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The Recuperative Effects of Exercise Versus Stress Management on Alcoholics Participating in an In-Patient Rehabilitation Program

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A Thesis

in

The Department

of

Psychology

Presented in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy at
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ABSTRACT

The Rehabilitative Effects of Exercise Versus Stress Management on Alcoholics Participating in an In-Patient Recovery Program

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Concordia University, 1991

The rehabilitative effects of aerobic exercise were examined for alcoholics who participated in an in-patient recovery program. Subjects were 118 alcoholics, 94 men and 24 women, with a mean age of 36 years. Three treatments were compared using a between-subject design: aerobic exercise, non-aerobic exercise and stress management. Their n's were 44, 35, and 39 respectively. The groups were run sequentially due to the limitations of the rehabilitation center. All treatments were administered for one hour a day, five days a week, over a four week period. Dependent measures included a Submaximal Exercise test to measure aerobic capacity (VO2 Max), a Glucose Tolerance test (GTT), the Sequential Multiple Analysis Computer (SMAC), and psychological tests including the Hopkins Symptoms Checklist, the Repression-Sensitization test and the Internal-External Locus of Control test. Subjects were assessed within the first week, prior to onset of treatment, and again just prior to discharge. Logarithmic ratios of change scores were used to minimize pretest differences.

For the physiological measures aerobic exercise training did not improve cardiovascular fitness (VO2 Max). No treatment effects were seen for glucose tolerance (GTT) scores. Both chloride and liver enzyme (GGT) levels significantly decreased. The Aerobic exercise group showed the greatest decrease, Non-aerobic exercise the next largest decrease and Stress Management the least decrease. For most of the psychological measures, both exercise groups were equally effective. They significantly decreased General Distress, Somatization, Anxiety and Depression (Hopkins Symptoms Checklist) and did so significantly better than Stress Management. They also significantly shifted the Repression-Sensitization scores towards the Repressor end of the continuum and did so significantly more than Stress Management. The results are discussed with regards to potential treatment benefits as part of a multi-modal approach.

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Studies on the deficits shown by alcoholics have dealt with both the physiological and psychological aspects of the individual's functioning. Treatment programs for alcoholic patients are generally designed around the various symptoms of alcoholic dysfunction. Since alcoholics display multiple deficits there are many different approaches to treatment. The physiological symptoms of dysfunction are related both to the withdrawal process and to the level of functioning of a variety of organs and organ systems. Withdrawal symptoms occur within several hours after cessation of or reduction in intake by a person who has been drinking for several days or more. Symptoms include nausea or vomiting, malaise or weakness, autonomic hyperactivity (tachycardia, sweating, elevated blood pressure), anxiety, depressed mood or irritability, headache, or insomnia often disturbed by nightmares, tremulousness and the possibility of transient hallucinations, illusions, or convulsions (American Psychiatric Association, 1980; Kalant & Woo, 1981; Sellers & Kalant, 1982; Hartman, 1982). The clinical manifestations of the withdrawal process generally return to normal within five to seven days. The level of functioning of the organs and organ systems, however, usually takes a longer period of time to recuperate from the effects of alcohol.

A variety of studies have examined the effects of alcohol on several organs and organ systems. The gastro-intestinal (G.I.) tract can develop esophageal varices, bleeding, disruption of peristalsis, malabsorption of

nutrients, impaired carbohydrate metabolism, increased production of cholesterol, and cancers of the upper portion of the tract (Chafetz, 1979; Peyser, 1982; Mezey, 1982). In addition, the pancreas may show signs of obstruction or abnormal secretion of digestive enzymes causing malabsorption of nutrients from the intestine and diabetes (Chafetz, 1979; Korstein & Lieber, 1982). Furthermore, liver dysfunction can affect carbohydrate metabolism, resulting in glucose intolerance (Seleney, Endrenyi & Devenyi, 1975) and hypoglycemia (Cohen, 1976; Wright & Marks, 1980). Other problems related to liver dysfunction such as "fatty liver" (an increase in serum triglycerides which accumulate in the liver cells) and ketoacidosis (Lieber, 1976; Chafetz, 1979; Korstein & Lieber, 1982; Peyser, 1982) can develop. Chronic inflammation of the liver, related to this accumulation of fat in the cells, can lead to cirrhosis, liver failure and death. Thus, it is apparent that carbohydrate metabolism may be disrupted in a variety of ways in alcoholism: through malfunctioning of the G.I. tract, pancreatic disturbances causing diabetes, and liver dysfunction resulting in glucose intolerance and hypoglycemia.

A number of researchers have examined a variety of complications arising from the disruption in carbohydrate metabolism resulting from alcohol abuse. Axelrod (1974) and Stokes (1982) have noted that serious aberrations in metabolic and endocrine functioning can cause changes in the

production of insulin and glucagon. Furthermore, levels of growth hormone, cortisol and epinephrine can also be affected. The efficiency of carbohydrate metabolism is decreased when the type of metabolism is shifted from an aerobic to an anaerobic method. Because of the inefficiency of this latter system, there is a build-up of metabolic byproducts such as lactic acid and free fatty acids which can be harmful to the body (Guyton, 1976). Thus, when carbohydrate metabolism has been disrupted, a variety of other systems can be negatively affected.

Other studies have shown that the cardiovascular system is compromised by alcohol abuse. A variety of symptoms of dysfunction have been noted, such as chronic shortness of breath, noisy breathing, enlargement of the heart, edema, disturbances in cardiac rhythm and contraction, interruption of the atrioventricular node, and elevated blood pressure and heart rate (Chafetz, 1979; Knott & Beard, 1982). Some of these symptoms are a direct result of the effect of acetaldehyde (a product of alcohol metabolism) on the heart (Chafetz, 1979).

The studies noted above have focused on the deleterious effects on organ and organ systems. Other studies have examined psychosocial problems associated with alcohol abuse. These may include changes in the personality dimension, an inability to relate appropriately to family, legal prosecution, or difficulty functioning at work. Many studies have documented the effects of alcohol on

personality. These might include moodiness, irritability or chronic complaining (Weiss, 1980), difficulty in relating to others (Chafetz, 1974), immaturity (Frankel & Murphy, 1974), denial that there is a problem (Kurtz, 1982), or symptoms such as anxiety, depression, loss of control over self and life events, low self esteem, guilt, or self-blame (Gary & Guthrie, 1972; Frankel & Murphy, 1974; Parker, Gilbert & Thorenson, 1978; Kurtines, Ball & Wood, 1978; Peyser, 1982; Solomon, 1982; Kissin & Begleiter, 1983).

Given these findings it is not surprising that other researchers have found that alcoholics experience difficulties in the areas of family life, the legal system and work milieu. The family is often disrupted when one of its members, especially a parent, has an alcohol problem (Kaufman, 1986). There is often an increased incidence of divorce and separation and children's poor performance at school is often found (Bergeron, Gosselin, & Parenteau, 1978; Boudreau, 1982; Gouvernement du Québec, 1985). Child abuse, violence (Chafetz, 1979; Gouvernement du Québec, 1985), or loss of income (Solomon, 1982) are also observed in many cases.

The alcoholic may have legal problems which may include charges of drunk driving or violent crimes such as assault and/or homicide (Chafetz, 1974; 1979; Gerson & Preston, 1979; Solomon, 1982; Gouvernement du Québec, 1985).

Quite often the alcoholic's work performance has deteriorated. Signs of this might be tardiness,

absenteeism, poor job performance, accidents on duty, difficulty with fellow employees and customers, as well as personality changes such as those previously discussed (Weiss, 1980; Rostain, Allan, & Rosenberg, 1980; Gouvernement du Québec, 1985). Due to the multifaceted physiological and psychosocial problems manifested by alcoholics, multi-modal treatment programs have been designed to try to meet the diverse needs of these individuals.

Treatment Approaches

Treatment programs have focused on a variety of the dysfunctions that alcoholics present. They tend to concentrate on the physiological or psychological aspects of the problem, or in the case of aerobic exercise training, attempt to alleviate both sorts of symptoms simultaneously. A short description of the various interventions currently used would be instructive.

Physiological treatments have included such diverse procedures as dietary regulation, pharmacological intervention and exercise to help the alcoholic improve both physical and psychological functioning. Martel (1973), Poulos, Stoddard, and Carron (1976), and Worden and Rosellini (1981), included diet therapy in alcoholic rehabilitation programs to treat psychological symptoms such as depression as well as the effects of hypoglycemia (carbohydrate intolerance) due to prolonged alcohol use. Glucose tolerance tests were used by Martel (1973) to

compare the rate of uptake and distribution of glucose in alcoholic, diabetic and normal subjects. He found that all three curves peaked within one hour, with diabetics attaining values of 250 mg/dl while the normal and alcoholic subjects reached levels of 150 mg/dl. The blood sugar levels of normals returned to baseline (100mg/dl) within three hours, whereas those of the alcoholics continued to decline briskly to approximately 50 mg/dl, a hypoglycemic value. He felt that the alcoholics also had a deficiency of magnesium and zinc caused by the ingestion of alcohol and that a dietary treatment including these two substances could improve liver functioning.

Poulos et al. (1976) also used the glucose tolerance test (GTT) to examine hypoglycemia in alcoholics. They found it necessary to use a six hour rather than the standard three hour glucose test so as not to overlook possible hypoglycemic responses occurring later in time. In addition, it was necessary to place alcoholics on a high carbohydrate diet for at least three days prior to the test so that their curves would not resemble those of mild diabetics (i.e., a sluggish insulin response). Glucose curves were provided for alcoholics and showed the different patterns of glucose metabolism depended on whether alcohol was last ingested five days, 10 days, or four weeks prior to the glucose tolerance test. The authors also suggest that insufficient protein causes symptoms similar to those of hypoglycemia and that a high protein diet would help

alleviate these symptoms.

Worden and Rosellini (1981), like the previous authors, have focused on the importance of nutritional factors in the treatment of alcoholics. These authors feel that proper nutrition is important because it might enhance the therapeutic process. In their study they note that subjects who are alcohol and drug free often report symptoms similar to those seen during withdrawal. When the daily nutritional intake of symptomatic subjects was examined, the majority of these subjects had been on high carbohydrate diets and had ingested large amounts of caffeine and nicotine. The authors don't recommend a high protein diet to alleviate symptoms but instead suggest at least three evenly spaced, well balanced meals a day.

Martel (1973), Poulos et al. (1976), and Worden and Rosellini (1981), have all been examining the problem of abnormal carbohydrate metabolism, hypoglycemia in particular. They describe a variety of hypoglycemic symptoms experienced by alcoholics. These symptoms, which include panic attacks, aggressive outbursts, sweating, trembling, dizziness, confusion and craving sweets or alcohol, are alleviated rapidly by alcohol. The authors suggest that many of these symptoms are part of the reason alcoholics keep drinking and that if the underlying hypoglycemia is treated with proper nutrition, the recovering alcoholics would be in a better position to maintain their sobriety.

A variety of medications have been used to treat different aspects of alcoholism and to deter resumption of alcohol consumption. Some of the conditions treated in this way are hypoglycemic coma and detoxification. In addition, medication may be used in conjunction with detoxification, or in aversion therapy. Chafetz (1974) has described the use of: (a) major tranquilizers to minimize the symptoms of withdrawal during detoxification; (b) minor tranquilizers to act as a "drug bridge" after detoxification and during the early phase of therapy; (c) glucose as a treatment for hypoglycemic coma; (d) apomorphine as a tool to cause nausea in aversion therapy; and (e) antabuse as a means of deterring drinking by causing extreme discomfort. However, when using tranquilizers or any other mood altering substance, a potential exists for the alcoholic to develop an additional dependence on the prescribed medication. Thus, if a patient needs this type of medication to facilitate early treatment, it might be preferable to use it initially for a limited period of time before proceeding to the next stage of the treatment protocol.

Another more recent treatment approach has been the use of aerobic exercise. The rationale for using this treatment with alcoholics is that it produces a variety of both physiological and psychological benefits in normal populations. Research has revealed aerobic exercise may lead to reduced muscle tension (Schwartz, Davidson, & Goleman, 1978; Ledwidge, 1980; Mihevic, 1982; Morgan, 1982),

improved resting and recovering heart rates (Collingwood & Willett, 1971; Eliot, Forker, & Robertson, 1976; Holmes & Roth, 1985; Holmes & McGilley, 1987; Sinyor, Golden, Steinert, & Seraganian, 1986), and improved blood pressure (Eliot et al., 1976). In addition, levels of plasma lipids and lipoproteins (Ismail & Young, 1977; Williams, Wood, Haskell, & Vranizan, 1982; Pauly, Palmer, Wright, & Pfeiffer, 1982; Tran, Weltman, Glass, & Mood, 1983), and liver functioning have shown some improvement (Frenkl, Gryore, Meszaros, & Szeberehyi, 1980), enhancing the liver's ability to flush drugs from the body.

Interestingly, aerobic exercise programs have also been found to improve carbohydrate metabolism in nonalcoholics. DeVries (1980) and Richter, Ruderman and Schneider (1981), have pointed out that most steps in the pathway of glucose metabolism are enhanced, demonstrated by an increase of glucose transport into the muscle cells and glycogen breakdown, the flow of glucose through the glycolytic pathway, the conversion of pyruvic acid to acetyl coenzyme-A, the oxidation of acetyl coenzyme-A in the Krebs Cycle, as well as more free fatty acids being used as fuel. The levels of the hormones glucagon and insulin have also been shown to fluctuate less as a result of aerobic exercise programs (Winder, Hickson, Hagberg, Ehsani, & McLane, 1979).

Research, using exercise programs to treat diabetic populations, has provided information which seems promising for the treatment of alcoholics who show similar signs of

cardiovascular and carbohydrate metabolic dysfunction. Exercise programs used in the treatment of insulin-dependent diabetics have been shown to decrease their insulin requirements and possibly retard or decrease the risk of cardiovascular complications associated with diabetes (Richter, Ruderman & Schneider, 1981). Exercise used in the treatment of maturity-onset diabetics (non-insulin dependent) has also been shown to improve glucose tolerance and decrease plasma cholesterol (Ruderman, Ganda & Johansen, 1979; Richter et al., 1981).

Recently, work with alcoholics has incorporated exercise programs into existing programs in an attempt to alleviate physical as well as psychological symptomatology. The Salem Program (Murphy, 1970; Murphy, Bennett, Hagin & Russell, 1970; Frankel & Murphy, 1974), an intensive multi-dimensional program for alcoholics, includes fitness training in addition to psychotherapy, work therapy, and personal and family counselling, in an attempt to address both the physiological and psychological aspects of alcoholism. They found improved physical fitness reduced aspects of emotional discomfort such as hypochondriasis, depression, and anxiety. Gary and Guthrie (1972) and Sinyor, Brown, Rostant, and Seraganian (1982) also integrated aerobic exercise into a program very similar to the Salem project. Gary and Guthrie found that cardiovascular fitness was improved and sleep disturbances were reduced although no corresponding change in self-esteem

was found. Sinyor et al. (1982) found that the cardiovascular fitness, of their alcoholic subjects, was inferior to Canadian work force norms on admission (Canadian Public Health Association, 1978). Aerobic training led to improved cardiovascular fitness and abstinence rates, three months after discharge, compared to the control group.

Aerobic exercise has also been shown to impact positively on psychological functioning in nonalcoholics. Changes have included decreased depression and anxiety (Folkins, 1976; Morgan, 1976; 1982; Ledwidge, 1980; Mihevic, 1982; Long, 1984; 1985; Goldwater & Collis, 1985; Taylor, Sallis, & Needle, 1985; Roth & Holmes, 1985; 1987) and increases in self assurance (Jasnoski & Holmes, 1981; Jasnoski, Holmes, Solomon, & Aguiar, 1981; Folkins & Sime, 1981; Long, 1984; 1985; Taylor et al., 1985).

Some of the more commonly used psychologically based interventions are individual and group psychotherapy, work therapy, training in cognitive-behavioral techniques and self-help groups such as Alcoholics Anonymous (AA). In psychotherapy the goal is to work on developing and maintaining abstinence by better understanding the underlying tensions as well as the more crucial life problems. The patient is helped to solve those problems which can be handled and is taught methods, other than drinking, for dealing with the problems which remain (Chafetz, 1974). Some therapies focus on the individual alcoholic (Wallace, 1985; Zimberg, 1985), while others deal

with the alcoholic and family members conjointly (Kaufman & Kaufman, 1979; Wegscheider, 1981; Lawson, Peterson, & Lawson, 1983; Stanton, Todd, & Assoc., 1983; Bepko & Krestan, 1985).

Work therapy is an activity which has been used to relieve tension, depression, and loneliness, diverting attention away from problems by allowing for self-expression and emotional discharge and by providing a sense of achievement. It is often used in conjunction with other therapy techniques (Murphy, 1970; Frankel & Murphy, 1974). Chafetz (1979) emphasizes that the activity chosen must be meaningful so that the client will be able to become involved in what he or she is doing.

Cognitive-behavioral techniques have been used to teach coping skills to nonalcoholics as a means of dealing with a variety of problems related to stress and anxiety. Some of these skills are of a more global nature, such as relaxation, meditation, or leisure time activities. These have been referred to as "time out" activities since it is thought that diverting ones mind away from his or her problems can be therapeutically beneficial (Byrd, 1964; Michaels, Huber, & McCann, 1976; Marlatt & Marques, 1977; Bahrke & Morgan, 1978; Pennebaker & Lightner, 1980; Morgan, 1982; Stoyva & Anderson, 1982). Both Michaels et al. (1976) and Bahrke and Morgan (1978) suggest that simply taking "time out" is as effective as exercise, biofeedback, or meditation in reducing anxiety. It may be the diversional

aspects of such activities, rather than the physiological changes, which are the common beneficial ingredients for the reduction of anxiety. Other skills are more specific in nature; that is, they seek to resolve or improve the particular problem(s) presented by the client. These cognitive-behavioral programs generally consist of an education, rehearsal and application phase (Meichenbaum, 1977; Roskies & Lazarus, 1980; Moos & Billings, 1982; Cameron & Meichenbaum, 1982; Lazarus & Folkman, 1984; Long, 1984; 1985). Their aim is to teach the individual to be able to appraise a situation, to develop adequate skills to cope with the situation, to be able to use those skills and then to be able to terminate the process once the problem has been solved.

Cognitive-behavioral techniques have also been used with alcoholics in an attempt to help them learn to cope with daily stress without relying on alcohol. Stress Management programs have been used to teach coping skills to negotiate high risk situations (Marlatt, 1978; Marlatt & Gordon, 1980), while coping and reappraisal skills have been taught to alcoholics and their spouses (Moos & Billings, 1982). Meditation, progressive relaxation and quiet restful reading have been used as "time-out" techniques, similar in aim to the work therapy used by Chafetz (1979), to reduce alcohol intake in heavy social drinkers (Marlatt & Marques, 1977). In the search for a therapy which might be more effective than others, Marlatt (1978) has suggested that

relaxation plus skill training might be a useful combination for decreasing the risk of relapse in alcoholics.

Relaxation is a procedure used to decrease tension, while skill training teaches the individual to cope better with the frustrations and problems of daily life. This combined approach, although tried in other clinical groups, has yet to be evaluated with alcoholics (Roskies, Seraganian, Oseasohn, Hanley, & Collu, 1986).

Alcoholics Anonymous is a loosely knit volunteer fellowship of alcoholics gathered together for the express purpose of helping themselves and others to become and remain sober (AA, 1955). Chafetz (1974) has described other functions it fulfils such as providing a role model for learning how to live a fuller and more meaningful life without alcohol. AA confronts its members with the fact that in relation to alcohol they are completely out of control and absolutely dependent. Once they have accepted the idea that they are powerless over alcohol, AA recommends limited control and limited dependence. It emphasizes the need for others and the choice of depending on others rather than upon alcohol.

Recent intervention programs have become more broad based. These multi-modal programs are an attempt to treat either the individual more completely or a wider variety of individuals. Nevertheless, there is a lack of consensus concerning which multi-modal programs are most effective for treating the greatest range of alcohol related problems.

The present study has been designed to look more closely at this issue.

The Present Study

The review of the literature indicates that there are a number of issues related to aerobic training and the functioning of alcoholics which require investigation. The purpose of the present study was to assess the possibility that aerobic exercise training might improve the physiological and psychological well-being of a population of alcoholic patients. There were two specific aims.

First Aim

The first aim was to develop a profile on the condition of these alcoholics prior to their admission for treatment. Symptoms related to withdrawal, family, legal and work functioning were documented. Developing a profile was deemed useful as it would facilitate comparison of the sample of alcoholics in this study with other samples.

The Second Aim

The second aim of the study was to determine the physiological and psychological effects of an aerobic fitness program on recovering alcoholics by assessing cardiovascular function (VO2 Max), liver function (carbohydrate metabolism and liver enzyme levels), and psychological characteristics (Hopkins Symptoms Checklist, Repression-Sensitization, Locus of Control).

In order to determine if these effects were specific to aerobic exercise or to exercise at all, three groups of

alcoholic subjects were studied during rehabilitation treatment: one group was given aerobic exercise training; a second group was given non-aerobic exercise training and a third group received equal experimenter attention in a stress management program that involved no physical exercise. Given this design, if improvement were only seen in the Aerobic exercise group this would suggest that aerobic fitness was the critical factor in improvement. If both fitness groups showed improvement however, exercise per se would be implicated in the improvement. If all three groups showed an improvement on any measure, it would not be possible to determine whether all treatments were effective or whether simply time or the non specific aspects of the program provided in the rehabilitation center had produced this improvement.

There were specific hypotheses made about the effects of an aerobic fitness program on cardiovascular function, liver function, and psychological characteristics.

Cardiovascular Function (VO2 Max)

VO2 Max is the variable commonly used to measure aerobic fitness or cardiovascular functioning. It was hypothesized that the Aerobic group would increase its VO2 Max over time whereas the other two groups would show no change.

Liver Function

Since aerobic exercise training has been shown to enhance carbohydrate metabolism in non-alcoholics and

improve abnormal carbohydrate metabolism in diabetics where prolonged periods of hyperglycemia occur after a glucose load and since it has been demonstrated that alcoholics also show signs of abnormal carbohydrate metabolism typically seen as a hypoglycemic drop immediately following the hyperglycemic surge, it was expected that aerobic exercise training would diminish the hypoglycemic reaction. For those in the Aerobic training group, glucose tolerance scores (GTT) would improve over time, whereas with members of the non-aerobic and Stress Management groups no change in GTT scores was expected.

Elevated liver enzymes are also signs of liver dysfunction. Of the four normally studied enzymes, gamma glutamyl transferase (GGT), glutamic oxaloacetic transaminase (GOT), lactic dehydrogenase (LDH) and alkaline phosphatase, GGT holds the most potential as a diagnostic tool since its elevation is specific to alcohol abuse (Shaw, 1982). Thus, only GGT was studied and it was expected that subjects with liver dysfunction related to alcohol abuse would show elevated GGT levels. Since aerobic training has been seen to enhance glucose metabolism in nonalcoholics and liver function is directly related to glucose metabolism, it was expected that aerobic exercise training would reduce GGT levels. Again, neither of the other two groups were expected to show such a change.

The blood profile provided an opportunity to examine sodium and chloride levels at pre- and posttest. There were

no specific predictions made about these variables.

Psychological Characteristics

It has been demonstrated that alcoholics in treatment programs show elevated scores on aspects of emotional discomfort such as hypochondriasis, anxiety and depression. The Hopkins Symptoms Checklist was used to measure changes in these variables. Since aerobic exercise training has been shown to alter some of these psychological variables in nonalcoholic subjects and since improved physical fitness has also been shown to alter some of these variables in alcoholic subjects, it was expected that both exercise training programs would lead to a decrease in scores on the Hopkins Symptoms Checklist. Since stress management has resulted in a decrease in anxiety for nonalcoholics (Michaels et al., 1976; Bahrke & Morgan, 1978), it was expected that the stress management program would show some decrease in these measures.

The Repression-Sensitization test was chosen to measure how subjects characteristically deal with anxiety-provoking stimuli. Since one aspect of an alcoholic's manner of dealing with life events is denial (Wegscheider, 1981; Bepko & Krestan, 1985) and since even minimal improvement in aerobic fitness can affect subjective ratings (Murphy, 1970), it was expected that subjects would initially have scores further toward the Repressor end of the continuum and that after treatment the scores of the Aerobic fitness group and the Non-aerobic fitness group would shift towards the

Sensitizer end while there would be no change in the Stress Management group.

The Locus of Control scale is used to measure whether individuals believe in External or Internal control. Previous research has suggested that alcoholics tend to deny there is a problem and feel a loss of control over self and life events (Wegscheider, 1981; Bepko & Krestan, 1985). It has also been shown that aerobic exercise is able to enhance self-assurance (Jasnoski & Holmes, 1981; Jasnoski, Holmes, Solomon & Aguiar, 1981; Folkins & Sime, 1981; Long, 1984; 1985; Taylor et al., 1985). Thus, it was expected that scores would be more in the External control range on admission and that both exercise groups would shift towards the Internal control end of the continuum while the Stress Management group would show no change.

METHOD

Subjects

Participants in the study were residents attending Pavillon Foster, an in-patient rehabilitation center for ambulatory alcoholics. During the 18 month experimental period, a total of 199 clients were admitted to the center. From this subject pool, 59% (118) completed all aspects of the investigation. There were 94 men and 24 women with a mean age of 36 years. All subjects completed the five to six week treatment period. Reasons for the remaining subjects not completing the project will be given in the following subsection.

Subject Selection

Potential subjects were screened using a variety of criteria. Nurses completed a questionnaire of demographic information with the residents at the time of admission (see Appendix A). Staff physicians examined all residents to check for major physical or psychological problems which could limit their participation in the testing procedures. Individuals were precluded from participating for the following reasons: general poor health including cardiovascular problems, seizures, diabetes, or some other physical ailment, such as a leg or back injury. Residents were also eliminated if they were too confused to participate (e.g. intoxication, brain damage, or psychological problems), if their principal drug of abuse was something other than alcohol, or if they had stopped

drinking for more than one month (abstinence for more than a month would diminish treatment effect). Finally, residents were eliminated if they left before posttests were completed or were asked by the staff to leave the program for noncompliance to the ground rules at the center. It should be pointed out that no subjects were eliminated due to lack of compliance to the experimental treatment procedures. The percentage breakdown of the 81 residents (i.e., 41% of the initial sample of 199) who were eliminated is as follows: poor mental or physical health (24%), seizures (11%), diabetes (only one case), drugs other than alcohol being main drug of choice (10%), too long a period of abstinence (9%), left early (26%), dismissed from the program (4%), or some unclear reason (8%).

Demographic Information

Demographic information was collected from subjects when they entered treatment. It included details on their sex and age, as well as their physiological and psychological conditions. The data are presented so as to compare the total alcoholic population entering treatment with those who were used as subjects as well as those who were eliminated from the study.

Apparatus

Submaximal Exercise Test

Equipment for the fitness test included an E&M Physiograph (model PMP-4A) to monitor heartbeat and respiration while the resident pedaled on a Bodyguard

ergometer (model 990) during the fitness test. Lange skinfold calipers and a Hartz standard sphygmomanometer were employed to measure fat thickness and blood pressure respectively.

Glucose Tolerance Test (GTT)

The Ames Glucometer Reflectance Photometer No. 5580 was used with the Ames Autolet and Autolet Lancets as well as their Dextrostix Reagent Strips to obtain and measure capillary blood glucose.

Sequential Multiple Analysis Computer (SMAC)

Standard Vacutainer equipment was used for obtaining venous blood from the arm. Auto Iso-Filters No. 1060 were used to isolate the serum during centrifuging. Sarstedt Test & Centrifuge Tubes were used to store the serum. A cooler was used to store and transport the serum before analysis.

Psychological Tests

All tests were available in both French and English. The Hopkins Symptoms Checklist was used to measure Depression, Anxiety and Somatization. The Repression-Sensitization test was used to differentiate coping styles while under stress, and the Internal-External Locus of Control test measured to what degree the person felt in control of his or her life.

Procedure

The Rehabilitation Center

This study was integrated into an ongoing multi-modal

bilingual treatment program conducted in a drug-free environment with ambulatory residents. The multi-disciplinary staff was made up of clinical psychologists, social workers, nurses and therapists who were recovering alcoholics. The rehabilitation program included a variety of activities lasting several hours a day, such as group and individual therapy, as well as lectures and films which educated the residents about alcoholism. Couple and family counselling and employer interviews were provided when necessary. Obligatory AA meetings were provided on the premises and residents were expected to attend other AA meetings while out on weekends.

Introductory Meeting with the Residents

The experimenter met with each group of newly admitted residents on a weekly basis to introduce herself and the program in which they were to participate. Clear descriptions of the treatment and test procedures were given at this time and ample opportunity was provided for questions. They were asked to sign the informed consent form at this time (see Appendix B). To encourage initial and continued participation in a program where some of the test procedures were uncomfortable (fasting for a prolonged period of time, drinking an unpleasant glucose drink and having frequent blood samples taken), it was important to emphasize the advantages of participating for them personally and to allay their fears or reticence about test procedures.

Group Formation

Groups were run one at a time rather than simultaneously since too many demands would have been put on the staff, the existing treatment program and the available space. The center has a twenty bed capacity and there is a constant turnover of clients throughout the week since admission can occur at any time. Thus, every week there would be a few admissions and a few discharges. Even though the optimal method for achieving randomized groups was not feasible, some randomization was achieved since subjects were not given their choice of treatment. They were screened on admission to the center and if they met all necessary criteria, became members of the experimental group that was in progress at the time.

Treatments

All three treatments were carried out in the morning for approximately one hour, five days a week for the duration of the resident's stay at the center. All treatments provided equal time and attention from a bilingual instructor.

Aerobic Training

This program was designed so that the level of participation was geared to the individual's capabilities based on both performance on an initial fitness test and the medical report at screening. A staff member, trained in biophysical education, attended most of the classes to make sure that the residents understood how to do the exercises

and actually carried them out. A resident was selected from the group each week to lead the exercises. The exercise routine was comprised of approximately 55 minutes of activity starting with 20 minutes of stretching and warm-up exercises consisting of light calisthenics (e.g., sit-ups, push-ups, jumping jacks, etc.), followed by a 15 minute walk/run period. Subjects were encouraged to jog slowly for 1/10 of a mile and then walk briskly for 1/10 of a mile. The sequence was then repeated for the full 15 minutes. This interval schedule permitted subjects of low aerobic capacity to train at sufficient intensity, that is at approximately 60-70% of maximal heart rate. With time, as their aerobic capacity increased, subjects then alternately jogged 2/10 of a mile with 1/10 of a mile brisk walking. This resulted in the distance and intensity of the aerobic exercise increasing with improved aerobic capacity. At the end of the one month treatment, several subjects were capable of jogging without intervening walking/recovery periods for the full 15 minutes. Following several minutes of cooling down, the last 20 minutes were spent doing light calisthenics.

Non-aerobic Training

This program was also designed so that the level of participation was geared to the individual's capabilities. The instructor was the same as in the Aerobic group and he saw to it that the residents understood how to do the exercises and that they carried them out appropriately.

Residents were again chosen to lead the group. The exercise routine lasted approximately 45 minutes. It began with 20 minutes of stretching and warm-up exercises (light calisthenics) followed by 25 minutes of muscle strengthening exercises such as sit-ups and push-ups. The session ended with a cooling down period.

Stress Management

This nonexercise program was also geared to the individual needs of the resident. The instructor was different from the one used in the previous two groups. The weekly schedule consisted of a half hour introductory film, 2.5 hours of supervised Progressive Relaxation training (Jacobson, 1938) broken up into daily half hour sessions, and two, one hour long group sessions of cognitive-behavioral stress management. The film depicted an individual using alcohol and pills as a means of coping with stress. It then showed how this person learned to use progressive relaxation as a more effective method of coping. The relaxation was carried out using an audio tape. The instructor explained the purpose of using such a method and made sure each resident was comfortably supine on the floor, did the exercises correctly and was shown the difference between tense and relaxed muscles. Individual problems were attended to and suggestions were provided on how to use the technique in a variety of situations. By tensing and relaxing various muscle groups of the body, residents were expected to become more aware of when they were tense and to

use this technique to alleviate the symptoms. A number of specific coping strategies were taught (e.g., muscular relaxation, communication skills, stress inoculation, problem solving) to help the residents develop skills which would aid them in dealing with daily stresses without alcohol. To help them learn to be more aware of when they were stressed and how they reacted (physiologically or psychologically) to different stressors, they were asked to keep a daily diary of those situations they found stressful, the degree of stress experienced and the physiological and psychological symptoms experienced for each stressful situation. At the beginning of each week, the group was divided into two sub-groups based on the length of time the residents had been in treatment (first two weeks compared to remaining time). This was deemed necessary since situations perceived as stressful at the beginning of treatment changed as time passed. Once a week each sub-group met to form a list of those situations that were currently causing stress as well as situations which they thought might be a problem in the near future. By spending time with the instructor discussing these situations and considering what might be done to handle them more effectively, new coping strategies were learned. Weekly group discussions, based on the daily diaries and group lists, focused on the improvements and problems related to applying these new skills (stress responses, problem solving). This enabled residents to develop their ability to evaluate the effectiveness of

different coping strategies used to enhance their psychological and physical well-being. Since the relaxation training and group discussions were continued over a five week period, residents had the opportunity to practice their new skills in an increasing variety of real-life situations and were able to give and receive feedback related to these experiences.

Tests

All test procedures were carried out within the first week of admission and again just prior to discharge (a 4-5 week interval). Four types of tests were utilized: the bicycle ergometer test, the glucose tolerance test, the SMAC blood test and a battery of three psychological multiple choice tests. Both the glucose tolerance and the SMAC tests required a period of fasting from 10 p.m. the previous night until test time at 7 a.m. the following morning.

Physiological Tests

Submaximal Exercise Test Residents had height and weight measurements taken as well as their percentage of body fat. The percent body fat was estimated by adipose tissue thickness taken at 10 different sites (Allen, Peng, Chen, Huang, Chang, & Fang, 1956). The resident was seated on a stationary bicycle while electrocardiogram electrodes were attached to the chest, side and back. A modified version of the Astrand-Rhyming protocol (Siconolfi et al., 1982) was used for estimating maximum oxygen uptake from heart rate elevations under a graded exercise routine. This

modified version was used since it is thought to be more accurate for older sedentary populations. Residents began by pedaling against no resistance for one minute. From this point on two separate protocols were used depending on the age and sex of the individual. Men 35 years of age or older and all women had their exercise resistance rate increased from zero to 150 kilopond meter (kpm) for a period of two minutes, followed by increments of 150 kpm every two minutes until the individual achieved the target heart rate, i.e., 70% of the maximum heart rate estimated as 220-minus-age. Men under 35 years of age had their rate increased from zero resistance to 300 kpm for two minutes, followed by increments of 300 kpm every two minutes if the heart rate was less than 60% of the predicted maximum. This continued until the individual achieved the target heart rate (also 70% of maximum). If heart rate was between 60% and 70% after two minutes of pedaling at 300 kpm, the following increments were 150 kpm every two minutes until the target heart rate of 70% maximum was reached. Once this threshold was reached, residents continued to exercise at the same rate for at least two additional minutes and then until a stable heart rate was attained (not more than five beats/min difference between one minute segments). Maximum oxygen uptake was estimated by using an age-correction factor to the heart rate at the end of this last phase of exercise.

Glucose Tolerance Test (GTT) For this procedure, the rate of absorption and distribution of glucose are usually measured over a three hour period. However, a six hour procedure was used here to make sure that the possibility of a hypoglycemic response was not missed in the latter phase of testing (Madsen, 1974; Poulos et al., 1976). Other signs of disturbance that have been picked up by this test are a rapid rise of blood sugar to abnormal levels followed by a slow return to normal. This condition can be distinguished from diabetes by the normal or low fasting blood sugar levels seen in liver disease but not in diabetes (Zimmerman, 1962). Once the SMAC sample was drawn, the glucose tolerance procedure was begun. It consisted of eight capillary blood samples being taken during a six hour period to measure serum levels of glucose after a glucose load. The first sample was taken to measure the fasting level of glucose in the body prior to the glucose load. The glucose load consisted of 8 ounces (250 cc) of 40% glucose taken by mouth with or without a little lemon juice. The resident had a maximum of five minutes to drink the solution. Following this, blood samples were taken at one half, one, two, three, four, five, and six hours. The lancet device was used to collect the blood samples. Only one drop of blood was necessary per sample. Each drop of blood was placed on the tip of a specially treated reagent strip, left for exactly sixty seconds, rinsed off in a precise fashion, and placed in the glucometer to be read. A digital readout

showed the amount of glucose present in the blood at that time, expressed in milligrams per decilitre (mg/dl). Subjects were allowed nothing but water during this testing period. They did not participate in any of the activities at the center on testing day but instead sat around and relaxed. Meals were provided for all participants at the end of the test period.

Sequential Multiple Analysis Computer (SMAC) Test results include both the normal range for each variable being measured as well as a computer printout comparing each of the subject's scores to its normal range. To carry out the test, approximately 10 cc of blood were drawn from the cubital vein (at the elbow) of each subject using the vacutainer system. The blood was allowed to coagulate in the tube for no more than one half to three quarters of an hour at which point a filter was placed in each tube on top of the coagulated blood. The tubes were then spun down in the centrifuge for approximately 10 minutes or until the serum had been separated from the red cells. The fibrinogen bundles were carefully removed from the serum with a fine stick and the serum was collected in storage tubes taking great care not to include any red cells. The presence of red cells would alter the readings, thus creating misleading results. These storage tubes were capped and refrigerated until analysis of the serum was completed in the haematology department of a local hospital.

Psychological Tests

Hopkins Symptoms Checklist The test consists of 60 items describing psychological symptoms likely to measure treatment response in out-patients who experience symptoms of anxiety or depression (Derogatis et al., 1974). Both internal consistency (split-half reliability) and test-retest reliability have been documented. Derogatis et al. (1974) reported internal consistency among test items based on a sample size of 1435. They found a correlation between items for each of the five primary symptom dimensions of the test when the same subjects were first tested and then retested (correlation coefficients were from .84 to .87). Test-retest reliability indicated the stability of scores over time for the same subjects. A sample size of 425 was used and indicated a correlation between tests, over a one week period, ranging from .75 to .84. The documentation on the validity of this test mentions that it has been designed to measure psychiatric out-patient symptomatology and is thought to be a sensitive measure of treatment response. For criterion-related validity, it is effective in identifying improvement related to drug treatment in people suffering from symptoms of anxiety and depression, as well as finding changes in emotional status among non-psychiatric out-patients. For construct validity, a high level of agreement was demonstrated between the hypothetical symptom constructs (conceptualized by clinicians) and actual symptoms (from clinical patient ratings).

Repression-Sensitization Scale The modified test, consisting of 30 true/false items, was developed by Epstein and Fenz (1967) from the original scale by Byrne (1961). Modifications were made because Byrne's scale showed a large number of items that were low in face validity and a large number that referred to symptoms of anxiety. The new scale was comprised of items with high face validity and was limited to only five items pertaining to anxiety. This scale is used to measure how subjects characteristically deal with anxiety-provoking stimuli. Repressors were defined as individuals who avoid anxiety by shutting out awareness of anxiety-producing cues and thoughts, while Sensitizers deal with anxiety by being especially alert to threatening cues. Individuals are thought to fall along a continuum between these two types. Since no information is available for the reliability and validity of this revised test, information based on the original version by Byrne (1961) shall be described here. Internal consistency among test items was based on a sample size of 133 college students, indicating a correlation of .88. Test-retest reliability, using a sample size of 75 college students, showed a correlation of .88 when tests were given six weeks apart. Thus, this test is thought to be a reliable measure. The validity of the test has been evaluated and its scores are consistent with those obtained by other instruments designed to measure defensive behavior. Normative data for the revised form of the Repression-Sensitization Scale have

not been provided and those provided by Byrne for the original test are not applicable. However, Shipley, Butt, Horwitz, and Farbry (1978) have found that Sensitizers (n=25) had scores ranging from 13 to 21, while Repressors (n=25) had scores ranging from 5 to 11. Ten subjects were eliminated because their scores fell at the median. In another study, Shipley, Butt, and Horwitz (1979) found that Sensitizers' (n=17) scores ranged from 14 to 18, while Repressors' (n=16) scores ranged from 4 to 12. In this case, three subjects were eliminated because their scores were equal to the median. These authors decided to use the median as the value which differentiated Repressors from Sensitizers. Kaloupek, White, and Wong (1984), also using a normal population (n=43), had Repression-Sensitization mean scores of 14.6 (S.D.=3.7) and 14 (S.D.=3.7).

Locus of Control The Internal-External Locus of Control scale is a 29-item forced-choice questionnaire including 6 filler items intended to make the purpose of the test more ambiguous (Rotter, 1966). The score is the total number of external choices; the higher the scores the more external the individual. Rotter has conceptualized the perceptions of individuals who believe in either external or internal control. The individual who believes in external control does not perceive a causal relationship between his own behavior and the outcome of that action. Instead he feels it is due to luck, chance, fate, or some other power outside of himself. An individual who believes in internal

control tends to perceive his own ability or skill as being directly related to the outcome of his efforts. Internal consistency estimates are considered to be moderately high with the coefficients ranging from .69 to .79. However, the items in the test are not comparable to each other, thus use of the split-half reliability method tends not to give a true picture of internal consistency. Test-retest reliability over a one month period seemed quite consistent for two different samples (college students .72 and prisoners .78). Correlations with other tests measuring variables such as adjustment, social desirability, need for approval, and intelligence are low (-.07 to -.35 for adjustment and social desirability; .01, .03, and -.09 to -.22 for intelligence) indicating good discriminant validity. There are no specific test score values available which differentiate external from internal. However, normative data have been provided. Rotter (1966) lists a variety of group scores based on university elementary psychology students (7.73 to 9.22), 12th grade college applicants (7.96), and 18 year olds (9.56). Apao and Damon (1982), looking at male university students, divided the Locus of Control scores into three categories with Internals ranging from 2-7, mid-range scores from 8-13, and Externals ranging from 14-20. Marlatt and Marques (1977) showed college students (age 21-35) classified as heavy social drinkers (1 1/2 drinks/day) dropping their mean Locus of Control scores from a range of 10.8-11.9. to a range of

7.1-9.9 after a variety of treatments (meditation, relaxation, attention, placebo, control).

The Hopkins Symptoms Checklist, the Repression-Sensitization test and the Locus of Control questionnaire were given together in either French or English. Supervision was provided in case problems or questions arose. Those residents who could not read or had trouble in this area had the tests read to them. All questionnaires were examined to make sure they were fully answered. Approximately one hour was allotted to complete this trio of tests combined, though residents were given as much time as they needed.

Statistical Analyses

The Biomedical Data Program (BMDP) statistical software package was employed to analyze the data (Dixon, 1983). The BMDP P2D program analyzed the subjects' demographic characteristics, providing a detailed data description including frequencies. The BMDP P2V program carried out univariate analyses of variance (ANOVAs). To pinpoint group mean differences, during the same phase of treatment and over time, Scheffé post hoc analyses (Bruning & Kintz, 1977) were employed when the ANOVA achieved statistical significance ($p<.05$).

RESULTS

Two types of data were collected for this study. The demographic data provided information about the alcoholics prior to entering treatment. The data from the pretests provided a more complete profile of the alcoholics' condition on admission, while the posttests, when compared with the pretests, evaluated treatment outcome. The demographic data are described first.

Before presenting the data, a brief explanation of the choice and utilization of statistical analyses is provided. When preliminary analyses were carried out on the raw data, all of the variables except Locus of Control demonstrated substantial differences between treatment groups on baseline measures. Since these pretreatment group differences made it impossible to adequately evaluate treatment outcome, each subject's raw scores were expressed as a ratio (postscore/ prescore) to correct for the differences when analyzing posttreatment scores. The logarithms of these ratios were then calculated to diminish the effects of outliers and to prevent a compression problem from occurring when one tries to calculate the mean of a number of ratios. Univariate analyses of variance (BMDP Program 2V) were then performed on the data, with the group means being calculated from the logarithms of each ratio (Kirk, 1968; Erickson & Nosanchuk, 1977; Kruskal, 1978).

In the Results section the bar graphs express the data as change scores represented as log ratios. If the raw data

had been used, a number of interaction effects might have been apparent. However, this would be uninformative due to the baseline differences. Thus, the transformed data were used exclusively in the ANOVAs. The original data, based on subjects' raw scores, are presented in Figures and Tables and can be found in Appendices C and D respectively.

Profile on Intake

Demographic Data

As indicated in Table 1 the data were grouped so as to describe all of the alcoholics who entered this treatment center, those who were used as subjects and those who were eliminated from the project (Rejects). One hundred and ninety-nine individuals entered treatment during the testing period. Fifty-nine percent (118) of these completed the study while the remaining 41% (81) were eliminated for a variety of reasons. Subjects were eliminated at three different times: prior to testing; following blood work and psychological tests; and following blood work, psychological tests and exercise testing (see Table 2).

On examining the total population of alcoholics on admission, it was found that 78% were male and 22% female, while their average age was 38 with individual ages ranging from 17 to 70 years (see Table 1). Results pertaining to this group's drinking profile demonstrated that 77% drank on a daily basis while 23% drank intermittently (binged). Signs of dysfunction related to alcohol abuse were noted in that 91% had experienced blackouts, 21% had delirium tremens

Table 1

Intake Profile: Demographic Data

Variables	Total Population (N=199)	Subjects (n=118)	Rejects (n=81)
Sex:			
Male	78.4%	79.7%	76.5%
Female	21.6%	20.3%	23.5%
Age:			
Mean	37.7	35.9	40.2
SD	10.8	9.1	12.5
Range	19-70 yrs.	19-61 yrs.	20-70 yrs.
Drinking Profile			
Drinking Pattern			
Daily	77.0%	71.8%	84.6%
Binge	23.0%	28.2%	15.4%
Blackouts	90.5%	94.0%	85.2%
DTs	20.6%	16.9%	25.9%
Convulsions	7.5%	1.7%	16.0%
Condition on Admission			
Dry	52.5%	54.2%	50.0%
In Withdrawal	47.5%	45.8%	50.0%
Withdrawal Med. (Dalmane)	41.0%	40.0%	43.2%
Psychosocial Profile			
Attempted Suicide	29.4%	27.0%	32.9%
Separated/Divorced	24.6%	20.4%	30.9%

Table 1 (continued)

Intake Profile: Demographic Data

Variables	Total Population (N=199)	Subjects (n=118)	Rejects (n=81)
Unemployed	48.7%	50.0%	46.9%
Crimes Against People	21.5%	19.1%	30.0%
Crimes Against Property	31.5%	32.5%	30.0%

Table 2

Intake Profile: Pretest Status

Variables (Normal Values)		Total Population (N=199)	Subjects (n=118)	Rejects (n=81)
Physiological Variables				
Sodium (135-145)	n	184	118	65
	M	144.20	144.12	144.35
	SD	3.18	3.25	3.08
Chloride (97-106)	n	184	118	65
	M	104.78	104.72	104.89
	SD	3.04	2.73	3.54
Weight (kg)	n	145	116	29
	M	72.68	72.68	72.70
	SD	13.54	12.96	15.91
VO2Max (M=3.07 L/Min) (F=2.41 L/Min)	n	143	114	29
	M	2.44	2.46	2.35
	SD	.61	.62	.60
GTT 1/2 hr. (<170)	n	183	118	65
	M	152.61	151.31	154.97
	SD	40.86	39.70	43.10
GTT 1 hr. (<170)	n	183	118	65
	M	147.87	144.15	154.63
	SD	49.47	42.73	59.58

Table 2 (Con'd)

Intake Profile: Pretest Status

Variables (Normal Values)		Total Population (N=199)	Subjects (n=118)	Rejects (n=81)
GTT 3 hr. (>70)	n	183	118	65
	M	76.73	72.79	83.89
	SD	28.69	19.54	39.51
GGT (M <60) (F <40)	n	183	118	65
	M	76.50	81.25	68.08
	SD	118.96	124.18	109.49
Psychological Variables				
Hopkins				
Total	n	183	118	65
	M	132.48	136.69	124.83
	SD	31.83	31.22	31.74
Soma.	n	183	118	65
	M	22.68	23.28	21.60
	SD	6.81	.6.69	6.95
Anxiety	n	183	118	65
	M	16.25	16.85	15.17
	SD	5.21	5.15	5.17
Depression	n	183	118	65
	M	27.58	28.09	26.65
	SD	6.99	6.82	7.26
Repression-Sensitization	n	183	118	65

Table 2 (Con'd)

Intake Profile: Pretest Status

Variables (Normal Values)		Total Population (N=199)	Subjects (n=118)	Rejects (n=81)
	M	17.36	17.90	16.37
	SD	4.07	4.07	3.92
Locus of Control	n	183	118	65
	M	8.97	9.04	8.85
	SD	3.72	4.01	3.15

and 8% had a history of convulsions. Forty-eight percent of the subjects were in a state of withdrawal at the time of admission and the majority of these experienced symptoms severe enough to warrant medication.

The demographic data also yielded information about the subject's family life, productivity at work and on deviant behaviors (Psychosocial Profile). Twenty-nine percent of those entering this center had attempted suicide at least once, 25% of families were separated or divorced, 49% of the alcoholics were unemployed at the time of admission, while 22% had faced legal prosecution for crimes against people and 32% for crimes against property.

Table 2 describes the physiological and psychological variables of the participants. When the total population of alcoholics' physiological results were examined, it was found that only the liver enzyme GGT was outside of the normal range (76.50 U/L; Normal is <40 U/L for women and <60 U/L for men).

Table 3 describes the results of the ANOVAs on the log ratios while Table E-1 in Appendix E provides more comprehensive information about the analyses.

Physiological Measures

Body Weight

Data were collected just prior to each exercise test. Figure 1 expresses this data for all three groups. Results of the ANOVA revealed no significant differences.

Table 3

Collective Summary Table of ANOVAs Based on Log Ratios

Measures	df	F	p
Physiological Measures			
Body Weight	2,112	.70	>.05
VO2 Max	2,109	1.90	>.05
GTT			
1/2 hr.	2,33	.81	>.05
1 hr.	2,24	.91	>.05
3 hr.	2,67	.37	>.05
SMAC			
GGT	2,42	6.59	<.003
Sodium	2,32	.66	>.05
Chloride	2,29	11.67	<.001
Psychological Measures			
Hopkins Symptoms Check List			
General Distress	2,123	5.00	<.004
Somatization	2,123	4.33	<.02
Anxiety	2,123	6.80	<.002
Depression	2,123	7.24	<.001
Repression-Sensitization	2,123	3.56	<.03
Locus of Control	2,123	.89	>.05

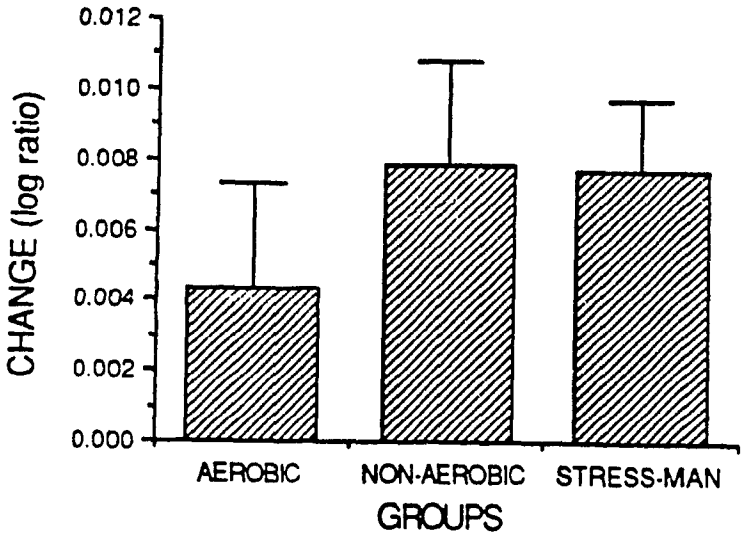

Figure 1. Body weight data expressed as change scores.

Submaximal Exercise Test (VO2 Max)

Aerobic capacity was derived from the heart rate scores during performance of the graded task on a bicycle ergometer. The data, as described in Figure 2 upon analysis, did not result in a significant ANOVA.

Glucose Tolerance Test (GTT)

Since subjects who had normal blood glucose levels to begin with were not expected to improve with any treatment and since any treatment effect for subjects with abnormal glucose levels may be masked if normals and abnormals are grouped together, analyses were carried out on only those subjects who had abnormal blood glucose levels during their pretests. Though blood glucose readings were taken a total of eight times during the test period, only the data from the first half hour, the first and the third hours of absorption were examined, since it is in these phases that abnormal readings are thought to be most prevalent (Martel, 1973). For the first half hour and the first hour phases, abnormal levels for subjects were considered to be anything greater or equal to 170 mg/dl, while for the third hour phase abnormal scores were those that were less than or equal to 70 mg/dl.

Figures 3, 4 and 5 depict the GTT measures. The ANOVAs for these three measures as described in Table 3 did not achieve statistical significance (see Table E-1 for a more complete description). The proportion of subjects classified as abnormal at the one half hour, one hour and

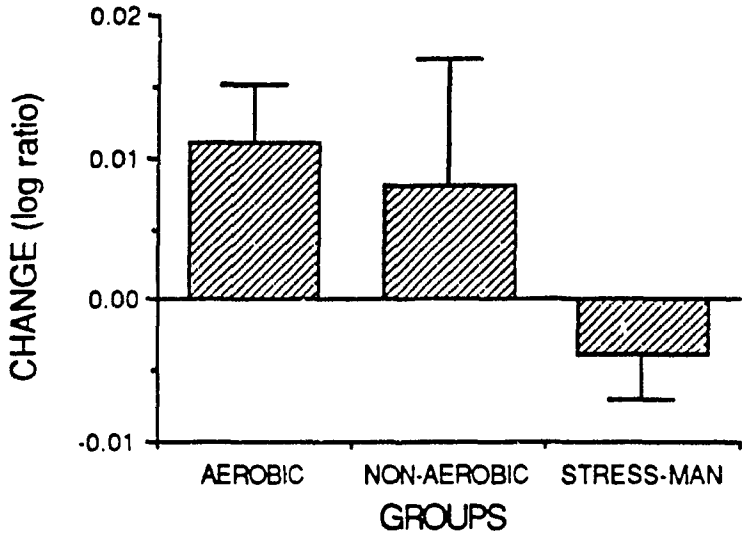

Figure 2. Aerobic capacity data expressed as change scores.

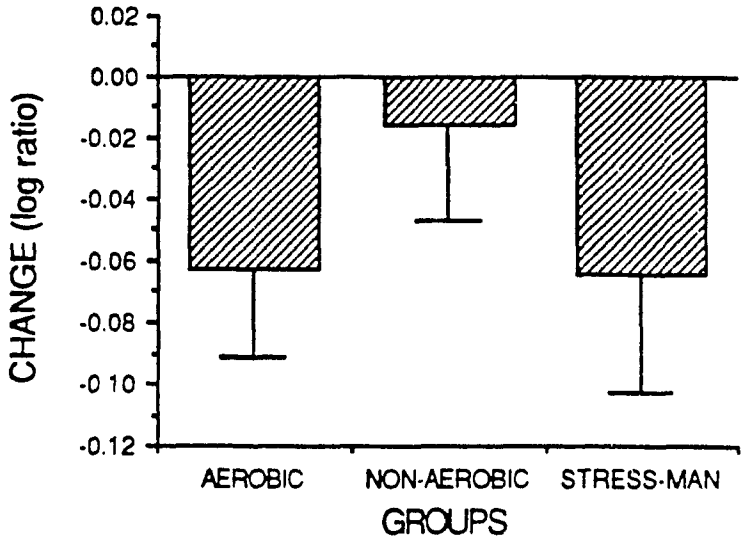

Figure 3. Change scores of glucose tolerance data, for the first half hour phase, in those subjects who had abnormally elevated scores at pretest.

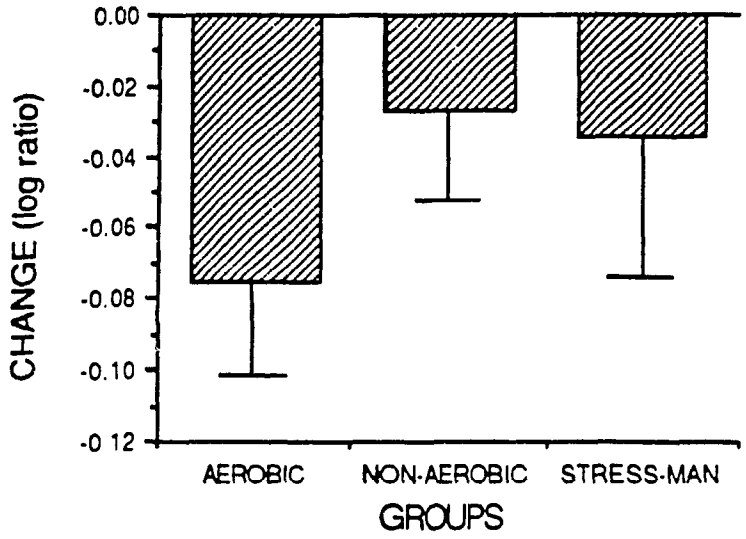

Figure 4. Change scores of glucose tolerance data, for the first hour phase, in those subjects who had abnormally elevated scores at pretest.

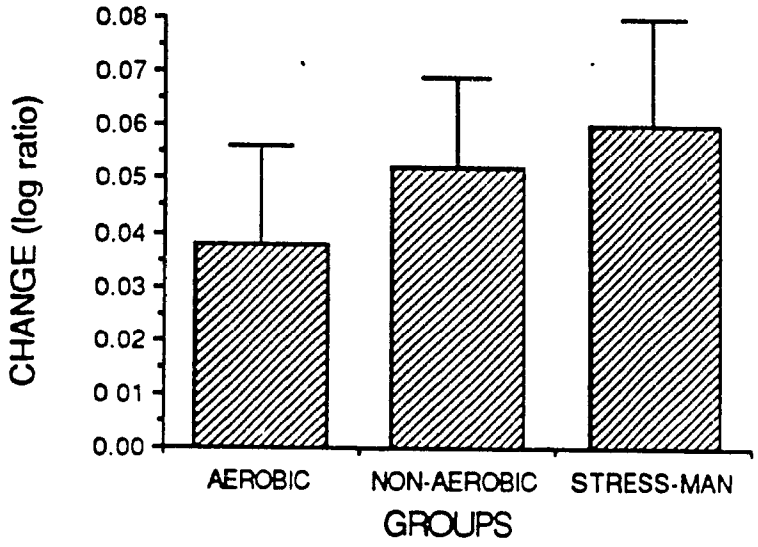

Figure 5. Change scores of glucose tolerance data, for the third hour phase, in those subjects who had abnormally diminished scores at pretest.

three hour marks was 31%, 23% and 59% respectively. In the third hour phase there were a small number of subjects with abnormally high glucose scores (equal to or greater than 100 mg/dl). The small number (n=13) precluded statistical analysis.

Sequential Multiple Analysis Computer (SMAC)

Serum levels of both sodium and chloride were assessed on admission and just prior to discharge. Abnormally elevated levels were noted for each of these variables in approximately 25% of the population on pretest measures. Figure 6 expresses the sodium data for those subjects who exhibited abnormally elevated pretest scores (>145 mEq/L). The ANOVA did not reveal statistical differences between the groups (see Table 3).

Figure 7 illustrates the chloride data of subjects who had abnormally elevated pretest scores (>106 mEq/L). As indicated in Table 3 the ANOVA demonstrates that groups showed significantly different amounts of change. Post hoc tests revealed significant differences between all groups (see Table F-1 in Appendix F). This reflects that there was significantly more change in the Aerobic group than the other two groups. It also shows that the Non-aerobic group changed significantly more than the Stress Management group.

An ANOVA was implemented for the liver enzyme data. Once again only those with abnormal scores from pretest measures were analyzed. For the enzyme GGT, abnormally high scores for men were considered anything greater than or

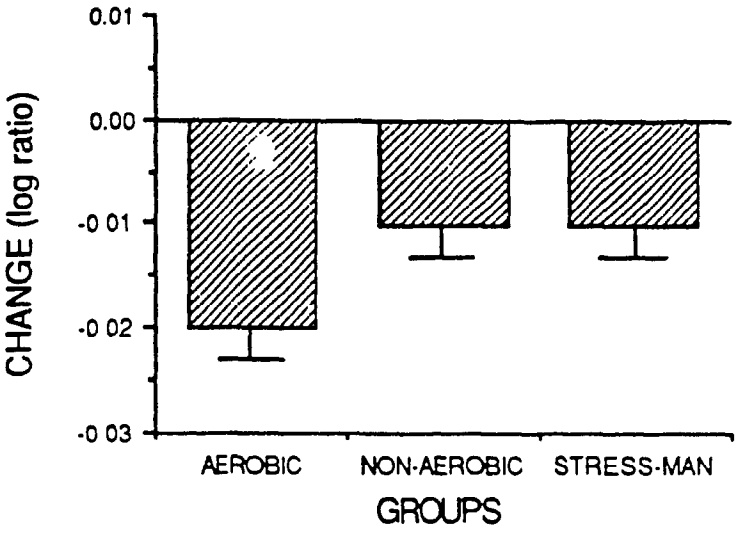

Figure 6. Change scores of sodium data for subjects with abnormally elevated scores at pretest.

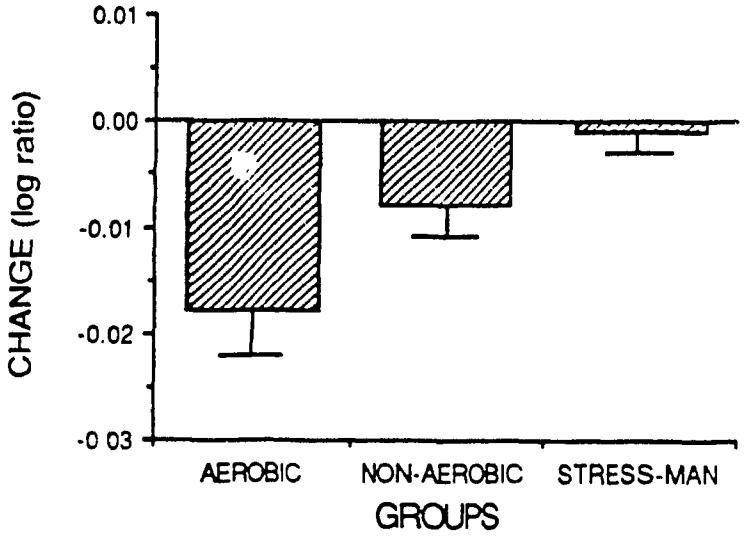

Figure 7. Change scores of chloride data for subjects with abnormally elevated scores at pretest.

equal to 60 U/L and for women, greater than or equal to 40 U/L (approximately 38% of the total number of subjects). Figure 8 depicts the GGT data. The ANOVA indicated that the groups demonstrated significantly different amounts of change (see Table 3). Post hoc tests revealed significant differences between all three groups (see Table F-1 in Appendix F). The Aerobic group showed the greatest decrease in enzyme levels over time, the Non-aerobic group the next largest decrease and the Stress Management group showed the least decrease in enzyme levels.

Psychological Measures

The Hopkins Symptoms Checklist

General Distress

Figure 9 depicts the General Distress data. The ANOVA demonstrates that groups showed significantly different amounts of change (see Table 3). Post hoc tests revealed significant differences between both exercise groups and the Stress Management group and the exercise groups did not differ from each other (see Table F-1 in Appendix F). Thus, both exercise groups were similarly effective at decreasing their General Distress scores over time, while the Stress Management group was significantly less effective than the two exercise groups.

Somatization

Figure 10 depicts the Somatization data. The ANOVA revealed significantly different amounts of change between the groups (see Table 3). Post hoc tests revealed that

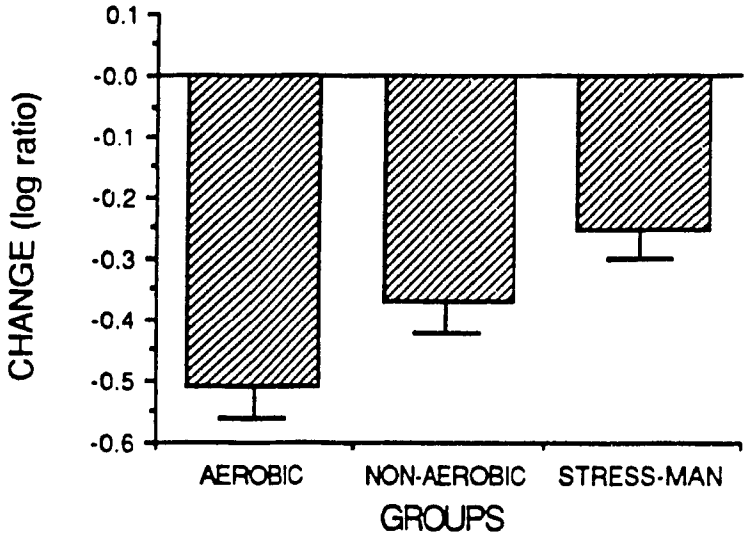

Figure 8. Change scores of liver enzyme (GGT) data for subjects with abnormally elevated scores at pretest.

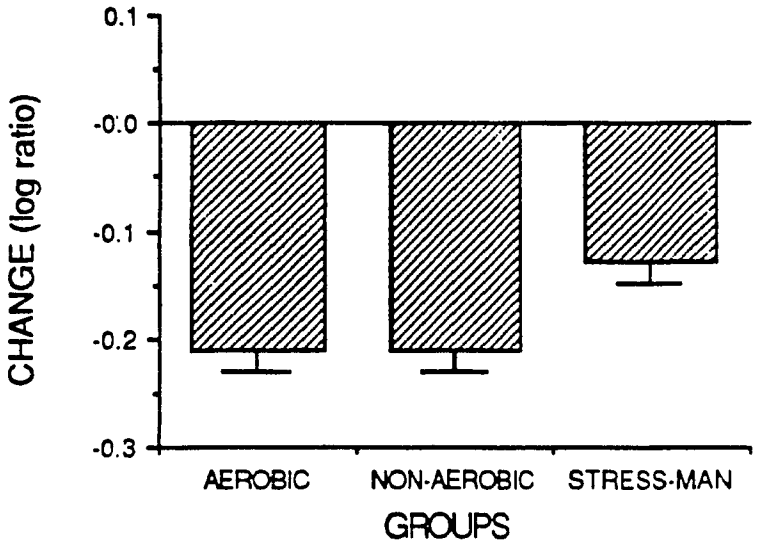

Figure 9. Hopkins Symptoms Checklist: General Distress data expressed as change scores.

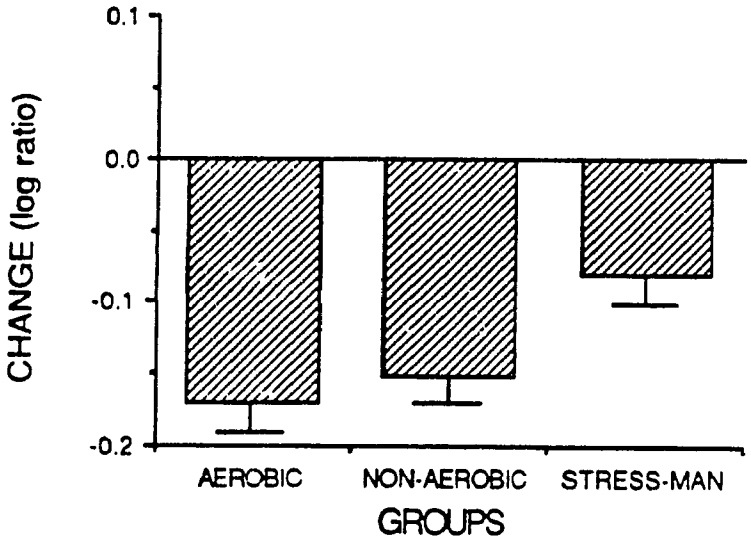

Figure 10. Hopkins Symptoms Checklist: Somatization data expressed as change scores.

these differences occurred between the exercise groups and the Stress Management group while the exercise groups did not differ from each other (see Table F-1 in Appendix F). Thus, both exercise groups were similarly effective at decreasing their Somatization scores and were significantly better at it than the Stress Management group.

Anxiety

Figure 11 depicts the Anxiety data. The ANOVA was significant (see Table 3). Post hoc tests showed that these differences occurred between the exercise groups and the Stress Management group and the exercise groups did not differ from each other (see Table F-1 in Appendix F). Thus, both exercise groups were similarly capable of decreasing their Anxiety scores over time and were significantly better at this than the Stress Management group.

Depression

Figure 12 displays the Depression data. The ANOVA demonstrated that groups showed significantly different amounts of change (see Table 3). Post hoc tests revealed that these differences occurred between each of the exercise groups and the Stress Management group while no difference was evident between the two exercise groups (see Table F-1 in Appendix F). Thus, both exercise groups were similarly capable of decreasing their Depression scores over time and did so significantly more than the Stress Management group.

Repression-Sensitization

Figure 13 depicts the Repression-Sensitization data.

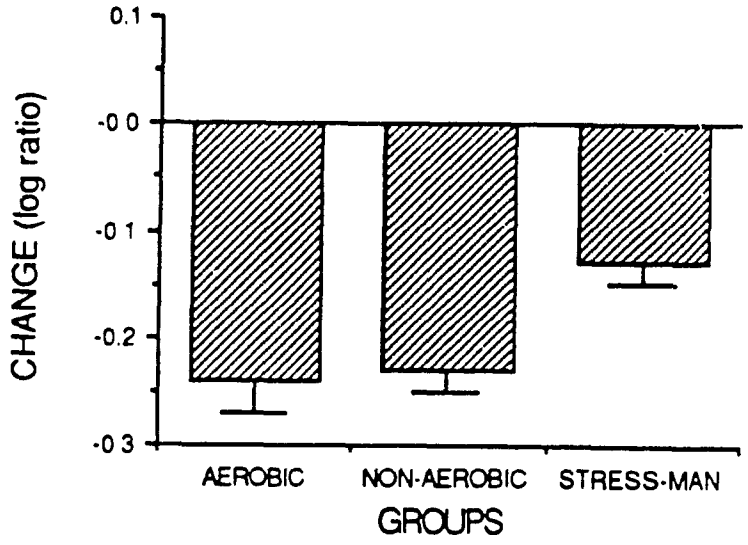

Figure 11. Hopkins Symptoms Checklist: Anxiety data expressed as change scores.

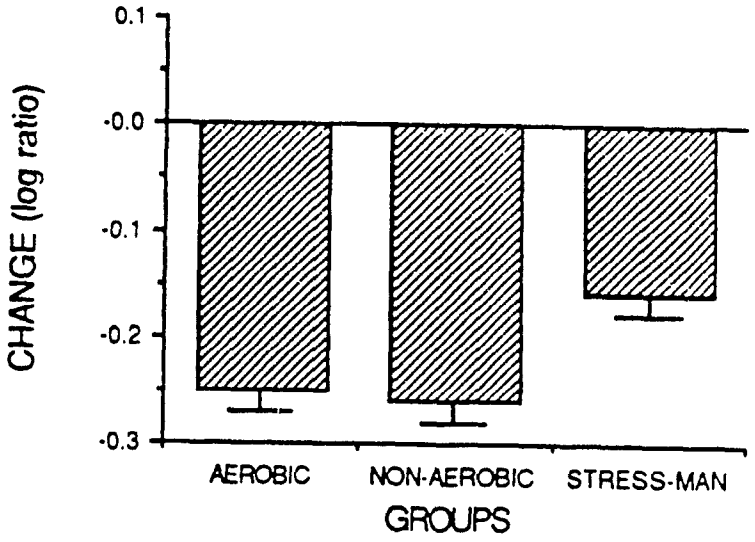

Figure 12. Hopkins Symptoms Checklist: Depression data expressed as change scores.

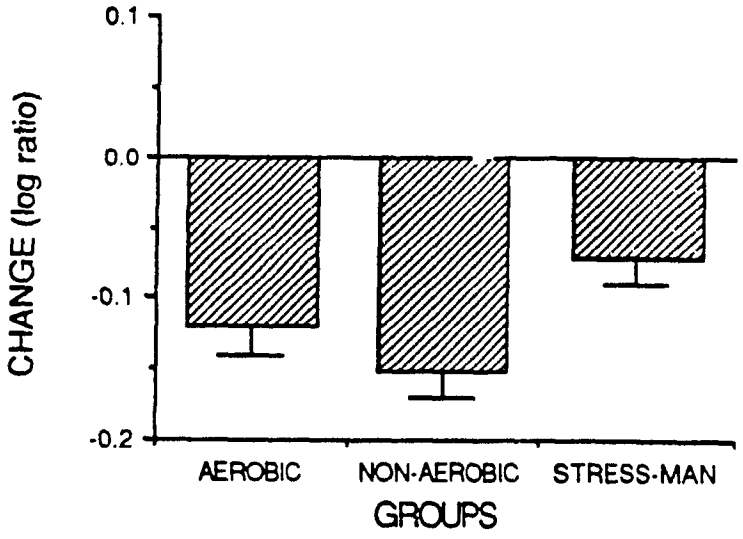

Figure 13. Repression-Sensitization data expressed as change scores.

The ANOVA revealed that groups showed significantly different amounts of change (see Table 3). Post hoc tests indicated that both exercise groups differed significantly from the Stress Management group but did not differ from each other (see Table F-1 in Appendix F). Thus, both exercise groups were similarly effective at shifting their Repression-Sensitization scores and did so significantly more than the Stress Management group.

Locus of Control

Figure 14 depicts the Locus of Control data. The ANOVA demonstrated no significant effects (see Table 3).

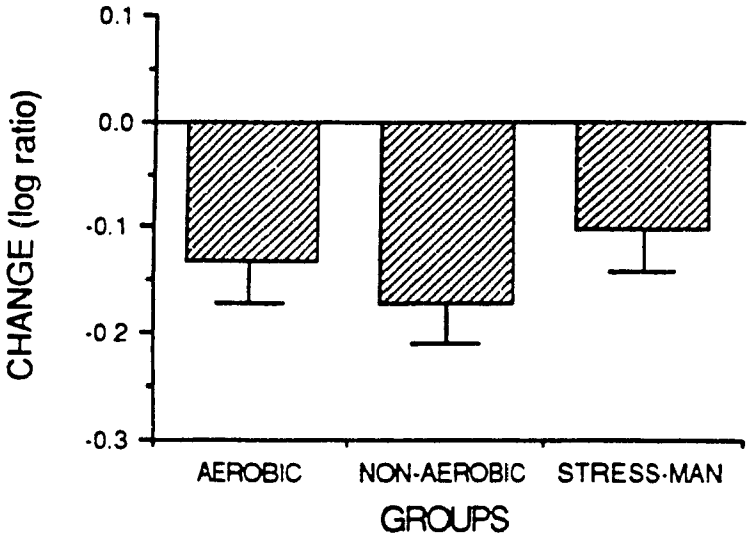

Figure 14. Locus of Control data expressed as change scores.

DISCUSSION

First Aim

The first aim of the study was to develop a demographic profile on the subjects in the study to facilitate future comparisons with other samples of alcoholics. The data provides information on the alcoholics used as subjects as well as those who were eliminated from the project. This allows for more precise comparisons than have usually been provided in similar studies (Murphy, 1970; Gary & Guthrie, 1972; Frankel & Murphy, 1974). In these studies the data were vague about the number of alcoholics eliminated and the reasons for their elimination. Having such information available allows one to consider the conditions of alcoholics who enter rehabilitation centers in general, not just those who are accepted to be subjects in research. The present sample of alcoholics was comparable to other alcoholic samples as far as problems involving family (separation and divorce), legal (crimes against people and property) and work related issues (Gouvernement du Québec, 1985). Even though a large part of this sample was eliminated from the study, the eliminated group did not appear to differ from those kept as subjects in the present investigation.

On intake it was found that for the pretest measures, with the exception of the liver enzyme GGT, mean values for the physiological test variables were within normal limits for those who were eligible to participate as subjects (see

Table 2). However, for reasons stated earlier, when looking at treatment effects on physiological measures, those subjects who had abnormal pretest scores were singled out for examination.

The results of the psychological measures utilized in the study were also instructive. For the Hopkins Symptoms Checklist, there are no available normative data on the specific categories in the test. However, normative data were available from Sinyor et al. (1986) for the conglomerate score (General Distress). The alcoholics in the present study had pretest scores which appeared noticeably higher (Mean=136.69) than those observed in Sinyor's nonalcoholic sample (Mean=80-86).

The Repression-Sensitization pretest scores in the present study corresponded to those in studies using normal, nonalcoholic populations (Shipley, Butt, Horwitz & Farbry, 1978; Shipley, Butt & Horwitz, 1979; Kaloupek, White & Wong, 1984). The subjects from the present study scored in the range that represents Sensitizers.

The Locus of Control pretest scores also appeared comparable to those in studies using normal samples (Apao & Damon, 1982) and were in the middle range between the Internal and External categories.

Second Aim

The second aim of the present study was to determine the physiological and psychological effects of an aerobic fitness program on recovering alcoholics by examining

cardiovascular function (VO2 Max), liver function reflected by carbohydrate metabolism (GTT) and liver enzyme levels (GGT), and psychological characteristics (Hopkins Symptoms Checklist, Repression-Sensitization, Locus of Control).

Aerobic exercise was expected to be more effective than the other two groups in influencing the physiological variables. With the exception of chloride and the liver enzyme GGT, the hypotheses were not supported.

Contrary to expectations, the aerobic exercise training used in the present study was not capable of increasing cardiovascular fitness as measured by VO2 Max. Liver function as measured by GTT was not affected by any of the interventions either.

However, the liver enzyme GGT, the other measure of liver function used in this study, was affected differentially by each of the treatment conditions. Aerobic exercise was the most effective at decreasing initially elevated scores, non-aerobic exercise was the next most effective while stress management was the least effective. The enzyme GGT is known to be particularly suited for diagnosing liver dysfunction directly related to alcohol abuse (Shaw, 1982). The extent of liver dysfunction due to chronic alcohol abuse has not been previously studied at this treatment center and is rarely documented in the literature of related alcohol research. These data suggest that GGT may be an effective and sensitive tool for assessing liver dysfunction and it should be considered for

inclusion in further research.

Since aerobic exercise appears to be the most effective treatment for decreasing the abnormally elevated liver enzyme GGT, it seems to be a potentially useful component in an overall treatment program for recovering alcoholics. Because non-aerobic exercise was also found to be effective for decreasing abnormally elevated GGT levels, it might also be considered as a valuable part of treatment particularly for those alcoholics who are not healthy enough to participate in an aerobic workout.

No directional hypotheses were made in relation to changes in sodium and chloride levels as a function of treatment. Analyses showed, however, that exercise was not effective in decreasing abnormally elevated sodium levels. Chloride results however, revealed that exercise training was effective at significantly decreasing abnormally elevated scores and that aerobic exercise training was significantly better than non-aerobic exercise at accomplishing this task.

Perhaps it is not surprising that many of the effects seen following aerobic fitness training in this study were not very different from those seen following non-aerobic exercise training for no increase in cardiovascular fitness as reflected in VO2 Max was found in the former group despite the fact that aerobic fitness has been used successfully in the past (Murphy, 1970; Gary & Guthrie, 1972; Sinyor et al., 1982). The great variability in health

noted among the alcoholics in this project might have contributed to these findings. However, the significant improvement in liver function suggests that aerobic training did, in fact, result in some degree of physiological benefits. Since cardiovascular fitness was not improved significantly by the aerobic exercise program, it may suggest that the amount of exercise received by the subjects in the present experiment was insufficient. Though VO2 Max is a common indicator of aerobic fitness, GGT may be a more sensitive measure of change due to exercise training.

As well as looking at these physiological measures, the psychological effects of an aerobic exercise program on recovering alcoholics were also examined. As expected, the aerobic and non-aerobic exercise treatments were found to be similarly capable of improving a number of the measures on the Hopkins Symptoms Checklist and were significantly better at doing so than stress management. However, contrary to expectations, the Repression-Sensitization scores were shifted more towards the Repressor end of the continuum by both exercise treatments rather than towards the Sensitizer end, while the stress management had significantly less of an effect. The Locus of Control scores did not demonstrate any significant change.

Both exercise programs were similarly capable of decreasing the symptomatology on the Hopkins Symptoms Checklist. The General Distress, Somatization, Anxiety and Depression scores were decreased. No normative data are

available for this test. However, as indicated earlier, it is quite evident that the alcoholics in the present study were quite symptomatic compared to ratings of nonalcoholics. Since the two exercise treatments were similarly capable of enhancing psychological well-being, each could be made available in rehabilitation programs for alcoholics.

Subjects who participated in either of the two exercise groups showed similar responses in the Repression-Sensitization test. Though both pre- and posttest scores were within the Sensitizer range (Shipley et al., 1979), the exercise groups' scores shifted more towards the Repressor end of the continuum than did those of the Stress Management group. It seems that some general effect of exercise rather than something specific to aerobic exercise was responsible for these scores shifting towards the Repressor end. These findings were contrary to the prediction that scores would initially be towards the Repressor end of the continuum and with treatment would shift more towards the Sensitizer end. One would expect denial (a component of the Repressor profile) to be elevated at the onset of treatment since it is a prevalent defense mechanism used by alcoholics. It is not clear why all three groups were initially in the Sensitizer range of scores. Neither is it clear why both exercise groups shifted towards the Repressor end of the continuum while the Stress Management group did not. Since the Sensitizer has a tendency to be especially alert to threatening cues, this shift may be suggestive of an

improved ability on the part of the exercise groups to differentiate threatening from nonthreatening cues.

Locus of Control showed no differential change as a result of intervention. The reasons for this are not clear. It may be that the Locus of Control is not a sensitive measure as used in this study. However, an alternate interpretation is that all three interventions are equally potent at effecting change on this measure.

Presenting a psychological profile and observing how the related variables were affected by aerobic exercise and exercise in general, proved quite useful for this study. Previous research from this lab, examining the effects of aerobic exercise on alcoholics' recovery process, noted that aerobic exercise enhanced the abstinence rate of these alcoholics three months after discharge (Sinyor et al., 1982). It was not clear which aspects of aerobic fitness were implicated in improved abstinence rates. The present study has been able to highlight some of the psychological variables which may affect recovery.

It is of interest to note that the aerobic and non-aerobic exercise programs are equally effective in decreasing these psychological symptom scores associated with alcoholism. What do these two types of exercise have in common that contribute to this improvement? Both Michaels et al. (1976) and Bahrke and Morgan (1978) suggest that it is the diversory rather than the physiological aspect of these activities which is the common beneficial

ingredient. As they and others have noted, this type of activity, as well as relaxation, meditation, biofeedback and leisure time activities, all share a common underlying factor often labelled "time out". It is believed that diverting an individual's attention from his or her problems for a period of time can be of therapeutic benefit. This may have occurred in the present project with the exercise groups. Both exercise programs provided this daily diversion from current problems, while the stress management program focused on those problems as a means of developing insight and building new coping skills to deal with them. It would have been necessary to have had a non-exercise "time-out" control group such as listening to music to be clearer about the importance of "time-out". However, it was very important, for ethical reasons, to develop a non-exercise control group which had potential benefits similar to those expected from the exercise treatment. Thus, it is difficult to come to any conclusion about "time-out" being a critical underlying factor for decreasing psychological symptoms.

This study had other limitations in its design besides the absence of a non-exercise "time-out" control group. There was the sequential running of groups rather than a random design, the lack of a follow-up program and the question as to whether subjects got enough exercise to test the exercise hypotheses.

The problem of sequentially running the groups rather

than using a randomized design has been dealt with under "Group Formation" in the "Procedure" section of this dissertation. Reasons for running the groups sequentially, rather than simultaneously, were given and it was pointed out that some randomization was achieved because subjects were not provided with their choice of treatment. However, if a true randomized design could have been used, the problem of pre-treatment differences between the groups might have been diminished, if not avoided, and clearer results might have been produced.

The lack of a follow-up program limited the potential of the research to predict whether the decreases in psychological symptoms would be maintained after discharge. However, alcoholics leaving treatment with lower levels of distress related to somatization, anxiety and depression might be in a better position to deal with problems associated with alcoholism, in addition to those encountered in every day life.

It is important to discuss whether subjects in the Aerobic exercise group received enough exercise. The liver function results suggest differential effectiveness of the aerobic and non-aerobic treatment programs; the aerobic exercise training did something more than non-aerobic exercise and it seems reasonable to assume that it produced something more in the direction of aerobic fitness. Perhaps an inadequate amount of aerobic training was the primary reason more significant effects were not found. It is

possible that increased aerobic training would have lead to enhanced physiological and psychological functioning.

Suggestions For Future Research

To run subjects using a random design (all three groups simultaneously), one would need staff that was willing to deal with three new treatment programs integrated into the multi-modal program already in existence as well as more research staff members to carry out the different treatments. This might be feasible if the treatment center wanted to incorporate these additions into their ongoing program. However, if the arrangements are only temporary, it would be too disruptive for the running of the center. In this particular center, there were not enough separate facilities to run three different groups simultaneously. Though running all three groups together would have greatly decreased the chances of having pretreatment differences between the groups, the design of the study was limited by existing work conditions.

The idea of at least a three month follow-up for this study is a good one since it is impossible to predict whether the observed effects would be maintained after discharge without it. If one assumes that treatment effects are to aid in recovery, it would be helpful to look at abstinence past the discharge date since maintaining sobriety is an essential part of recovery. If the treatment effect disappeared shortly after discharge then the effectiveness of such a treatment program would be

questionable.

Since the aerobic exercise program used in the present study did not cause a reliable improvement in the index (VO2 Max) that was chosen to measure cardiovascular fitness, a more intensive exercise program might be effective where the present exercise program was not. It seems likely that the alcoholic patients of the present study were not exercising as energetically as they might. It may be necessary to supervise an exercise program closely if it is to be a useful adjunct to the rehabilitation of alcoholics or other groups that are not enthusiastic volunteers for a fitness program. All forms of exercise may be effective in enhancing the recovery process of alcoholics and aerobic exercise may prove to be the best. However, a more intensive aerobic training program will have to be used to evaluate this with more certainty.

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Appendix A

Demographic Questionnaire

PAVILLON FOSTER
BOITE POSTALE 119
ST-PHILIPPE-DE - LAPRAIRIE, QUEBEC
JOL 2KO

CLIENT INTAKE

COMPLETE THIS QUESTIONNAIRE BY CIRCLING THE NUMBER(S) WHICH CORRESPOND(S) TO THE MOST ACCURATE ANSWER(S) OR BY COMPLETING THE BLANK(S). UNLESS OTHERWISE SPECIFIED MORE THAN ONE ANSWER MY BE GIVEN.

MEDICARE # _____

SOCIAL NUMBER INSURANCE #_____

A. LAST NAME _____FIRST NAME _____

B. TEL # _____

C. ADDRESS _____ APT# _____

D. DATE OF BIRTH _____

E. PLACE OF BIRTH _____

F. EMERGENCY:

Name _____

Relationship _____

Tel. No. _____

G. MOTHER'S MAIDEN NAME _____

MAIDEN NAME _____

H. NAME OF SPOUSE _____ _____

I. TEL. # _____

J. ADDRESS _____ _____

1. CLIENT # _____ 2. DATE _____

3. SEX 1. M 2. F

4. AGE _____

5. MARITAL STATUS

1. Single
2. Married
3. Separated
4. Divorced
5. Widowed
6. Widowed and remarried
7. Divorced and remarried
8. Common law

5a. IF MARRIED THE NATIONALITY OF YOUR SPOUSE IS

1. The same 2. Different

5b. IF MARRIED THE RELIGION OF YOUR SPOUSE IS

1. The same 2. Different

6. AGE OF SPOUSE _____

7. DATE OF MARRIAGE OR BEGINNING OF COMMON LAW RELATIONSHIP

_____

8. HOW MANY CHILDREN ARE THERE FROM THIS UNION _____

8a. HOW MANY CHILDREN NOW LIVE IN THE HOUSE _____

8b. AGE OF YOUNGEST _____ AGE OF OLDEST _____

9. MOTHER TONGUE

1. French
2. English
3. Other: specify _____

10. LANGUAGE(S) SPOKEN

1. French
2. English
3. Other: specify _____

11. RELIGION

1. Catholic
2. Protestant
3. Jewish
4. Other: specify _____

12. CITIZENSHIP

1. Canadian
2. American
3. Other: specify _____

13. MILITARY SERVICE

1. YES 2. NO

IF YES HOW LONG _____ REGIMENTAL NUMBER _____

IF YES OVERSEAS SERVICE: 1. YES 2. NO

13.a POLICE SERVICE

1. YES 2. NO

IF YES HOW LONG _____

14. EDUCATION

	# of years completed
1. Primary	_____
2. Secondary	_____
3. Collegial	_____
4. University	_____
5. Other schooling	_____

15. ARE YOU NOW EMPLOYED?

1. Full time
2. Part time
3. Unemployed: For how long: _____ months
4. Retired
5. Welfare: For how long: _____ months

16. PROFESSION OR TRADE WHEN EMPLOYED

1. Professionnal: (e.g. M.D., Lawyer, nurse, teacher, etc...)
2. Administration and management (e.g. director, manager, etc...)
3. Semi-professionnal (e.g. skilled technician, etc...)
4. Small businessman (e.g. self-employed, etc...)
5. White collar and office employee (e.g. secretary, clerk, etc...)
6. Skilled worker (e.g. chef, cook, barman, etc...)
7. Unskilled worker (e.g. labourer, driver, etc...)
8. Housewife (if no other employement)
9. Student (if no other employement)
10. If you have difficulty in choosing a number, write the occupation here _____

18. HOW MANY BROTHERS OR SISTERS DO YOU HAVE? _____

19. WHAT IS YOUR RANK IN THE FAMILY _____

IN ANSWERING THIS QUESTION USE THE FOLLOWING DRUG CODE.

20. DRUG CODE

01. Alcohol
02. Cannabis
03. Psychedelics
04. Amphetamines
05. Cocaine
06. Narcotic-organic
07. Narcotic-synthetic
08. Barbiturates
09. Hypnotics
10. Tranquilizers
11. Glue or solvents
12. Anti-depresants

WHICH OF THE DRUGS MENTIONED HAVE YOU CONSUMED?

DRUG CODE	AGE AT FIRST USE	AGE AT LAST USE	WERE THESE DRUGS CONSUMED UNDER MEDICAL PRESCRIPTION YES	NO	DID YOU EXCEED THE PERSCRIBED USE YES	NO	CONSUMED DURING HOSPITILISATION YES	NO

FAMILY BACKGROUND

	ABUSER OF ALCOHOL OR OTHER DRUG		DECEASED		PRESENT AGE OR AGE WHEN DECEASED	IF DEAD CAUSE	TREATED FOR MENTAL ILLNESS		HISTORY OF DIABETES	
Mother	YES	NO	YES	NO			YES	NO	YES	NO
Father	YES	NO	YES	NO			YES	NO	YES	NO
Spouse	YES	NO	YES	NO			YES	NO	YES	NO
Child(ren)	YES	NO	YES	NO			YES	NO	YES	NO
Sibling(s)	YES	NO	YES	NO			YES	NO	YES	NO
Grandparent(s)	YES	NO	YES	NO			YES	NO	YES	NO

22. AT WHAT AGE DID DRINKING BECOME A PROBLEM? _____

23. WHAT HAS BEEN YOUR DRINKING PATTERN IN THE LAST YEAR.

1. Daily drinker 2. Binge drinker

24. IF YOU EVER HAD A PERIOD OF SOBRIETY, WAS IT DONE

1. By yourself
2. With the aid of A.A.
3. With the aid of friends
4. With the aid of family
5. With the aid of a professionnal
6. With the aid of a treatment program
7. Other: specify _____
8. Never remained dry

25. IF SOBER, HOW LONG HAVE YOU BEEN SOBER? _____

26. WHAT WAS YOUR LONGEST PERIOD OF SOBRIETY? _____

27. WHICH OF THE FOLLOWING SYMPTOMS HAVE YOU HAD?

1. Convulsions
2. D.T.
3. Blackouts
4. None of the above

29. AS A RESULT OF DRINKING HAVE YOU EVER EXPERIENCED MARITAL PROBLEMS?

1. YES 2. NO

30. HAVE YOU EVER BEEN HOSPITALIZED? 1. YES 2. NO

IF YES,

NAME OF THE HOSPITAL	ADDRESS	DATE

31. HAVE YOU EVER ATTENDED AN A.A. MEETING(S)? 1. YES 2. NO

32. IF ATTENDED, HOW LONG

1. Once _____
2. Week(s) _____
3. Month(s) _____
4. Year(s) _____

33. WHO REFERRED YOU TO BEAVER?

1. Client
2. Professionnal
3. Employer
4. Court
5. Family
6. Friend
7. Acquaintance
8. A member of A.A.
9. A physician
10. Other: specify _____

If not self-referred provide name of reference: _____

_____

34. WHEN CLIENT FIRST APPRARED FOR ADMISSION, THE CLIENT WAS:

1. Dry
2. State of withdrawal

35. INTERACTION WITH JUDICIAL SYSTEM:

A. Crimes against person: 1. YES 2. NO

IF YES

1. Not charged
2. Charged
3. Charged and dropped
4. Convicted
5. Convicted and imprisoned

AGE AT FIRST INCIDENT_____

B. Crimes against property: 1. YES 2. NO

IF YES

1. Not charged
2. Charged
3. Charged and dropped
4. Convicted
5. Convicted and imprisoned

AGE AT FIRST INCIDENT_____

36. SUICIDE ATTEMPTS

1. YES 2. NO HOW MANY TIMES?_____

HOW TRIED_____

_____

Appendix B

Informed Consent

INFORMED CONSENT FOR PHYSICAL TASKS AND BLOOD TESTS

As a participant in this alcohol treatment center, you will participate in a graded exercise program, fill out psychological evaluation questionaires and have blood samples taken.

Explanation of Graded Exercise Program

after being examined by our staff physician, you will be randomly assigned to one of two exercise programs for the duration of your stay here. Classes will be held five times a week with individual sessions lasting one hour. The intensity of exercise will begin at a level you can comfortably handle and will advance in stages depending on your capacity.

Explanation of Blood Tests

Blood will be taken by a qualified registered nurse. Samples will be taken from the arm with a single needle and from the finger tip. One of the blood tests helps to evaluate how your body has been affected by your drinking. The same test done at the end of the program will note any changes (improvements) which have occurred during your stay here. The other blood test will help us understand how your body reacts to sugar, since abnormal response to sugar is a common problem seen in alcoholics. A repeat of this test at the end of the program will help us see if any improvements have occurred either due to our program, or simply due to the abstinance from alcohol.

Risks and Discomforts

There exists the possibility of certain changes occuring during the tests. They include abnormal blood pressure, fainting, disorders of heart beat, aches and pains associated with exercise, and very rare instances of heart attack. Every effort will be made to minimize these by the preliminary screening done by your physician as well as ours, and by observations during the testing by a qualified exercise physiologist.

Freedom of Consent

Your participation in the blood work is voluntary and you are free to deny consent of you desire.

I have read this form and I understand the test procedures and possible risks and discomforts involved. I consent to participate in these tests.

Signature of Subject.....

Witnessed by.....

I.D. #.....

CONSENTEMENT À EFFECTUER CERTAINNES TACHES PHYSIQUES ET EPREUVES PSYCHOLOGIQUES

En tant que participant au centre de traitements des alcooliques, vous prendrez part à un programme d'efforts gradués, subirez des épreuves psychologiques ainsi que des prises de sang.

Explication du programme d'exercises gradués

Apres avoir été examiné par un médecin résident, vous serez assigné au hasard à un des deux programmes d'exercises pour toute la durée de votre séjour. Des classes se tiendront cinq jours par semaine par sessions d'une heure. Nous commencerons les exercises à un niveau facilement supportable et avancerons selon vos capacités.

Explication des prises de sang

Les prises de sang seront effectuées par une infirmiére diplomée. Les échantillons seront pris dans le bras et au bout d'un doigt. Un des examens sanguins aide à évaluer les effets de l'alcool sur votre organisme. Le même test fait à la fin du programme montrera les changements (améliorations) survenus durant votre séjour. L'autre examen nous aidera à comprendre comment votre organisme réagit au sucre, puisqu'un résultat anormal est un problème commun chez les alcooliques. Une répétition de ce test nous aidera à constater si les changements survenus sont dus soit à notre programme, soit à l'abstinence d'alcool.

Risques et inconvenients

Il est possible que certains changements surviennent au cours des tests. Ceux-ci peuvent comprendre: tension artérielle anormale, évanouissements, palpitations, douleurs dans l'effort et quelques rares exemples de crise cardiaque. Toutes les précautions seront prises pour minimiser ces inconvénients par un examen sélectif préliminaire fait par votre médecin et les notres, et par des observations effectuées durant le test par un physiologiste qualifié.

Consentement de la personne

Votre participation a ces tests est volontaire et vous etes libre de refuser votre consentement.

J'ai lu cette formule et accepte de passer ces tests tout en sachant les risques et inconvénients encourus. Je consens à y participer.

Signature du sujet.....

Témoin.....

I.D. #.....

Appendix C

Figures for Original Data

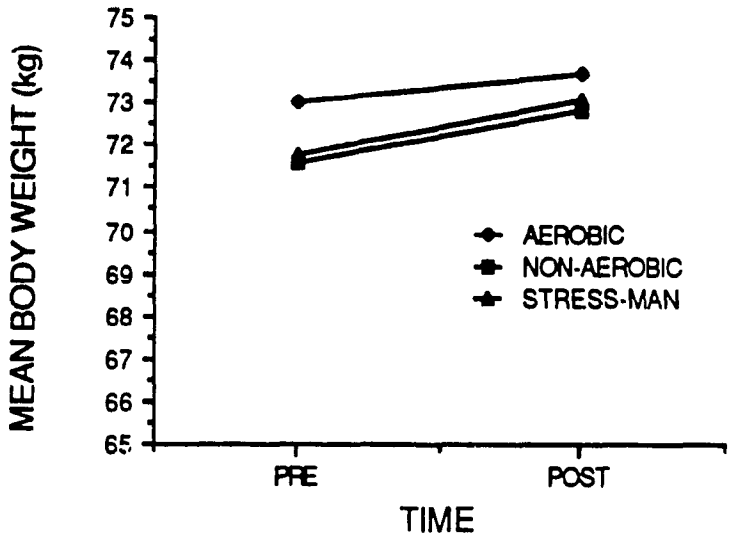

Figure C-1. Mean body weight (kg) before and after treatment.

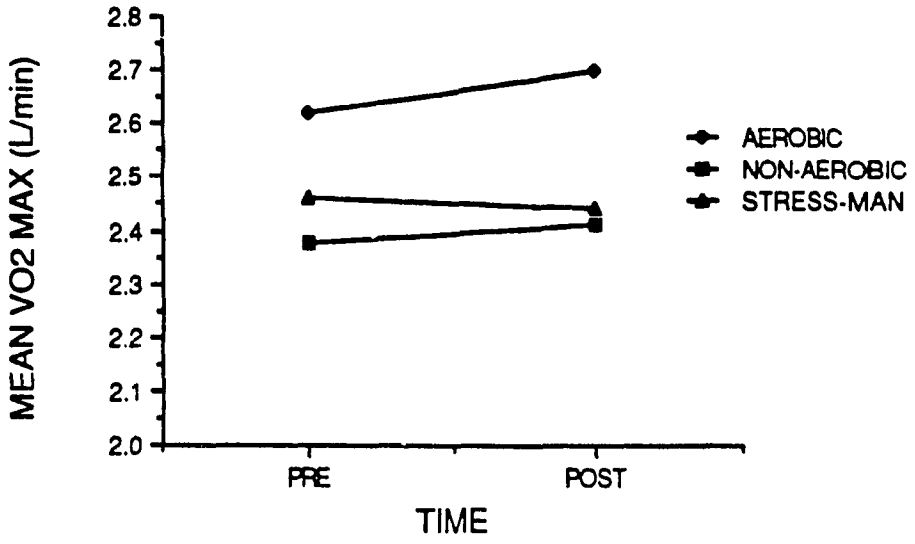

Figure C-2. Mean aerobic capacity (L/min.) before and after treatment.

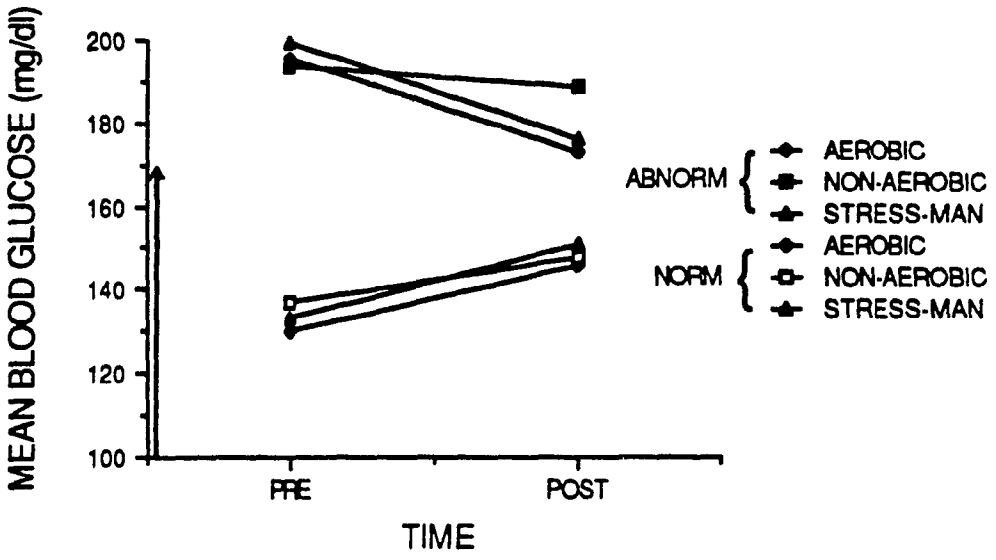

Figure C-3. Subjects with normal glucose tolerance scores on admission compared to those with abnormally elevated scores during the first half hour phase of absorption, showing mean blood glucose (mg/dl) before and after treatment.

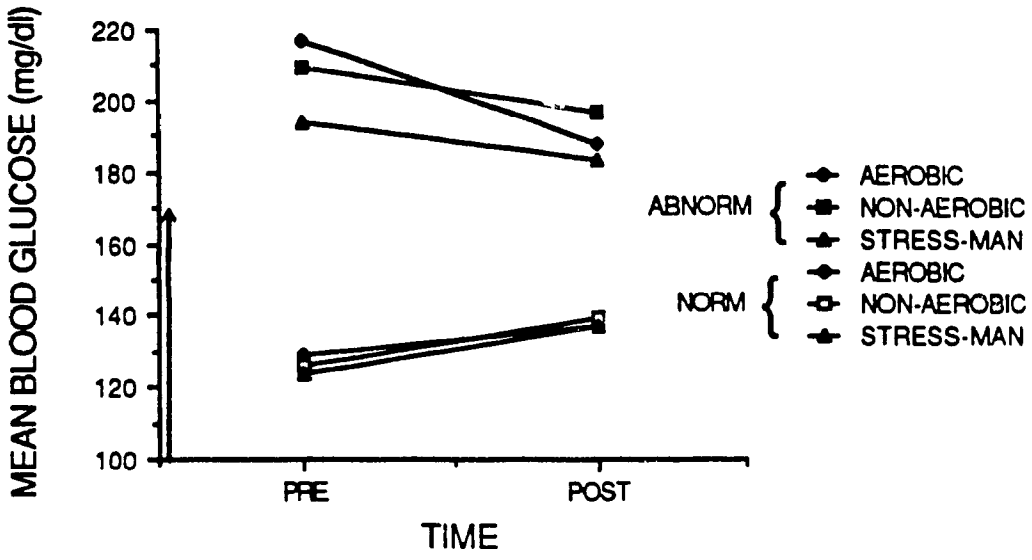

Figure C-4. Subjects with normal glucose tolerance scores on admission compared to those with abnormaly elevated scores during the first hour phase of absorption, showing mean blood glucose (mg/dl) before and after treatment.

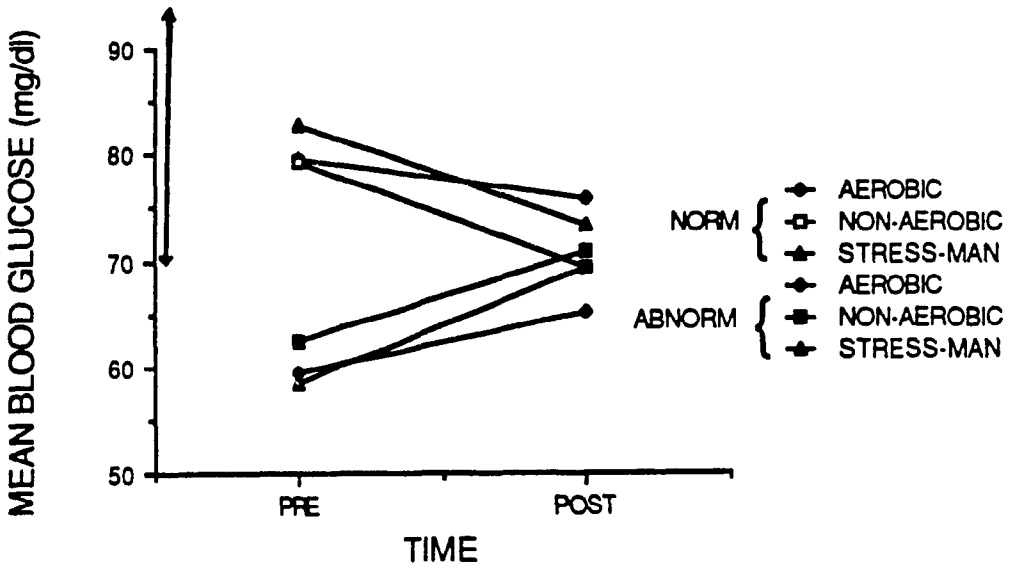

Figure C-5. Subjects with normal glucose tolerance scores on admission compared to those with abnormally diminished scores during the third hour phase of absorption, showing mean blood glucose (mg/dl) before and after treatment.

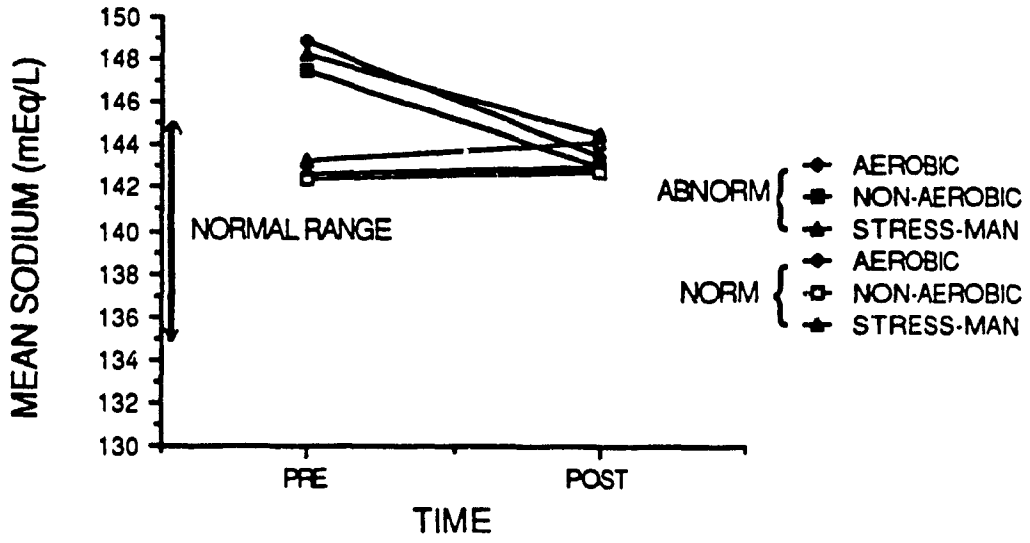

Figure C-6. Subjects with normal sodium scores on admission compared to those with abnormally elevated scores, showing mean sodium (mEq/L) before and after treatment.

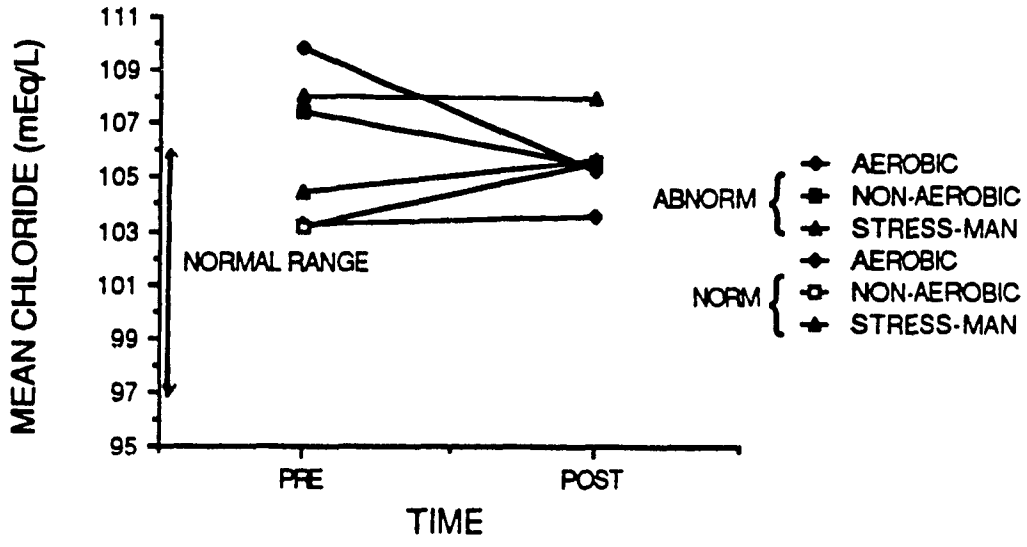

Figure C-7. Subjects with normal chloride scores on admission compared to those with abnormaly elevated scores, showing mean chloride (mEq/L) before and after treatment.

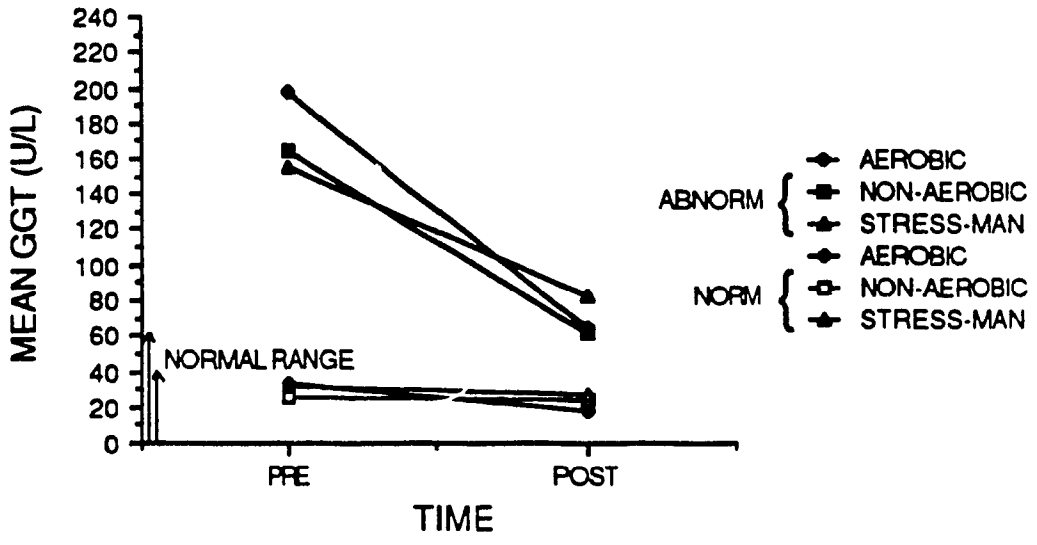

Figure C-8. Subjects with normal liver enzyme (GGT) scores on admission compared to those with abnormally elevated scores, showing mean GGT (U/L) before and after treatment.

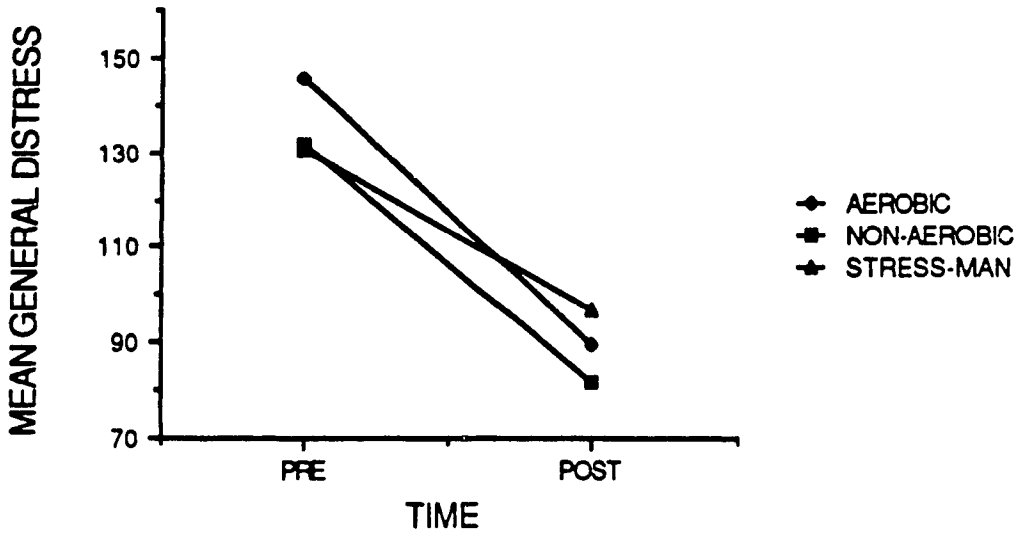

Figure C-9. Hopkins Symptoms Checklist: General Distress before and after treatment.

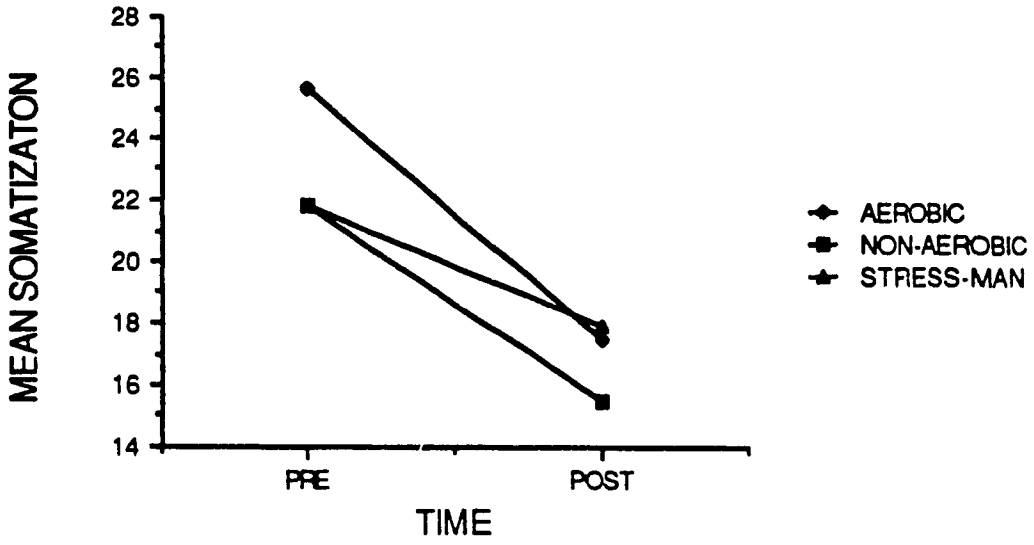

Figure C-10. Hopkins Symptoms Checklist: Somatization before and after treatment.

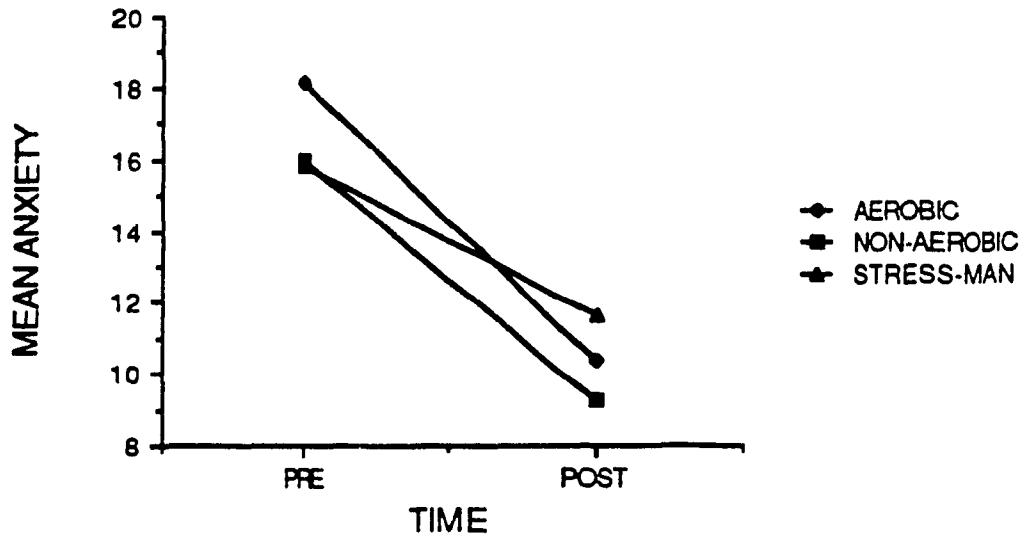

Figure C-11. Hopkins Symptoms Checklist: Anxiety before and after treatment.

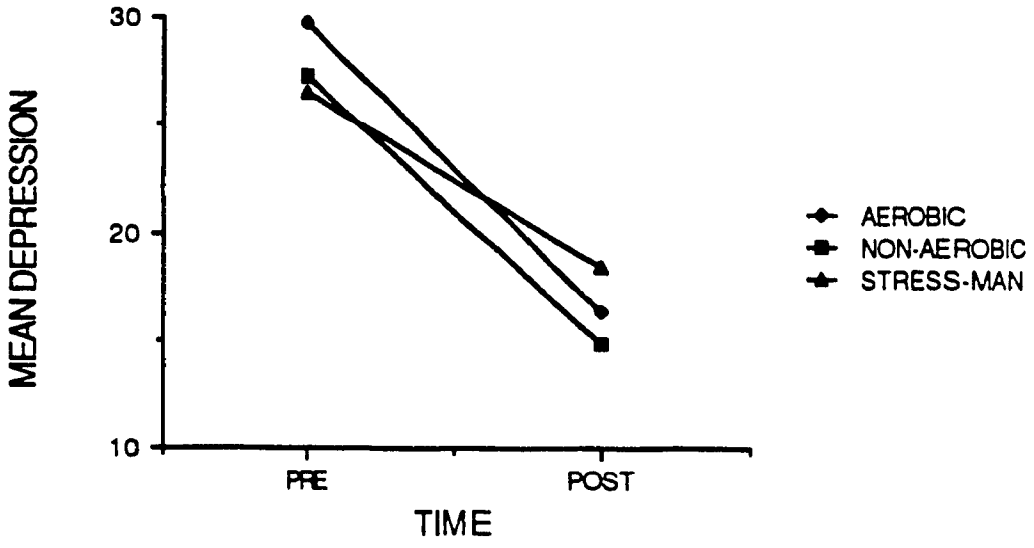

Figure C-12. Hopkins Symkptoms Checklist: Depression before and after treatment.

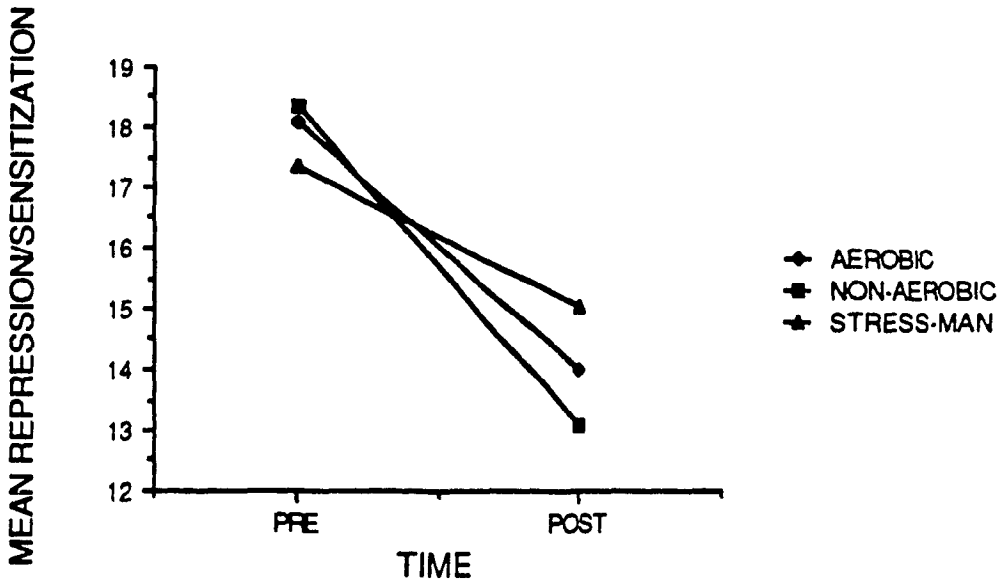

Figure C-13. Repression-Sensitization before and after treatment.

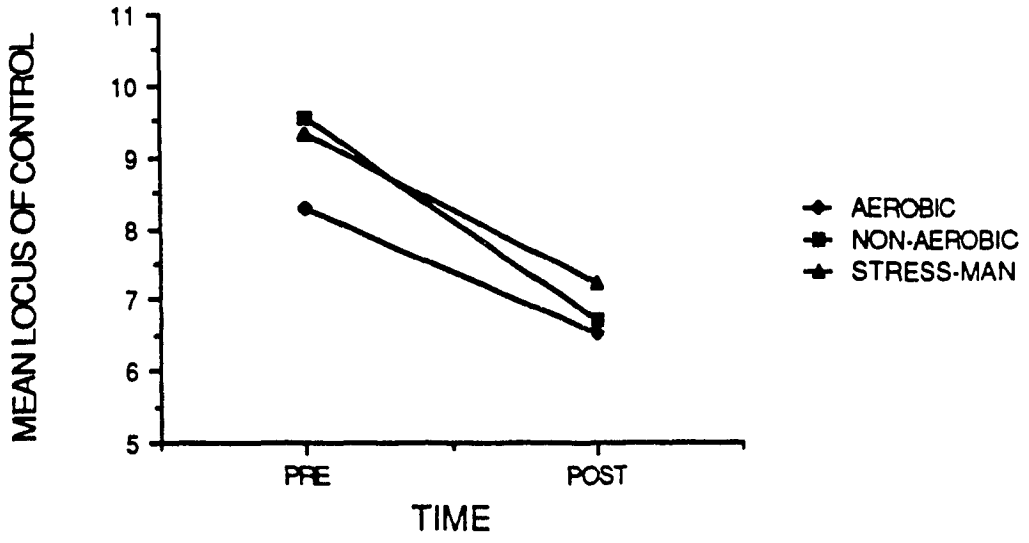

Figure C-14. Locus of Control before and after treatment.

Appendix D

Tables for Original Data

Table D-1

Means and Standard Errors for Body Weight in Kilograms

		Time	
Groups	n	Pretest	Posttest
Aerobic	41		
M		73.0	73.7
SE		± 1.6	± 1.6
Non-aerobic	37		
M		71.6	72.8
SE		± 2.0	± 1.9
Stress Management	37		
M		71.8	73.1
SE		± 2.0	± 2.0

Repeated Measures ANOVA for Body Weight Scores in Kilograms, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	63.54	2	31.77	.13	
Error$_b$	27519.71	112	245.71		
Time (T)	64.31	1	64.31	20.08	<.001
G x T	3.19	2	1.59	.50	
Error	358.62	112	3.20		

Table D-2

Means and Standard Errors for Fitness Scores (VO2 Max) (L/min)

		Time	
Groups	n	Pretest	Posttest
Aerobic	38		
M		2.62	2.70
SE		± .09	± .10
Non-aerobic	37		
M		2.38	2.41
SE		± .11	± .10
Stress Management	37		
M		2.46	2.44
SE		± .11	± .11

Repeated Measures ANOVA for Fitness Scores (VO2 Max), as a Function of Time

Source	SS	df	MS	F	p
Group (G)	2.82	2	1.41	1.88	
Error$_b$	81.57	109	.75		
Time (T)	.05	1	.05	3.86	<.05
G x T	.09	2	.04	3.35	<.04
Error	1.40	109	.01		

Table D-3

Means and Standard Errors for Subjects with Normal GTT Scores (<170), 1st Half Hour

		Time	
Groups	n	Pretest	Posttest
Aerobic	29		
M		130.1	146.2
SE		± 5.0	± 6.0
Non-aerobic	25		
M		137.4	147.5
SE		± 4.3	± 6.5
Stress Management	31		
M		133.6	150.7
SE		± 4.8	± 7.1

Table D-4

Means and Standard Errors for Subjects with Abnormally Elevated GTT Scores (>170), 1st Half Hour

		Time	
Groups	n	Pretest	Posttest
Aerobic	16		
M		195.31	173.19
SE		± 7.81	± 12.22
Non-aerobic	12		
M		194.00	188.50
SE		± 12.76	± 12.46
Stress Management	8		
M		199.50	175.88
SE		± 6.06	± 14.33

Repeated Measures ANOVA for Abnormally Elevated GTT Scores (>170) the First Half Hour, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	674.38	2	337.19	.16	
Error$_b$	68810.44	33	2085.16		
Time (T)	4849.04	1	4849.04	5.54	<.02
G x T	1179.06	2	589.53	.67	
Error	28865.31	33	874.71		

Table D-5

Means and Standard Errors for Subjects with Normal GTT Scores (<170), First Hour

		Time	
Groups	n	Pretest	Postest
Aerobic	33		
M		129.0	137.0
SE		± 4.0	± 5.2
Non-aerobic	26		
M		125.8	139.8
SE		± 4.8	± 8.8
Stress Management	32		
M		124.2	137.1
SE		± 3.6	± 5.7

Table D-6

Means and Standard Errors for Subjects with Abnormally Elevated GTT Scores (>170), First Hour

		Time	
Groups	n	Pretest	Posttest
Aerobic	13		
M		216.69	188.15
SE		± 10.66	± 17.16
Non-aerobic	7		
M		209.43	196.86
SE		± 18.28	± 15.86
Stress Management	7		
M		193.86	183.14
SE		± 8.20	± 17.95

Repeated Measures ANOVA for Abnormally Elevated GTT Scores (>170) the First Hour, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	2088.44	2	1044.22	.33	
$Error_b$	76312.56	24	3179.69		
Time (T)	3703.07	1	3703.07	5.06	<.03
G x T	968.15	2	484.07	.66	
Error	17560.19	24	731.67		

Table D-7

Means and Standard Errors for Subjects With Normal GTT Scores (>70 and <100), Third Hour

		Time	
Groups	n	Pretest	Posttest
Aerobic	15		
M		79.6	75.8
SE		± 2.2	± 4.6
Non-aerobic	16		
M		79.4	69.4
SE		± 1.6	± 2.6
Stress Management	7		
M		82.9	73.3
SE		± 3.4	± 7.7

Table D-8

Means and Standard Errors for Subjects with Abnormally Diminished GTT Scores (<70), 3rd Hour

		Time	
Groups	n	Pretest	Posttest
Aerobic	26		
M		59.38	65.23
SE		± 1.63	± 2.44
Non-aerobic	14		
M		62.43	70.79
SE		± 1.13	± 2.60
Stress Management	30		
M		58.33	69.37
SE		± 1.45	± 4.06

Repeated Measures ANOVA for Abnormally Diminished GTT Scores (<70), 3rd Hour, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	336.48	2	168.24	.80	
Error$_b$	14014.41	67	209.17		
Time (T)	2223.41	1	2223.41	17.85	<.001
G x D	187.79	2	93.89	.75	
Error	8343.78	67	124.53		

Table D-9

Means and Standard Errors for Subjects With Normal Serum Sodium Levels (135-145)

		Time	
Groups	n	Pretest	Posttest
Aerobic	32		
M		142.7	143.1
SE		± .3	± .4
Non-aerobic	29		
M		142.4	142.8
SE		± .6	± .4
Stress Management	26		
M		143.3	144.2
SE		± .3	± .5

Table D-10

Means and Standard Errors for Subjects with Abnormally Elevated Serum Sodium Levels (>146)

		Time	
Groups	n	Pretest	Posttest
Aerobic	14		
M		148.9	143.6
SE		± .9	± .7
Non-aerobic	7		
M		147.5	143.0
SE		± 1.2	± .8
Stress Management	14		
M		148.3	144.5
SE		± .6	± .7

Repeated Measures ANOVA for Abnormally Elevated Sodium Scores (>146), as a Function of Time

Source	SS	df	MS	F	p
Group (G)	10.)5	2	5.03	.93	
Error$_b$	172.32	32	5.39		
Time (T)	312.22	1	312.22	36.73	<.001
G x T	11.25	2	5.63	.66	
Error	272.04	32	8.50		

Table D-11

Means and Standard Errors for Subjects with Normal Serum Chloride Levels (97-106)

Groups	n	Time	
		Pretest	Postest
Aerobic	36		
M		103.2	103.5
SE		± .3	± .4
Non-aerobic	22		
M		103.1	105.5
SE		± .4	± .5
Stress Management	21		
M		104.4	105.6
SE		± .4	± .5

Table D-12

Means and Standard Errors for Subjects with Abnormally Elevated Serum Chloride Levels (>107)

		Time	
Groups	n	Pretest	Posttest
Aerobic	9		
M		109.8	105.2
SE		± .6	± .4
Non-aerobic	6		
M		107.3	105.3
SE		± .2	± .7
Stress Management	17		
M		108.2	107.9
SE		± .4	± .6

Repeated Measures ANOVA for Abnormally Elevated Chloride Scores (>107), as a Function of Time

Source	SS	df	MS	F	p
Group (G)	26.56	2	13.28	3.48	<.04
$Error_b$	110.55	29	3.81		
Time (T)	68.50	1	68.50	28.94	<.001
G x T	55.09	2	27.55	11.64	<.001
Error	68.64	29	2.37		

Table D-13

Means and Standard Errors for Subjects with Normal GGT Scores (Males <60; Females <40)

		Time	
Groups	n	Pretest	Posttest
Aerobic	29		
M		33.2	18.8
SE		± 6.5	± 1.9
Non-aerobic	19		
M		25.6	23.6
SE		± 3.1	± 2.9
Stress Management	29		
M		31.3	27.0
SE		± 6.4	± 5.1

Table D-14

Means and Standard Errors for Subjects with Abnormally Elevated GGT Scores (Males >60; Females >40)

		Time	
Groups	n	Pretest	Posttest
Aerobic	19		
M		198.11	64.21
SE		± 46.84	± 20.10
Non-aerobic	15		
M		163.93	61.80
SE		± 42.03	± 9.43
Stress Management	11		
M		155.18	83.45
SE		± 31.38	± 15.61

Repeated Measures ANOVA for Abnormally Elevated GGT Scores (Males >60; Females >40), as a Function of Time

Source	SS	df	MS	F	p
Group (G)	5845.21	2	2922.60	.12	
Error$_b$	1035954.79	42	24665.59		
Time (T)	225285.55	1	225285.55	32.37	<.001
G x T	13864.37	2	6932.18	1.00	
Error	292293.85	42	6959.38		

Table D-15

Means and Standard Errors for the Hopkins Symptoms Checklist: General Distress Scores

		Time	
Groups	n	Pretest	Posttest
Aerobic	46		
M		145.60	89.80
SE		± 5.26	± 3.09
Non-aerobic	40		
M		131.40	81.55
SE		± 4.23	± 2.99
Stress Management	40		
M		130.50	97.10
SE		± 4.76	± 3.74

Repeated Measures ANOVA for the Hopkins Symptoms Checklist: General Distress Scores, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	5484.53	2	2742.26	3.18	<.05
$Error_b$	106163.63	123	863.12		
Time (T)	134586.00	1	134586.00	239.66	<.001
G x T	5634.40	2	2817.20	5.02	<.008
Error	69071.76	123	561.56		

Table D-16

Means and Standard Errors for the Hopkins Symptoms Checklist: Somatization Scores

Groups	n	Time	
		Pretest	Posttest
Aerobic	46		
M		25.67	17.48
SE		± 1.07	± .76
Non-aerobic	40		
M		21.80	15.48
SE		± .96	± .67
Stress Management	40		
M		21.85	17.95
SE		± .96	± .81

Repeated Measures ANOVA for the Hopkins Symptoms Checklist: Somatization Scores, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	374.73	2	187.37	4.43	<.01
$Error_b$	5205.15	123	42.32		
Time (T)	2364.96	1	2364.96	98.21	<.001
G x T	197.62	2	98.81	4.10	<.02
Error	2961.81	123	24.08		

Table D-17

Means and Standard Errors for the Hopkins Symptoms Checklist: Anxiety Scores

		Time	
Groups	n	Pretest	Posttest
Aerobic	46		
M		18.15	10.37
SE		± .88	± .50
Non-aerobic	40		
M		15.98	9.28
SE		± .67	± .42
Stress Management	40		
M		15.83	11.68
SE		± .76	± .53

Repeated Measures ANOVA for the Hopkins Symptoms Checklist: Anxiety Scores, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	117.92	2	58.96	2.59	
$Error_b$	2805.49	123	22.81		
Time (T)	2419.70	1	2419.70	181.40	<.001
G x T	146.19	2	73.10	5.48	<.005
Error	1640.66	123	13.34		

Table D-18

Means and Standard Errors for the Hopkins Symptoms Checklist: Depression Scores

		Time	
Groups	n	Pretest	Posttest
Aerobic	46		
M		29.72	16.35
SE		± 1.11	± .76
Non-aerobic	40		
M		27.28	14.83
SE		± .97	± .59
Stress Management	40		
M		26.55	18.40
SE		± 1.12	± .79

Repeated Measures ANOVA for the Hopkins Symptoms Checklist: Depression Scores as a Function of Time

Source	SS	df	MS	F	p
Group (G)	175.46	2	87.73	2.02	
$Error_b$	5331.15	123	43.34		
Time (T)	8042.55	1	8042.55	292.68	<.001
G x T	322.49	2	161.25	5.87	<.004
Error	3379.86	123	24.48		

Table D-19

Means and Standard Errors for Repression-Sensitization Scores

		Time	
Group	n	Pretest	Posttest
Aerobic	46		
M		18.09	14.02
SE		± .61	± .62
Non-aerobic	40		
M		18.35	13.10
SE		± .63	± .54
Stress Management	40		
M		17.33	15.03
SE		± .66	± .75

Repeated Measures ANOVA for Repression-Sensitization Scores, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	9.38	2	4.68	.19	
$Error_b$	2985.12	123	24.27		
Time (T)	926.28	1	926.28	102.88	<.001
G x T	87.63	2	43.81	4.87	<.009
Error	1107.44	123	9.00		

Table D-20

Means and Standard Errors for Locus of Control Scores

		Time	
Groups	n	Pretest	Posttest
Aerobic	46		
M		8.28	6.54
SE		± .51	± .62
Non-aerobic	40		
M		9.55	6.73
SE		± .62	± .64
Stress Management	40		
M		9.33	7.23
SE		± .76	± .60

Repeated Measures ANOVA for Locus of Control, as a Function of Time

Source	SS	df	MS	F	p
Group (G)	37.51	2	18.75	.73	
Error$_b$	3139.24	123	25.52		
Time (T)	309.53	1	309.53	48.25	<.
G x T	12.90	2	6.45	1.01	
Error	789.12	123	6.42		

Appendix E

More Complete Collective Summary Table of ANOVAs

Table E-1

Collective ANOVA Table Using Log Ratios As a Function of Time

Source	SS	df	MS	F	p
Body Weight					
Group	.0003	2	.0002	.70	
Error	.0252	112	.0002		
VO2 Max					
Group	.0047	2	.0024	1.90	
Error	.1357	109	.0013		
GTT					
First Half Hour					
Group	.0179	2	.0090	.81	
Error	.3639	33	.0110		
First Hour					
Group	.0135	2	.0068	.91	
Error	.1790	24	.0075		
Third Hour					
Group	.0065	2	.0032	.37	
Error	.5921	67	.0088		
Sodium					
Group	.0002	2	.0001	.66	
Error	.0047	32	.0002		

Table E-1 (Continued)

Collective ANOVA Table Using Log Ratios as a Function of Time

Source	SS	df	MS	F	p
Chloride					
Group	.0018	2	.0009	11.67	<.001
Error	.0022	29	.0001		
GGT					
Group	.49	2	.24	6.59	<.003
Error	1.55	42	.04		
Hopkins Symptoms Check List					
General Distress					
Group	.17	2	.09	5.17	<.004
Error	1.85	123	.02		
Somatization					
Group	.15	2	.08	4.33	<.02
Error	2.19	123	.02		
Anxiety					
Group	.32	2	.16	6.80	<.002
Error	2.89	123	.02		
Depression					
Group	.28	2	.14	7.24	<.001
Error	2.35	123	.02		

Table E-1 (Continued)

Collective ANOVA Table Using Log Ratios as a Function of Time

Source	SS	df	MS	F	p
Repression-Sensitization					
Group	.12	2	.06	3.56	<.03
Error	2.11	123	.02		
Locus of Control					
Group	.11	2	.05	.89	
Error	7.10	123	.06		

Appendix F

Collective Post Hoc Table

Table F-1

Collective Post Hoc Table

Measures	C. Diff	p
Physiological Measures		
Chloride		
Aerobic vs Non-aerobic	.0005	<.05
Aerobic vs Stress Man.	.0007	<.01
Non-aerobic vs Stress Man.	.0011	<.001
GGT (Liver Enzyme)		
Aerobic vs Other 2 grs.	.53	<.001
Aerobic vs Non-aerobic	.40	<.005
Non-aerobic vs Stress Man.	.23	<.05
Psychological Measures		
Hopkins Symptoms Check List		
General Distress		
Aerobic vs Stress Man.	.17	<.001
Non-aerobic vs Stress Man.	.12	<.01
Somatization		
Aerobic vs Stress Man.	.25	<.005
Non-aerobic vs Stress Man.	.10	<.05
Anxiety		
Aerobic vs Stress Man.	.40	<.001
Non-aerobic vs Stress Man.	.20	<.01

Table F-1 (con'd)

Collective Post Hoc Table

Measures	C. Diff	p
Depression		
Aerobic vs Stress Man.	.28	<.005
Non-aerobic vs Stress Man.	.20	<.01
Repression-Sensitization		
Aerobic vs Stress Man.	.15	<.05
Non-aerobic vs Stress Man.	.19	<.05