain Research, 1970, 24, 552-553.

Franks, B. D., & Jette', M. Manifest anxiety and physical fitness. NCPEAM Proceedings, 1969, 73, 48-57.

Goodall, M. Sympothoadrenal response to gravatational stress. J. Clin. Invest. 1962, 41:197-202.

Gove, P. B. (Editor in chief) Webster's third new international dictionary. Springfield, Mass.: G. and C. Merriam Co., 1969.

Hahner, R. H., & Rochelle, R. H. A comparison of autonomic nervous system activity between physically trained and untrained individuals. Research Quarterly, 1968, 39, 975-982.

Hartley, L. H., Mason, J. W., Hogan, R. P., Jones, L. G., Kotchen, T. A. Mougey, E. H., Wherry, F. E., Pennington, L. L., Ricketts, P. T. Multiple hormonal responses to groded exercise in relation to physical training. Journal of Applied Physiology. 1972, 33:602-606.

Haugin, G. B., Dixon, H. H., Dickel, H. A. A therapy for anxiety tension reactions. New York: MacMillan Co., 1960.

Hollandsworth, J. G., Jr. Some thoughts on distance running as training in biofeedback. Journal of Sports Behavior, 1979, 2,

71-82.

Herrnstein, R. J. Method and theory in the study of avoidance. Psychol. Rev. 76, 1969, 49-69.

Holloszy, J. O., Rennie, M. J., & Hickson, R. C. Physiological consequences of the biochemical adaptions to endurance exercise. In P. Milvy (Ed.). The marathon: physiological, medical, epidemiological, and psychological studies (Vol. 301). New York: New York Academy of Sciences, 1977.

Holmes, T. H., & Masuda, M.: Life change and illness susceptibility. In Senay, E. C. & Scott, J. P. (Eds.): Separation and Depression: Clinical and Research Aspects. Lancaster, Pa., American Association for the advancement of Science, 1973 p. 161.

Hokfelt, T., Fuxe, K. et. al. Immunohistochemical evidence for the existence of adrenaline neurons in the rat brain. 1974 Brain Research 66:235-51.

Ismail, A. H., & Young, J. R. Effect of chronic exercise on the personality of adults. In P. Milvy (Ed.), The marathon: physiological, and psychological studies (Vol. 301). New York: New York Academy of Sciences, 1977.

Ismail, A. H., & Young, J. R. Effect of chronic exercise on the multivariate relationships between selected biochemical and personality valuables. 1977, 12:49-67, J. of Multivariate Behavioral Research

Jacklér, F., & Steiner, S. Morphine and intracranial self-stimulation in the hypotholamus and dorsal brain stem: differential effects of dose, time and site. Int. J. Neurosci. 1979, 9:21-35.

Jasper, Herbert H. Reticular Formation of the Brain. Toronto: Little Brown & Co., 1958.

Jensen, C. R., & Fisher, G. A. Scientific basis fo athletic conditioning. Philadelphia: Lea and Febiger, 1979.

Jette', M. A blood serum personality trait profile of habitual exercises. Proceedings of the joint meeting of the Canadian Assoc. Sports Sci and the American College of Sports Science, 1971, Toronto, Canada.

Jones, S. S., & Smith, T. Impressions of running/jogging and their effect on mental health. Psychology: A Quarterly Journal of Human Behavior, 1979/1980, 16, 21-24.

Kelly, D. Anxiety and Emotions Physiological Basis and Treatment Springfield, Illinois: Charles C. Thomas, 1980.

Kelly, E.L., Tests and Reviews: Character-Nonprojective. In O.K. Buros (Ed.), The Seventh Mental Measurement Yearbook (Vol. I). New Jersey: Gryphon Press 1972.

Kimber, D. C., Gray, C. E., & Stackpore, C. E. Anatomy and physiology. New York: Macmillan Co., 1966.

Kline, N. B-Endorphin-induced changes in schizophrenic and depressed patients. Arch. Gen. Psychiatry. 1977, 34:1111-13.

Larsson, S. On the hypotholamic organization of the nervous mechanism regulating food intake. 1954, Acta Physiol. Scand. 32, (Suppl.115):1-63.

Lazarus, R. S. A cognitively oriental psychologist looks at biofeedback. American Psychologist, 1975, 30, 553-561.

Little, J. C. The athlete's neurosis--a deprivation crisis. Acta Psychiatrica Scandinavica, 1969, 45, 310-320.

Martin, B. J., Robinson, S., Wiegman, D. L., & Aulick, L. H.: Effect of warm-up and metabolic responses to strenuous exercise. Medicine

in Science and Sports, Vol. VII, No. 2, pp. 146-149, 1975.

Martin, I. Psychophysiology and conditioning. In P. H. Venables and J. C. Margaret (Ed.), Research in psychophysiology. London: John Wiley and Sons Ltd., 1975.

Mason, J. W. A review of the psychoendocrine research on the sympathetic-adrenal medullary system. Psychosomatic Medicine, 1968, 30, 631-653.

McGeer, P. L., & McGeer, E. G. Chemistry of Mood & Emotion. In M. R. Rosenzweig, & L. W. Porter (Ed.), Annual Reviews Inc. Polo Alto Cal., 1980, 31:273-307.

Miller N. Learning of visceral and glandular responses. Science, 1969 163, 434-445.

Morgan, W. P. Physical fitness and emotional health: a review. American Corrective Therapy Journal, 1969, 23, 124-127.

Morgan, W. P. Influence of acute physical activity on state anxiety. NCPEAM Proceedings, 1973, 76, 113-121.

Morgan, W. P., & Pollock, M. L. Psychologic characterization of the elite distance runner. Annals of New York Academy of Sciences, 301:382-403, Oct. 31, 1977.

Morgan, W. P., & Pollock, M. L. Psychologic characterization of the elite distance runner. In P. Milvy (Ed.), The marathon: physiological, medical, epidemiological and psychological studies (Vol.301). New York: New York Academy of Sciences, 1977.

Morgan, W. P. The management of anxiety in sports. National Convention, Kansas City, Mo., 1978, Part I.

Mowrer, OH 1947 Two facto theory of learning. On the dual nature of learning: A reinterpretation of "conditioning" and "problem

solving" Harvard Educat. Rev. 17, 102-48. Learning Theory and Behavior. Wiley, N. Y.

Olds, J., & Milner, P. Positive reinforcement produced by electrical stimulation of ceptal area and other regions of rat brain. J. Comp Physiol. Psychol. 1954, 47:419-427.

Olds, M. E., & Fobes, J. L. The central basis of motivation: Intracranial self-stimulation studies. In M. R. Rosenzweig, & L. W. Porter. Annual Review of Psychology, (Vol. 32), 523-574. Polo Alto California: Annual Review, Inc., 1981.

Paxton, C. A study of the effects of a self-moderated running program on health hazard appraisal and anxiety assessments. Health Education - Research Abstracts, 12:42, Mar/April 81. (Unpublished Doctorial Dessertation Univ. Of Oregon, Eugene, 1979).

Peronnet, F., Cleroux, J., Perrault, H., Cousineau, D., DeChamplain, J., Nadeau, R. Plasm norepinephrine response to exercise before and after training in humans. J. Applied Physiology, 1981, 51 (4): 812-15.

Rapoport, S. I., MD Blood-Brain Barrier in Physiology and Medicine New York: Raven Press, 1976.

Rescorla, R. A., & Solomon, R. L. Two process learning theory: relationships between pavlovian conditioning and insturmental learning. Psychological Review. 1967, 74, 151-182.

Robertson, D., Johnson, G. A., Robertson, R. M., Nies, A. S., Shand, D. G., & Oates, J. A. Comparative assessment of stimuli that release neuronal and adrenomedullary catecholamines in man. Circulation, 1979, 59, 637-643.

Ross, E. Diseases of the adrenal medulla. Medicine (Endocrine

Diseases), 2:157, 1972.

Routtenberg, A. The reward system of the brain. Sci. America 1978, 239:154-64.

Schwartz, G. E., Davidson, R. J., & Goleman, D. J. Patterning of cognitive and somatic processes in self-regulation of anxiety: Effects of medication versus exercise. Psychosomatic Medicine, 1978, 40, 321-328.

Silva, J. M., Schultz, B., & Murray, D. Psycophysiological assessment of the 1980 United Stated Olympic freestyle and greco Roman wrestling candidates. Abstract of Research Papers, NV:115 '81.

Spielberger, C. D., Gorsuch, R. L., & Luschene, R. E. The state-trait anxiety inventory. Palo Alto, Calif.: Consulting Psychologists Press, 1970.

Spielberger, C. D. Theory and research on anxiety. In C. D. Spielberger (Ed.), Anxiety and behavior. New York: Academic Press, 1966.

Spielberger, C. D. Anxiety: Current trends in theory and research (Vol. 1 & 2). New York: Academic Press, 1972.

Svante von Euler, U. Sympath-adrenal activity in physical exercise. Medicine and Science in Sports, 1974, 6, 165-174.

Taber's Cyclopedic Medical Dictionary Ed C. L. Thomas 13th edition Philadelphia 1977.

Thoresen, C. E., & Wilber, C. S. Some encouraging thoughts about self-reinforcement. Journal of Applied Behavior Analysis, 1976, 9, 518-520.

Torpy, R. M. Basic Principals of Learning. Scott Formman and Co. California: 1975.

Van Toller, C. The nervous body an introduction to the autonomic nervous system and behavior. New York: John Wiley and Sons, 1979.

Wilson, V. E., Berger, B. G., & Bird, E. I. Effects of running and of an exercise class on anxiety. Percept and Mot. Sk. Oct. 81, 53:472474.

Wilson, V. E., Morley, N. C., & Bird, E. I. Mood profiles of marathon runners, joggers, and non-exercisers. Perceptional and Motor Skills, 1980 50:117-118.

Winder, W. W., Hagberg, J. M., Hickson, R. C., Ehsani, A. A., & McLane, J. A. Time course of sympathoadrenal adaption to endurance exercise training in man. Journal of Applied Pyhsiology, 1978, 45, 370-374.

Young, R. J. The effect of regular exercise on cognitive functioning and personality. Brit. J. Sports Med. 1979, 13:110-117.

Zuckerman, M. The development of an affect adjective check list for the measurement of anxiety. Journal of Consulting Psychology, 1960, 24, 457-462.

Appendix A

Name: Age:

Address: Zip Code:

Occupation: Present Education Level:

Sport (if any)
participating in:

Dear Participant;

The research study underway has to do with several possible psychological changes that may be occuring during detraining procedures.

The tasks asked of you will be very brief. Paper and pencil test (two) and submaximal (pulse rate limited) cardiovascular tests (two). You will be plaed (randomly) in one of your groups. The duration of the study will be two (2) weeks. The most time involved will be only Mon., Wed. and Friday of each week for a maximum of thirty five minutes.

It is very important that as a member of this study you follow all directions to the best of your ability.

All participants completing the study tasks will be presented with a full summary of the results.

Signed: Date:
(If under 18 parent or guardian)

Appendix B

TESTING SEQUENCE

PRE TEST

	Test	Ave Time
A.	STAI TRAIT	6-8 min.
B.	STAI STATE	6-8 min.
C.	MAACL "TODAY"	5-7 min.
D.	O.S.U. STEP TEST	20-40 min.*

POST TEST

	Test	Ave Time
A.	STAI STATE	6-8 min.
B.	MAACL "TODAY"	5-7 min.
C.	O.S.U. STEP TEST	15-40 min.*

*This time frame varied greatly depending on the type of group, conditioned or unconditioned and the numbers to be tested.

Appendix C

SELF-EVALUATION QUESTIONNAIRE

Developed by C. D. Spielberger, R. L. Gorsuch and R. Lushene

STAI FORM X-1

NAME _____ DATE _____

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

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	①	②	③	④
2. I feel secure	①	②	③	④
3. I am tense	①	②	③	④
4. I am regretful	①	②	③	④
5. I feel at ease	①	②	③	④
6. I feel upset	①	②	③	④
7. I am presently worrying over possible misfortunes	①	②	③	④
8. I feel rested	①	②	③	④
9. I feel anxious	①	②	③	④
10. I feel comfortable	①	②	③	④
11. I feel self-confident	①	②	③	④
12. I feel nervous	①	②	③	④
13. I am jittery	①	②	③	④
14. I feel "high strung"	①	②	③	④
15. I am relaxed	①	②	③	④
16. I feel content	①	②	③	④
17. I am worried	①	②	③	④
18. I feel over-excited and "rattled"	①	②	③	④
19. I feel joyful	①	②	③	④
20. I feel pleasant	①	②	③	④

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SELF-EVALUATION QUESTIONNAIRE

STAI FORM X-2

NAME _____ DATE _____

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

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I tire quickly	①	②	③	④
23. I feel like crying	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I am losing out on things because I can't make up my mind soon enough	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I am inclined to take things hard	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I try to avoid facing a crisis or difficulty	①	②	③	④
35. I feel blue	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

Appendix D

MULTIPLE AFFECT ADJECTIVE CHECK LIST

TODAY FORM

By Marvin Zuckerman
and
Bernard Lubin

Name..... Age..... Sex.....

Date..... Highest grade completed in school.....

DIRECTIONS: On this sheet you will find words which describe different kinds of moods and feelings. Mark an ☒ in the boxes beside the words which describe how you feel now - today. Some of the words may sound alike, but we want you to check all the words that describe your feelings. Work rapidly.

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MAA 001

- ☐ active
- ☐ adventurous
- ☐ affectionate
- ☐ afraid
- ☐ agitated
- ☐ agreeable
- ☐ aggressive
- ☐ alive
- ☐ alone
- ☐ amiable
- ☐ amused
- ☐ angry
- ☐ annoyed
- ☐ awful
- ☐ bashful
- ☐ bitter
- ☐ blue
- ☐ bored
- ☐ calm
- ☐ cautious
- ☐ cheerful
- ☐ clean
- ☐ complaining
- ☐ contented
- ☐ contrary
- ☐ cool
- ☐ cooperative
- ☐ critical
- ☐ cross
- ☐ cruel
- ☐ daring
- ☐ desperate
- ☐ destroyed
- ☐ devoted
- ☐ disagreeable
- ☐ discontented
- ☐ discouraged
- ☐ disgusted
- ☐ displeased
- ☐ energetic
- ☐ enraged
- ☐ enthusiastic
- ☐ fearful
- ☐ fine

45 ☐ fit
46 ☐ forlorn
47 ☐ frank
48 ☐ free
49 ☐ friendly
50 ☐ frightened
51 ☐ furious
52 ☐ gay
53 ☐ gentle
54 ☐ glad
55 ☐ gloomy
56 ☐ good
57 ☐ good-natured
58 ☐ grim
59 ☐ happy
60 ☐ healthy
61 ☐ hopeless
62 ☐ hostile
63 ☐ impatient
64 ☐ incensed
65 ☐ indignant
66 ☐ inspired
67 ☐ interested
68 ☐ irritated
69 ☐ jealous
70 ☐ joyful
71 ☐ kindly
72 ☐ lonely
73 ☐ lost
74 ☐ loving
75 ☐ low
76 ☐ lucky
77 ☐ mad
78 ☐ mean
79 ☐ meek
80 ☐ merry
81 ☐ mild
82 ☐ miserable
83 ☐ nervous
84 ☐ obliging
85 ☐ offended
86 ☐ outraged
87 ☐ panicky
88 ☐ patient

89 ☐ peaceful
90 ☐ pleased
91 ☐ pleasant
92 ☐ polite
93 ☐ powerful
94 ☐ quiet
95 ☐ reckless
96 ☐ rejected
97 ☐ rough
98 ☐ sad
99 ☐ safe
100 ☐ satisfied
101 ☐ secure
102 ☐ shaky
103 ☐ shy
104 ☐ soothed
105 ☐ steady
106 ☐ stubborn
107 ☐ stormy
108 ☐ strong
109 ☐ suffering
110 ☐ sullen
111 ☐ sunk
112 ☐ sympathetic
113 ☐ tame
114 ☐ tender
115 ☐ tense
116 ☐ terrible
117 ☐ terrified
118 ☐ thoughtful
119 ☐ timid
120 ☐ tormented
121 ☐ understanding
122 ☐ unhappy
123 ☐ unsociable
124 ☐ upset
125 ☐ vexed
126 ☐ warm
127 ☐ whole
128 ☐ wild
129 ☐ willful
130 ☐ wilted
131 ☐ worrying
132 ☐ young

Appendix E

STEP TEST- HEART RATE

No.1 NAME AGE GR

1. _____
2. _____
3. _____
4. _____ Pre test HR _____
5. _____
6. _____

---

7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

---

13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

No.2 NAME AGE GR

1. _____
2. _____
3. _____
4. _____ Pre test HR _____
5. _____
6. _____

---

7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

---

13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

Appendix F

Example

Detraining Program

Basketball

3/4, 3/6, 3/9, 3/11, 3/13

The purpose of the sessions was to keep the heart rates of the boys up to 25 beats per minute for approximately 35 minutes on 3/4 and 3/6, 30 minutes on 3/9 and 3/11, and 20 minutes on 3/13. The boys did their usual pre-work stretching routine. After they started a gradual warm up was used--a familiar drill, the 3 man weave and shoot. The boys started slowly and worked in 2-minute blocks and checked their heart rates after each 2 minutes and gradually had their heart rates up to between 23-25 beats per 10 seconds after 5 minutes.

The boys then went into the weight (Universal) room. They worked a program of low weight, high reps. (8-12) and 15 seconds per work station and 10 seconds to change stations. Their heart rates were checked as they worked and recorded. When each player was working on the leg extension station, I took their heart rates and recorded them. On 3/4 and 3/6 there were six trips around all the stations with a short rest after 4 trips. On 3/9 and 3/11 there were 5 trips with no rest; and on 3/13, 4 trips with no rest.

Then there was a 5-minute warm down consisting of the 3 man weave and shoot again, slowly bringing down their rates and then walking until their rates were only a few beats above their resting levels.

Specific results are as follows:

Mean heart rates of group will be given.

Wednesday 3/4

*HR after Stretch= 12.3

warm up
- 2 min. - 18
- 2 min. - 25
- 1 min. - 24.8

weight machine (universal)
- 4 trips - 25.3
- 2 trips - 25.5

high - 27
low - 19

warm down
- 2 min. - 24.3
- 2 min. - 21.1
- 1 min. - 17.3

3 man weave and shoot
walking

Friday 3/6

*HR after Stretch= 17

warm up
- 2 min. - 19
- 2 min. - 26
- 1 min. - 25

weight machine
- 4 trips - 24.6
- 2 trips - 24.5

high - 26
low - 21

warm down
- 2 min. - 24.3
- 2 min. - 21.1
- 1 min. - 17.3

3 man weave and shoot
walking

Monday 3/9

warm up
- 2 min. - 18.4
- 2 min. - 24.7
- 2 min. - 25.4

weight machine
- 3 trips - 24.3
- 2 trips - 24.1

high - 26
low - 19

warm down
- 2 min. - 27
- 2 min. - 26.1
- 1 min. - 16

3 man weave and shoot
walking

Wednesday	3/11	warm up	2 min. - 26.1	
			2 min. - 27.4	
			1 min. - 26.1	
		weight machine		
			5 trips - 24.1	high - 27
				low - 21
		warm down	2 min. - 26	3 man weave
			2 min. - 18	and shoot
			1 min. - 16	walking
Friday	3/13	warm up	2 min. - 24.6	
*HR Start before			2 min. - 24.3	
the Stretch - 14.8			1 min. - 25	
		weight machine		
			4 trips - 23.8	high - 26
				low - 19
		warm down	2 min. - 21.1	3 man weave
			2 min. - 20.6	and shoot
			1 min. - 14.3	easy walking

Stations used on the universal weight machine for the circuit were: sit up (slant board); leg press; curls (Regular and Reverse); Press (facing machine and away); Bench; Leg extension and leg curl, and latpull.

The mean resting heart rate increased from 12.3 on 3/4 to 14.8 on on the last detraining day.

Appendix G

Pearson Correlations

	ANX-1	ANX-2	Host-1	Host-2	St-1	State 2
State-1	0.4201	0.1817	0.3286	0.0187		0.2466
State-2	0.0863	0.5230	0.0909	0.3452	0.2466	
ANX-1		0.4654	0.7006	0.2658	0.4201	0.0863
ANX-2	0.4654		0.2710	0.7209	0.1817	0.5230
Host-1	0.7006	0.2710		0.307	0.3286	0.0909
Host-2	0.2658	0.7209	0.3071		0.0187	0.3452
Dep.-1	0.7672	0.3849	0.7363	0.3097	0.4235	0.0097
Dep.-2	0.4392	0.8037	0.3038	0.7325	0.1448	0.4364

STATE 1 & 2 = STAI

ANX; Dep; Host = MAACL

Appendix H

Power Analysis

Post - A - State

Group

$1 = mi = (40.80 - 39.1071)^2 = 2.8659$
$2 = mi = (39.4231 - 39.1071)^2 = 0.0998$
$3 = mi = (38.8235 - 39.1071)^2 = 0.0804$
$4 = mi = (36.8636 - 39.1071)^2 = \underline{5.0332}$
8.0793

$$\sigma_m = \sqrt{\frac{\sum_{i=1}^{k}(mi-m)^2}{k}}$$

$$\sigma_m = \sqrt{\frac{8.079}{4}} = 2.019825$$

$$\sigma_m = \sqrt{2.019825}$$

$$\sigma_m = 1.4212054$$

$$f = {}^{m} = \frac{1.4212054}{7.6457}$$

$$f = .1858829$$

Power - A = .05 u=k-1=3 f=.18 $n=\frac{n}{k} = 28$

Power of Statistical Analysis = .39 (From graph p. 308-309 Cohen, 1969)

Appendix I

Program For Step Test

Written in "Basic" for TRS 80 Color Computer

File Code "Big Timer" on Cassette Tape Feb. 1981

```
 10     For K = 1 to 6
 20     For I = 1 to 13
 23     L = 89 : if I = 13 then L = 5
 30     Sound L, I
 40     For J = 1 to 1150
 50     Next J
 60     Next I
 70     For J = 1 to 1165 : Next J
 80     Sound 176, 1
 90     For J = 1 to 4660 : Next J
100     Sound 176, 1
110     For J = 1 to 2330 : Next J
120     Next K
130     For K = 1 to 6
133     L = 89 : if I = 16 then L = 5
140     For I = 1 to 16
143     L = 89 : if I = 16 then L = 5
150     Sound L, 1
160     For J = 1 to 932
170     Next J
180     Next I
190     For J = 1 to 1398 : Next J
200     Sound 176, 1
210     For J = 1 to 4660 : Next J
220     Sound 176, 1
230     For J = 1 to 2330 : Next J
240     Next K
250     For K = 1 to 6
260     For I = 1 to 21
263     L = 89 : if I = 21 then L = 5
270     Sound L, 1
280     For J = 1 to 699
290     Next J
300     Next I
310     For J = 1 to 1631 : Next J
320     Sound 176, 1
330     For J = 1 to 4660 : Next J
340     Sound 176, 1
350     For J = 1 to 2330 : Next J
360     Next K
```

Appendix J

GROUP	SPORT	AGE	GRADE	TRAIT	PRE STATE	POST STATE	PRE MACCL	POST MACCL	PRE CUA	POST CUA	PRE HR	POST HR
1	7	16	12	29	32	47	05	12	01	02	12	16
1	7	17	12	42	46	38	10	04	06	06	16	15
1	7	15	10	35	31	32	02	03	06	64	13	20
1	7	17	12	46	23	46	05	06	06	04	12	17
1	7	14	10	39	40	54	09	09	05	04	15	17
1	7	16	11	39	30	35	02	02	10	08	15	16
1	7	15	10	36	32	43	03	09	07	06	14	16
1	7	17	12	42	44	37	04	00	08	08	12	15
1	7	14	10	43	43	49	09	10	11	07	11	10
1	7	17	12	44	37	37	05	05	07	07	17	17
1	7	17	12	31	30	30	07	06	07	08	15	12
1	7	17	12	33	49	45	07	08	08	07	13	14
1	7	15	10	36	31	33	01	01	05	05	14	12
1	7	15	10	38	56	50	09	09	06	04	16	14
1	7	16	11	39	41	49	07	10	06	07	18	16
1	7	14	89	37	38	36	01	07	06	06	15	16
1	7	14	09	38	46	46	08	09	06	06	13	16
1	7	18	12	46	23	43	05	04	06	03	16	20
1	7	17	12	46	43	48	14	18	07	07	13	14
1	7	14	09	33	25	51	02	02	08	06	15	16
1	7	15	10	49	28	40	03	08	08	04	09	10
1	7	14	09	37	38	32	03	04	06	07	19	18
1	7	14	09	38	50	37	08	03	02	02	15	14
1	7	16	10	47	27	34	06	04	09	01	14	17
1	7	14	09	35	36	34	09	10	14	12	15	13
1	7	17	12	51	46	28	06	04	10	07	16	16
1	7	14	09	45	30	37	07	08	09	05	16	14
1	7	15	09	41	43	45	09	08	07	11	13	12
1	7	16	11	48	45	38	02	05	08	08	12	15
1	7	17	10	51	45	50	03	07	10	10	11	15

Appendix K

GROUP	SPORT	AGE	GRADE	TRAIT	PRE STATE	POST STATE	PRE MACCL	POST MACCL	PRE CUA	POST CUA	PRE HR	POST HR
2	5	14	09	40	47	33	08	02	02	08	17	12
2	5	16	10	35	42	32	09	07	06	02	12	15
2	5	15	09	44	35	42	05	08	11	06	13	12
2	5	17	11	36	28	35	03	01	19	14	09	11
2	5	15	10	43	54	39	10	09	11	13	11	12
2	5	17	11	31	38	41	03	04	14	14	10	11
2	1	15	09	38	32	41	07	07	11	10	13	12
2	1	16	10	44	42	27	10	09	13	13	10	11
2	1	17	11	55	59	40	08	06	17	14	13	13
2	1	15	09	59	60	65	05	06	13	08	13	12
2	5	17	12	43	37	38	10	08	19	18	12	13
2	3	16	11	34	34	36	04	02	09	07	18	13
2	3	17	12	45	30	46	02	01	04	04	16	17
2	3	16	11	31	33	34	04	04	07	10	15	15
2	3	18	11	58	52	55	08	11	06	01	15	14
2	3	16	11	35	47	47	08	09	08	08	14	13
2	3	16	11	34	34	32	06	02	06	01	13	19
2	2	17	12	45	38	54	02	14	13	07	11	14
2	2	15	10	49	39	40	10	08	13	13	12	15
2	2	15	10	41	39	43	03	05	10	07	11	16
2	2	15	10	43	30	38	09	07	13	13	12	10
2	1	18	12	28	33	31	07	01	13	07	11	13
2	1	18	12	43	40	37	08	05	13	07	12	13
2	1	18	12	45	49	29	03	02	13	07	11	12
2	1	17	11	59	54	34	05	02	14	08	13	14
2	1	16	11	52	52	36	09	02	13	13	12	14

Appendix L

GROUP	SPORT	AGE	GRADE	TRAIT	PRE STATE	POST STATE	PRE MACCL	POST MACCL	PRE CUA	POST CUA	PRE HR	POST HR
3	1	18	13	36	31	33	09	08	13	10	14	9
3	1	23	16	44	31	33	07	06	13	13	10	13
3	1	18	13	45	40	36	09	07	14	13	10	13
3	1	19	13	43	43	34	11	08	14	13	09	12
3	1	18	13	37	38	35	09	08	14	13	12	11
3	1	21	16	26	35	27	09	09	14	13	07	12
3	5	14	09	41	43	38	07	04	13	16	09	09
3	5	16	11	43	37	37	08	08	19	16	11	11
3	5	15	10	43	58	44	13	07	07	07	11	14
3	5	14	09	33	52	49	04	07	17	10	10	13
3	5	16	11	40	37	48	05	05	19	15	09	12
3	5	17	10	46	47	46	09	07	10	08	10	11
3	1	14	09	45	37	35	07	05	13	09	12	12
3	1	16	10	30	51	41	11	07	14	11	13	13
3	1	16	10	41	40	41	09	10	10	13	12	12
3	1	17	12	35	33	34	07	07	19	19	10	10
3	1	15	09	48	45	44	09	11	13	07	12	11
3	3	17	12	33	43	55	03	08	13	01	11	18
3	3	17	12	31	25	27	03	03	04	04	16	18
3	3	16	11	38	35	39	03	04	08	07	07	12
3	3	16	11	45	49	52	09	13	10	12	12	12
3	2	17	12	58	46	35	02	04	13	10	11	13
3	6	18	12	24	28	51	02	08	13	13	14	13
3	2	15	10	33	26	27	04	01	15	14	11	12
3	2	15	10	45	49	48	08	09	13	13	11	13
3	2	16	11	27	26	28	00	01	19	19	09	11
3	2	20	15	32	31	53	09	10	11	08	10	12
3	4	16	10	37	38	37	03	10	08	10	17	15
3	4	17	11	30	33	34	05	05	13	19	13	12
3	1	17	12	35	43	30	10	01	13	08	11	15
3	1	18	12	39	37	37	04	04	10	07	13	16
3	1	18	12	27	48	33	12	05	13	08	11	15
3	1	17	11	41	54	39	07	06	14	10	15	15
3	1	17	11	44	37	40	08	05	12	07	13	16

Appendix M

GROUP	SPORT	AGE	GRADE	TRAIT	PRE STATE	POST STATE	PRE MACCL	POST MACCL	PRE CUA	POST CUA	PRE HR	POST HR
−4	2	17	12	32	36	35	04	07	13	13	12	12
−4	2	15	10	40	38	41	07	07	11	07	11	13
−4	2	15	10	32	30	30	02	02	13	13	12	11
−4	2	15	10	30	34	33	04	07	13	12	14	16
−4	2	14	09	38	35	26	01	06	16	14	11	13
−4	5	16	11	34	38	36	04	04	19	16	09	11
−4	5	15	10	35	43	42	01	03	04	05	13	13
−4	5	14	09	47	28	41	05	09	08	08	12	12
−4	5	14	09	37	34	36	03	04	05	04	14	15
−4	5	10	11	31	43	26	07	03	09	09	13	14
−4	5	17	12	37	35	35	05	04	14	10	11	11
−4	5	17	11	46	45	47	08	10	16	14	11	12
−4	5	17	11	40	27	47	04	07	13	10	10	13
−4	1	17	12	36	34	38	09	09	19	19	13	11
−4	1	17	12	43	38	34	08	07	13	11	13	12
−4	1	16	11	34	50	28	07	04	14	17	13	11
−4	1	17	11	35	48	40	06	08	14	15	15	13
−4	1	16	11	32	29	29	02	01	19	19	10	11
−4	1	17	12	45	36	35	09	06	16	13	11	14
−4	1	16	11	41	39	50	08	09	18	15	10	12
−4	1	16	11	36	41	41	03	04	14	11	12	12
−4	1	15	10	37	33	41	01	04	15	14	15	12