

USE OF THE EATING DISORDER INVENTORY IN
DETERMINING EATING DISORDER TENDENCIES AMONG RUNNERS

by

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(ABSTRACT)

The purpose of this study was to use the Eating Disorder Inventory (EDI), Negative Addiction Scale (NAS) and other measured characteristics to determine differences between consistent runners and sedentary controls. 38 male and 23 female local non-team related runners of more than 9 miles per week were studied. They completed the EDI and NAS. 31 male and 30 female nonexercisers completed the EDI. They were drawn from college classes and participated in less than one hour per week of physical activity. Height, weight and body fat were determined for both groups. As compared with anorectics, none of the EDI subscale averages for runners or controls were higher than the 38th percentile. Body dissatisfaction was less for runners than controls. Females scored higher on drive for thinness and body dissatisfaction. Female runners scored significantly higher on drive for thinness than all other groups. The mean NAS score was 78 for the females and 74 for the males. Significant body dissatisfaction subscale differences found

between runners and controls were probably due to the runners' lower body fat and weight. In looking at the male/female differences, females typically have a stronger concern about weight and are less satisfied with their bodies. It is believed that in the group of runners studied, severe eating disorders did not exist.

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TABLE OF CONTENTS

	<u>Page</u>
Acknowledgments.....	iv
List of Tables.....	vii
List of Figures.....	viii
I. INTRODUCTION.....	1
Statement of the Problem.....	3
Research Hypothesis.....	4
Significance of the Study.....	5
Delimitations.....	6
Limitations.....	7
Definitions.....	8
Basic Assumptions.....	9
Summary.....	9
II. LITERATURE REVIEW.....	11
The History and Incidence of Anorexia Nervosa.....	11
Description and Diagnosis of Anorexia Nervosa in the Typical Population.....	14
Bulimia.....	24
Eating Disorders Related to Athletes.....	27
Exercise Addiction.....	38
Summary.....	42
III. JOURNAL MANUSCRIPT	
Abstract.....	45
Methods.....	49
Results.....	55
Discussion.....	59
References.....	66
IV. SUMMARY.....	83
Research Implications.....	86
Recommendations for Further Study.....	87
LITERATURE CITED.....	89
Appendix A: Detailed Methodology.....	95
Appendix B: Data Tables and figures.....	106
Appendix C: Informed Consent.....	114
Appendix D: Eating Disorder Inventory.....	117
Appendix E: Negative Addiction Scale.....	121
Appendix F: Individual Subject Data.....	124
Vita.....	133

LIST OF TABLES

	<u>Page</u>
Table 1: Anthropometric and Body Image Data for Runners and Controls.....	70
Table 2: Mean EDI Subscale Scores for the Three Point Scoring for Runners and Controls.....	71
Table 3: Mean EDI Subscale Scores for the Three Point Scoring for Males and Females.....	72
Table 4: Multiple Regression of the EDI Subscales for Total Runners, Male Runners and Female Runners for the Three Point Scoring System.....	75
Table 5: Mean EDI Subscale Scores for the Six Point Scoring for Runners and Controls.....	76
Table 6: Mean EDI Subscale Scores for the Six Point Scoring for Males and Females.....	77
Table 7: Multiple Regression of the EDI Subscale for Total Runners, Male runners and Female Runners for the Six Point Scoring System.....	80

LIST OF FIGURES

	<u>Page</u>
Figure 1: Mean Three Point Drive for Thinness Scores for Male and Female Runners and Controls.....	73
Figure 2: Mean Three Point Bulimia Scores for Male and Female Runners and Controls.....	74
Figure 3: Mean Six Point Drive for Thinness Scores for Male and Female Runners and Controls.....	78
Figure 4: Mean Six Point Bulimia Scores for Male and Female Runners and Controls.....	79

CHAPTER 1

INTRODUCTION

Along with the increased industrialization and modernization in this country in the last century has come a decrease in the level of physical fitness of the population. The average American can no longer achieve physical benefits from working, as machines have replaced muscles in many settings. The industrial revolution has brought with it a change in lifestyle in the United States. Most people drive rather than walk, watch T.V. by the hour and buy groceries in supermarkets. This change in lifestyle has caused people to become more sedentary. Therefore they receive less physical benefit from the every day tasks than ever before. They must now make an effort to include physical activity into their lives.

Health and physical fitness have become prime concerns of many Americans within the last few decades. It is a rare American adult who has not heard of the risk factors associated with heart disease. The nation has become more diet, stress and exercise conscious. Health spas and fitness centers have sprung up in almost every town across the country. Sales of exercise equipment reached \$1.1 billion in 1985, athletic shoe sales reached \$2.6 billion and \$3.7 billion was spent on athletic clothing (Strauss, 1986).

The late 1970's saw the evolution of the "running boom." The number of runners in the U.S. is estimated between 20 and 30 million (Hathaway, 1984; Moore, 1978). Suddenly, everyone was talking of "personal bests," "long slow distance" and "interval training." Running shoe sales skyrocketed and the executive lunch turned into five miles and a sauna. The concern with the "roll around the middle" and being able to "pinch an inch" lead many health-conscious runners to change their eating habits to optimize their running performance.

Increasing demands are placed on athletes to improve their techniques and the physical state of their bodies. With some runners the desire to optimize their running performance by minimizing their body fat can lead to excessive voluntary weight loss to the point where it becomes an obsession (Clark, 1984; Huben, 1983; Smith, 1980; Yates, Leehey & Shisslak, 1983). The athlete may develop destructive eating patterns so severe that they satisfy the major diagnostic criteria of primary anorexia nervosa. The emotional stresses that may prompt the marked loss of weight in the athletes are usually not deep-seated, chronic problems, but are usually short-term concerns that respond

to counseling. The identification of these unhealthy eating patterns is the first step in their elimination.

Statement of the Problem

Eating disorders are a serious health problem for those with them. The ramifications include not only malnutrition, but electrolyte imbalances, hypothermia, hypoglycemia, amenorrhea, dehydration, gastric problems, excessive adrenergic stimulation, leukopenia and other physical problems(Arenson,1984; Gross, 1982; Levenkron, 1982; Russell, 1982; Wilson, 1983). Crisp(1983) estimates that one in 20 people with disorders will die from them. With the incidence on the increase, anorexia nervosa, bulimia and other abnormal eating habits have become a major health problem in this country and others. Duddle(1973) found a sharp increase in the number of reported cases of anorexia nervosa among the college population in the late 60's and early 70's. There was not a corresponding increase in other psychiatric diagnoses.

Some studies of the nutritional habits of athletes have found sub-optimal diet patterns characterized by abnormal intakes of a variety of elements and inadequate caloric intake(Barry et al., 1981; Benson, Gillien, Bourdet &

Loosli, 1985). Other researchers have begun to link obsessive-compulsive eating disorders such as anorexia nervosa with certain athletes (Clark, 1984; Huben, 1983; Rosen, McKeag, Hough & Curley, 1986; Smith, 1980; Yates, Leehey, & Shisslak, 1983). Eating disorders which affect athletes may not only decrease their performance but may also be life-threatening. In light of these facts, it is important to establish if in fact eating disorders do exist among a population of runners. If so, are there any individual variables which can be used to predict eating disorder tendencies?

Research Hypothesis

Ho: There are no significant differences in incidence of eating disorder tendencies between runners and non-exercising individuals.

Ho: There are no significant relationships among runner's eating disorder tendencies, exercise addiction, age, sex, years of running, weekly mileage, body fat, satisfaction with current body weight, height and weight.

Significance of the Study

This study determined the incidence of eating disorders among a group of runners and nonexercising individuals. Selected variables (exercise addiction, age, sex, years of running, weekly mileage, body fat, body image, height and weight) were analyzed to determine if a relationship exists between these variables and eating disorder tendencies. If certain variables were found to be significantly related to eating disorders, then runners who have the particular characteristics can be watched more closely for signs of eating disorders. The educational value of the study was to describe the use of questionnaires designed to detect eating disorders and exercise addiction among runners.

The results of abnormal eating attitudes or behavior and exercise addiction can physically affect an athletic individual. He or she is prone to insufficient nutrition intake, metabolic disturbances, amenorrhea, chronic fatigue, loss of lean body mass and running associated injuries. However, often the ramifications of the disorder are more than physical. An individual with eating disorders and/or exercise addiction may experience depression, anxiety, interpersonal problems with family and friends, and

decreased ability to perform at work or school(Arenson, 1984; Gross, 1982; Levenkron, 1982; Wilson, 1983). The obsessive weight and exercise control behavior may carry over into other aspects of the individual's life. A person with an eating disorder or exercise addiction needs counseling in order to bring not only the physical but also the emotional factors back into the right perspective. These are significant problems which must be diagnosed and controlled for the individual to function normally in society. This investigation will not only target problematic groups of runners, if they exist, but also describe a potential tool to help diagnose eating disorders and running addiction among runners.

Delimitations

The following delimitations were inherent in the design of the study:

1)Only non-team related runners who ran more than nine miles per week were included in the sample of runners.

2)Only individuals who exercised less than one hour per week were included in the sample of inactive subjects.

3)The only variables measured were age, sex, body fat, height, weight, satisfaction with current body weight,

exercise addiction, weekly mileage, and years of running (the last three for runners only).

4) A portable scale was used to weigh the non-exercising subjects, and these subjects reported their height rather than being measured.

Limitations

The following limitations restricted the generalization of the findings:

1) Due to the sample studied, the extent to which experimental results can be generalized is confined to non-team member runners of similar characteristics and running habits.

2) The use of a self-report subjective questionnaire is an inherent source of error. Subject response bias may distort the results. In an attempt to control these biases, subjects were assured of the confidentiality of their responses.

3) The Eating Disorder Inventory is a preliminary screening instrument which may indicate individuals who are preoccupied with their weight. More clinical evidence must be obtained from an individual before a diagnosis can be made.

Definitions

Active subjects Those who run more than nine miles per week.

Inactive subjects Those who participate in physical activity for fitness for less than one hour per week.

Exercise addiction An individual is regarded as being addicted to exercise if two basic requirements are met (Morgan, 1979). First, the individual must require daily exercise in order to exist or cope. Second, if deprived of exercise, the individual must manifest various withdrawal symptoms.

Anorexia nervosa A disorder characterized by "a preoccupation with body weight and food, behavior directed toward losing weight, peculiar patterns of handling food, weight loss, intense fear of gaining weight, disturbance of body image and amenorrhea" (Halmi, 1982, p. 371).

Eating Disorder Inventory (EDI) A 64 item, self-report questionnaire designed to assess some psychological and behavioral traits common in anorexia nervosa and bulimia.

Negative Addiction Scale A 27 item, self-report questionnaire revised from Hailey and Bailey (1982). It is designed to assess certain traits associated with negative addiction to running.

Basic Assumptions

For the purpose of the study the following assumptions were made:

1)The self-report questionnaire provided an accurate assessment of the subject's actual eating attitudes and/or behavior and exercise patterns.

2)Skinfold techniques provided an accurate assessment of the individual's body fat.

3)Height and weight were accurate values for each subject.

4)Predisposing factors associated with anorexia nervosa and bulimia(socio-economic status, race, etc.) were the same in both the running group and the nonexercising group.

Summary

Anorexia nervosa is a major health problem in this country today. The results of the disorder are at least damaging to the health of the individual, if not life-threatening. With the recent association of anorexia nervosa with certain athletes it becomes important to establish the occurrence among runners and attempt to determine if any variables can be used as predictive

measures of eating disorders in the population. Once diagnosed then an individual with an eating disorder can be helped to establish normal eating patterns and function successfully in sports and in society in general.

CHAPTER II

LITERATURE REVIEW

Eating disorders are a topic currently drawing much attention. Many young girls are trapped by these damaging syndromes. However, teenage girls are not the only ones who have been found to have eating disorders. Recently, athletes of both sexes and various ages have been connected with them as well. Another topic of concern with athletes is exercise addiction and its consequences, which may or may not be related to eating disorders in athletes. This review will attempt to give insight to the current knowledge on these subjects. The literature review will be divided into the following sections: 1)the history and incidence of anorexia nervosa; 2)description and diagnosis of anorexia nervosa in the "typical population"; 3)bulimia; 4)eating disorders related to athletes and; 5)exercise addiction.

The History and Incidence of Anorexia Nervosa

Anorexia Nervosa is not a new disorder. It was clearly discussed and reported in English works over 300 years ago(Crisp, 1983; Gross, 1982; Wilson, 1983). The syndrome attracted attention in France at the turn of the century, in

Britain in the 1930's, in the United States in the 1940's and in Germany and Scandinavia in the 1950's. It was neglected in the United States until the 1960's when it started to receive considerable attention in the mass media.

The incidence of anorexia nervosa appears to be increasing. Duddle(1973) reported the number of cases of anorexia nervosa diagnosed in a college population increased sharply in the late 1960s through early 1970s. There was no change in pattern of other diagnoses. It is not clear whether there are more cases now because dieting is so popular and because many American girls attempt weight loss or because the disease is now more easily recognized and diagnosed(Gross, 1982). Crisp(1983) reported that there are at least 10,000 severely affected patients in Britain at any one time. The current estimate is 500,000 or more anorectics in this country(Sanger & Cassino, 1984). The worldwide yearly incidence of new cases is about 1 per 100,000 population. Estimates of the prevalence in the United States vary from 1 in 200(Garner, Garfinkel & Moldofsky, 1978; Schwabe, 1981)), to 1 in 100 girls over 16(Crisp, Palmer & Kalucy, 1976), to over three percent of our female population(Levenkron, 1982), to 13 to 17% in a high school population(Zucker, 1985). Eating disorders usually occur

during adolescence or early adult life, when looks and sexual attractiveness are of utmost importance(Gross, 1982). Eighty-five percent of women who develop the disease are between the ages of 13 and 20 years old(Halmi, 1982). In a study of male and female college students done by Miller, Coffman and Linke(1980), the majority of female students classified as normal, slightly overweight, or overweight and the men who were classified as overweight or slightly overweight were dissatisfied with their weight. Over half of all the women appeared to have mildly distorted body images. And although the majority of women were trying to lose weight, only 39 percent were classified as slightly overweight or overweight.

Anorexia nervosa is much more rare in males. Reports of the sex ratio being from 1 in 10 to 1 in 20(Crisp & Toms, 1978; Russell, 1982; Zucker, 1985). The male prevalence rate may be higher than this but it is more likely to be under-reported because of a greater reluctance on the part of clinicians to diagnose the condition in young men(Crisp & Toms, 1978).

Description and Diagnosis of Anorexia
Nervosa in the Typical Population

Anorexia nervosa is a disorder characterized by "a preoccupation with body weight and food, behavior directed toward losing weight, peculiar patterns of handling food, weight loss, intense fear of gaining weight, disturbance of body image and amenorrhea"(Halmi, 1982, p. 371). Aronson(1984) describes it as "voluntary self-starvation to the point of losing 25 percent of body weight, which sometimes leads to death"(p.21).

Anorectics have tremendous determination, self-control, and will power. They tend to be perfectionistic, achievement-oriented young women, 10-25 years old, who control their bodies in an attempt to gain control of their lives(Wilson, 1983). Most anorectics tend to overexercise compulsively for many hours every day(Gross, 1982). It is predominant among whites with a strong suggestion that the disorder is more common in middle and upper socioeconomic families(Schwabe, 1981).

Aronson(1984); Gross(1982); Levenkron(1982); Mira, Stewart and Abraham(1985); Russell(1982) and; Wilson(1983) provide the basis for the following description of an

anorexic individual. Loss of weight may be the first feature noticed by the parents, who draw the patient's attention to it. She is likely to explain the weight loss as the result of "dieting" in an attempt to improve her figure. About one-third may have begun dieting because they were slightly overweight, but then adapted obsessive, compulsive eating habits with weight loss as the primary goal.

Once they succeed in losing weight, they continue relentlessly, to the point of extreme emaciation. The initial goal is forgotten and ever lower body weights are desired. When a significant amount of weight is lost, they become fearful of regaining it and resist their parents' attempts to make them eat.

The loss of weight can be very rapid, with a fall from 55kg(121 pounds) to 35kg(72 pounds) within two or three months. This is achieved mainly by avoiding high fat and carbohydrate foods. Self-induced vomiting, the abuse of laxatives, and excessive exercising, in different combinations, may accelerate the loss of weight.

The patient's life becomes unhappy and constricted. There is often a change in temperament, consisting of impatience, irritability and depression. She may become preoccupied with schoolwork or indulge in solitary

exercises, thus withdrawing from her typical social life. If she has a boyfriend she loses interest in him and avoids any sexual contact. Relations with family members become strained. Parents may react to their daughter's food aversion by alternately pleading with her and trying to force her to eat. Food refusal leads to malnutrition which may persist for months or even years. The patient subsists on a diet of vegetables, fruit, and cheese, and avoids bread, potatoes, and sweets.

In addition to decreasing caloric intake, the patients make persistent attempts to burn up calories and lower their weight even further. This may take the form of an endless exercise routine presumably designed to keep in shape but actually done in an attempt to promote the state of emaciation. Characteristically, the girl appears hyperactive and full of energy, which is in marked contrast to her emaciated appearance. Patients rarely admit that they feel hungry or miss eating the foods they once enjoyed. During the starvation the anorectics report being afraid of eating because they will put on too much weight and get fat. In severe cases the patient is a pitiable sight of emaciation, weakness, apathy and depression.

In some patients, the syndrome involves alternating bouts of starving and gorging. Typically, sustained periods of starvation with weight loss and emaciation alternate with short-term bouts of bulimia in which huge amounts of food are eaten and then vomited up, because of severe guilt and fear of gaining weight. Due to the suppression of appetite, these girls become preoccupied with thoughts of food most of the time. Many of them undertake elaborate preparation of food for the family but rarely eat the food themselves. Most of them do not sit near the dinner table with the family. Anorectics usually eat by themselves - eating very slowly, cutting the food into tiny pieces and not finishing the meal.

In a physical exam, the anorectic will show the signs of severe malnutrition in a young girl who has developed secondary sex characteristics. The malnutrition is of a caloric-deficiency type. The disappearance of subcutaneous fat leads to gaunt, shallow facial features, bony prominences stand out sharply, the limbs are thin and wirey, the stomach is flat, the breasts shrunken, the buttocks wasted. The hands and feet remain cold, even when the temperature is warm. The core body temperature may be reduced by 1° C. The blood pressure is low (e.g., 90/60), the

heart rate is slow(50 to 60), and adema may be present in the extremities. The skin is dry and flakey and there is an excessive growth of downy hair over the nape of the neck, cheeks, forearms and legs(lanugo hair), changes attributed to a follicular keratosis.

In patients who vomit, dehydration follows, together with a marked fall in the level of serum potassium, chloride and phosphates. Other physical problems which can occur with eating disorders include: gastric problems; kidney damage; abnormal liver function; abnormal metabolism; muscle spasms; bleeding of the throat; chemical imbalances that can lead to cardiac arrest; leukopenia; a relative lymphocytosis; a hypocellular bone marrow; a low fasting glucose level; and reduced immunological resistance.

The loss of menstrual periods(amenorrhea) and menstrual irregularities are other common symptoms in anorexic girls. Patients show a fall in the levels of leutinizing hormone, follicle stimulating hormone, and estrogen, which causes menstrual abnormalities.

In spite of progressive malnutrition, the patient may reject her parents' suggestion to see a doctor, and she minimizes the extent of her food avoidance. When she finally does agree to seek help, she is likely to deny that she has

a problem or admit only to insomnia, constipation, sensitivity to cold or depression.

Anorexia nervosa does occur in males, but at a much lower frequency. The syndrome itself is characterized by the same features presented by women: a conscious avoidance of food; a deliberate pursuit of extreme thinness; difficulty in recognizing their own emaciation and other body-image difficulties; vomiting and purging; and a preoccupation with diets and cooking(Wilson, 1983). In Bruch's(1971) work with nine male anorexic patients, hyperactivity and high drive for achievement were present. Bruch describes two patients in the following manner, "In order to be fit, he began to walk more and more, would do calisthenics to the point of exhaustion and then would refuse to eat because he felt he was too fat."(p.37), "He would run by the hour until he was so exhausted that he could not stand up."(p.39).

Diagnosis of anorexia nervosa is especially complicated. They realize that others will not understand or accept the nature of their fears, so they deny that they are ill, insist that all is well and say that they just are not hungry(Arenson, 1984). Diagnostic criteria have varied from a primary emphasis on the medical aspects to a behavioral interpretation. Generally, the most widely accepted criteria

have been established by Feighner, Robins, Guze, Woodruff, Winokur and Munoz(1972). For a diagnosis of anorexia nervosa, A through F are required:

- A. Age of onset prior to 25.
- B. Anorexia with accompanying weight loss of at least 25% of original body weight.
- C. A distorted, implacable attitude towards eating, food, or weight that overrides hunger, admonitions, reassurances and threats; eg, 1)denial of illness with a failure to recognize nutritional needs, 2)apparent enjoyment in losing weight with overt manifestation that food refusal is a pleasurable indulgence, 3)a desired body image of extreme thinness with overt evidence that it is rewarding to the patient to achieve and maintain this state, and 4)unusual hoarding or handling of food.
- D. No known medical illness that could account for the anorexia and weight loss.
- E. No other known psychiatric disorder with particular reference to primary affective disorders, schizophrenia, obsessive-compulsive and phobic neurosis. (The assumption is made that even though it may appear phobic or obsessional, food refusal alone is

not sufficient to qualify for obsessive-compulsive or phobic disease.)

F. At least two of the following manifestations: 1)amenorrhea; 2)lanugo; 3)bradycardia (persistent resting pulse of 60 or less); 4)periods of overactivity; 5)episodes of bulimia; 6)vomiting (may be self-induced) (p.61).

The Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1980) lists the following criteria for anorexia nervosa:

A. Intense fear of becoming obese, which does not diminish as weight loss progresses.

B. Disturbance of body image, such as claiming to feel fat even when emaciated.

C. Weight loss of at least 25% of original body weight; if under 18 years of age, weight loss from original body weight plus projected weight gain expected from growth charts combine to make the 25%.

D. Refusal to maintain body weight over a minimal normal weight for age and height.

E. No known physical illness that would account for the weight loss(p.69).

Once diagnosed, the immediate treatment is to alleviate the patient's malnutrition, which can become dangerous (Gross, 1982). During the early treatment stages it is desirable to try altering the patient's abnormal attitudes, for the treatment phase is greatly affected by the psychological state (Levenkron, 1982). Thus, treatment is best administered in a psychiatric unit, but good nursing facilities are essential. The longterm aim of treatment is to reduce the duration of the illness and prevent relapses. There is no single therapy that is always completely successful in treating this disorder (Gross, 1982). Crisp (1983) states that the outlook for recovery is poor. About half the anorexic patients remain chronically ill and the average length of the illness in those who eventually recover is about four years.

As well as clinical diagnosis made by a trained observer, screening can be done through the use of a written inventory (Garner & Garfinkel, 1979; Garner, Olmsted, Bohr & Garfinkel, 1982; Garner, Polivy & Olmsted, 1983; Slade, 1973). In a scale developed by Slade (1973), anorexia behavior is reported on three dimensions of the disease (resistance to eating, methods of disposing of food and activity level). The drawback of this scale is that it

relies of the ratings of a trained observer, and it only measures three dimensions of anorexic behavior.

Garner and Garfinkel(1979) developed a 40-item scale called the Eating Attitude Test(EAT). It attempted to assess a broad range of behaviors and feelings previously reported in anorexic patients. Garner et al.(1983) developed a 26 question, abbreviated version of the EAT based on a factor analysis of the original questionnaire.

In 1983 Garner et al. developed the Eating Disorder Inventory(EDI) in an attempt to go beyond the behavioral aspects reported in earlier questionnaires. The authors of the EDI attempted to assess the psychological dimensions which have been found to differentiate anorexic and bulimic patients from those with less severe problems associated with dieting. The EDI includes psychological characteristics which have been associated with anorexia and bulimia but not assessed by previous questionnaires. These characteristics include: body image; interoceptive awareness; maturity level; ineffectiveness; interpersonal mistrust, self-control and perfectionism. The EDI contains the following eight subscales: drive for thinness; bulimia; body dissatisfaction; ineffectiveness; perfectionism; interpersonal distrust; interoceptive awareness and; maturity fears.

Bulimia

The definition of bulimia is "an abnormal craving for food that results in excessive bingeing, followed by self-induced vomiting after the gorging episodes"(Gross, 1982, p.154). The food that is consumed is usually high in calories with large amounts of carbohydrates. After the bingeing, the person feels guilty or fearful of gaining weight. Also, there are usually abdominal pains due to the stomach distention. Once the stomach is emptied, there is decreased abdominal distention and pain, and the person continues to binge. Often these bingeing and purging episodes continue for three to five hours(Levenkron, 1982).

Bulimia is not a disease; instead it is a symptom of other, underlying problems(Gross, 1982). Most people with bulimia show great concern about their weight and usually make repeated attempts to lose weight by dieting or use of laxatives, diuretics or diet pills.

The prevalence of bulimia in the different populations is difficult to measure. Some researchers fail to distinguish clearly between bulimic symptoms and bulimia as a syndrome (Hart & Ollendick, 1985). Hart and Ollendick

(1985) found the incidence to be 1% in working women and 5% among university women. They suggest that the prevalence of bulimia is less than 5%.

As with anorexia, the disorder usually begins during adolescence or early adulthood when appearance is of utmost importance (Arenson, 1984). However, it differs from anorexia in that anorectics must change their habits when their weight becomes so low that it is a threat to their lives. Bulimics may continue their habits for years, their weight fluctuates frequently, and often they may be slightly overweight. Usually the bingeing and vomiting increase when the person is under stress.

The results of bulimia are social isolation, inability to concentrate and function academically, GI tract problems, malnutrition, decay of teeth, severe dehydration, hypokalemia, hypotension, electrolyte disturbances, cardiac arrest, amenorrhea, hernia and abnormal liver function (Arenson, 1984; Gross, 1982).

The diagnostic criteria for bulimia suggested by the Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association (1980) are as follows:

- A. Recurrent episodes of binge eating (rapid consumption of a large amount of food in a discrete period of time,

usually less than two hours).

B. At least three of the following:

1)consumption of high-caloric, easily ingested food during a binge; 2)inconspicuous eating during a binge; 3)termination of such eating episodes by abdominal pain, sleep, social interruption, or self-induced vomiting; 4)repeated attempts to lose weight by severely restricting diets, self-induced vomiting, or use of cathartics or diuretics; 5)frequent weight fluctuations greater than 10 pounds due to alternating binges and fasts.

C. Awareness that the eating pattern is abnormal and fear of not being able to stop eating voluntarily.

D. Depressed mood and self-depreciating thought following eating binges.

E. The bulimic episodes are not due to Anorexia Nervosa or any other known physical disorder (p.70-71).

The differential diagnosis of bulimia to be considered first is anorexia. Whereas in anorexia there is severe weight loss that might lead to life-threatening malnutrition, the weight in bulimia fluctuates but not as much as in anorexia(Gross, 1982). Anorectics may turn to vomiting as a form of weight control.

The treatment of bulimia is first to correct any medical abnormalities which exist. After this is accomplished, the patient undergoes individual psychotherapy.

Eating Disorders Related to Athletes

Almost all athletes, at some point in their careers, are concerned with lowering their weight in the hopes of achieving better athletic results. When this is achieved through a sound dietary plan and with a realistic goal in mind, controlled weight loss can be beneficial for an athlete. However, the athlete's desire to decrease body fat may lead him/her to excessive voluntary weight loss, and in some cases losing weight becomes an obsession (Clark, 1984; Huben, 1983; Smith, 1980; Yates, et al., 1983). The athlete may develop abnormal eating behaviors so severe that they satisfy the major diagnostic criteria of primary anorexia nervosa. Liberman and Palek (1984) identified highly athletic males as having hematologic abnormalities identical to those previously reported in anorectic patients.

In comparison to non-athletic individuals of similar age, athletes usually have lower body fat. Wilmore(1977) found female distance runners to be six to eight percentage points lower on body fat than others their age. In another study, Wilmore(1974), found female distance runners to be 15.2% body fat. The average for a woman is 20 to 22%. Costill(1970) states that male distance runners are among the leanest of all athletes. Female gymnasts, distance runners, cross country skiers, ballet dancers and figure skaters are often recommended to reduce their body fat to less than 10%(Smith, 1980).

Athletes may develop a fetish for avoiding fatness in an attempt to optimize their fitness level and through pressure from coaches or by their own attitudes of thinness. In a study of 31 female high school athletes, Peron and Endres(1985) found inadequate energy intake and low iron values. Although the athletes had good nutritional attitudes, the attitudes were not reflected in the foods they ate. They concluded that the eating habits of female athletes may not have been shaped by good nutritional knowledge but rather by motivational desire to be thin. This may begin with the perception that a lower level of body fat will provide a physical advantage in a particular sport.

However, the athlete does not stop at what would be considered a low, but healthy level. If a five percent reduction of fat is good, he or she thinks a 10 or 15% reduction would be even better. This desire to decrease body fat is often not done with a slow, steady, nutritionally sound diet. Often it involves a diet of extreme caloric restriction with inadequate nutrients (Barry, et al., 1981; Benson, et al., 1985).

The effects of poor nutrition on physical performance have been documented (Benson, et al., 1985; Smith, 1983; Zucker, 1985). Inadequate caloric intake is always manifested by weight loss, and decrease in performance will follow (Smith, 1983). Vomiting in particular causes low potassium - potassium being a cation necessary for muscle contraction (Zucker, 1985). With diet being low in carbohydrates, the glycogen stores in the liver and muscle are greatly reduced. These low stores may cause a decrease in the ability of the muscles to function properly (McArdle, Katch & Katch, 1981). This decreased muscular functioning is bound to lead to a decrease in performance.

In a report on sports and diet (Nutrition Committee, Canadian Paediatric Society, 1983), it is stated that in a well trained athlete the amount of body fat can be reduced

to five percent of body weight. "If a further effort is made to reduce weight it will result in the loss of muscle tissue and thus reduce the physical performance of the athlete"(p. 553). Spurr, Reina, Dahners and Barac-Nieto(1983) found that malnourished boys ages 6 to 16, had significantly lowered maximum treadmill oxygen consumption compared to normal boys. They concluded that malnutrition will have a detrimental effect on these boys when they engage in physical activity as men.

The athlete who accepts the challenge of competitive sports is often extremely self-disciplined and perfectionistic, at least in behaviors while participating in sports(Smith, 1980). During some point in training the highly competitive athlete may also exhibit some of the following traits: the drive to excel; the desire to control mind and body; the denial of pain, fatigue and hunger; the setting and resetting of goals, always just beyond reach; and the experience of depression, anxiety and deprivation when personal "rituals" cannot be performed(Huben, 1983). These are also some of the behaviors seen in victims of eating disorders, and they may be rationalized in a similar way(Crisp,1983; Crisp & Toms,1972; Feighner et al.,1972; Garner et al.,1982; Garner et al.,1983; Garner &

Garfinkel,1980; Halmi,1974; Russell,1982; Schwabe,1981; Smart, Beumont & George,1976; Yates et al.,1983).

In *Psychology of Running*(1981), Sours describes the parallels between runners and anorectics as follows:

Many long distance runners astoundingly resemble adolescents with anorexia nervosa. They are hyperactive, full of energy and hardly ever tire. They restrict their food intake, go on food fasts, and follow repetitive and routinized daily exercise programs with intense dedication. They annoy their lovers and spouses with their monomaniacal focus on running and fitness, often to the relative exclusion of instinctual interests....In general, they maximize pleasure in their ascent to control and mastery. (p.86-87).

Epling, Pierce and Stephan(1983) present a theory they call activity anorexia, which is a subset of anorexia nervosa. They hypothesize strenuous locomotor activity works to suppress appetite. This appetite suppression affects food schedule and/or deprivation, which further augments activity. The factors of excessive physical activity and food restriction appear to be sufficient for producing anorexia. They suggest that some people who participate in

high-level physical activity fail to increase their food intake, thus developing the hypothesized condition.

Often the athlete's prevailing concern is a fear of failure - failure to make the team, failure to meet coaching and parental expectations, failure to win (Huben, 1983). If the athlete thinks that the likelihood of failing will be decreased by weight loss, and that this loss can be achieved by increasing training and decreasing food intake, it will be done.

In a case study of three runners who ran more than 50 miles per week, Yates et al. (1983) noted that the character and style of those they denoted as "obligatory runners" were similar to the character, style and background of the typical anorexic patient. The three case studies are described as follows (Yates et al., 1983). The first individual, a 43 year old male, ran 60 to 90 miles per week, swam 4 to 7 miles and biked at least 50 miles. His vacations were taken in order to run marathons. When he was upset, sometimes he would double his daily workout. If he was unable to exercise he became extremely anxious. Due to his exercise, he expected to live a long life with little aging. He had several unusual nutritional beliefs and avoided

social engagements and poorly balanced meals in order to obtain optimal athletic performance.

The second was a 31 year old teacher. At age 24, he decided to quit smoking, lose weight and begin running. He ran at least 50 miles per week, swam laps and played handball daily. He ate only fruit and vegetables after 3:00 pm and was in bed by 9:30 each night. If he gained more than .9 kg he felt "terrible." His athletics gave him increased confidence and a sense of control and achievement.

The third individual was a 50 year old male. At age 46, when he was overweight, depressed and physically tired he began to run. He ran at least 10 miles every day, regardless of the weather or his health. He regularly measured his body fat and claimed he felt best at less than 9%.

The authors described certain runners in which "running becomes a consuming goal that preempts all other interests in life"(p. 252). This compulsive drive for an elusive goal of physical fitness and effectiveness is similar to anorectics' drive for ever increasing thinness, and control of their bodies. They conclude that anorectic women and obligatory runners seem to have similar personality characteristics. Both the obligatory runner and the

anorectic disregard physiologic needs in their compulsive striving for an elusive ideal.

Nancy Clark(1984), a nutritionist at a large sports medicine clinic, commonly helps athletes with eating disorders. She claims most athletes with eating disorders do not know how to eat normally, maintain their proper weight, and enjoy food as a health-promoting fuel. In a study of female collegiate athletes, Rosen, Mckeag, Hough and Curley(1986) found 14% used self-induced vomiting for weight-control, 16% abused laxatives, 25% routinely used diet pills and 32% of all the athletes they studied used at least one form of abusive weight-control. Smith(1980) reports a case history of a crew member who reduced his weight from 172 pounds at 15% body fat, to 140 pounds. With a small food intake, he trained intensely.

Unlike the typically female victim of anorexia, athletes who avoid food and experience significant weight loss can be either male or female. Often they are participants in sports such as wrestling, gymnastics, body building, dancing and running. Their abnormal eating and training habits may be long or short-term.

At one end of the continuum are the athletes who use abnormal eating techniques and intensive training only

before and during their competitive season. Their compulsions and obsessions are for the short term to achieve perfection and to win. The eating disorder does not control his life, and the athlete discontinues the eating patterns as soon as his weight goal is reached(Zucker, 1985). When the season is over, the athlete reverts his behavior to its inactive, pre-competition status. The prognosis for reversing this particular weight loss and placing the rationale for these activities in the proper perspective is good with appropriate counseling.

At the other end of the continuum, however, are those athletes who continue the eating disorder behaviors beyond competition. Their dieting and weight control behaviors are of greater intensity and duration, perhaps out of fear of losing the developed body shape and/or becoming fat(Zucker, 1985). Females and older males, particularly those who can be classified as obligatory runners, seem to be at higher risk for developing long-term eating disorder behavior and may be an indication of more severe psychological changes(Huben, 1983).

Diagnosis of an athlete with eating disorders can be difficult. In addition to behavioral abnormalities, physiological changes occur in anorectics that can sometimes

mimic those seen in highly trained athletes(Huben,1983). For instance, amenorrhea is often seen in victims of anorexia nervosa, but also in females who are physically very active or are under stress. Like a bulimic or anorectic at rest, a training athlete may also experience dehydration, hypothermia, hypotension, low heart rate or have an abnormal electrocardiogram(Huben, 1983).

To further complicate diagnosis, those with eating disorders are experts at manipulation. They most likely will not volunteer information about their unusual behavior patterns or disturbed feelings during questioning. However, the fear of losing or performing poorly intensifies as the season progresses. Rituals and unusual behaviors may then become noticeable. It is from the underlying fears, as well as the outward behaviors, that diagnosis is made.

Coaches, trainers and parents are often unaware of the attitudes and symptoms of those engaged in food aversion. Prevention of disorders should start with a well guided nutritional program with the education aimed at the athletes, coaches and trainers(Rosen, 1986). The desired level of body fat should be well defined for each athlete, with individual attention given to each athlete on the proper way to achieve this level. And, a standard should be

developed to advise coaches and athletic trainers how to identify symptoms and where to obtain treatment for athletes with eating disorders(Rosen, 1986). Clark(1984) concludes that most athletes with food problems can be helped with good nutritional guidance, strong parental and coach support and positive feedback.

Opposing the theory of runners and anorexia, Blumenthal, O'Toole and Chang(1984) and Blumenthal, Rose and Chang(1985) discuss runners with normal personality traits. Using the Minnesota Multiphasic Personality Inventory(MMPI), Blumenthal et al.(1984) compared the personality profiles of obligatory runners and anorectics. Anorectic patients scored significantly higher on 8 of the 10 MMPI clinical subscales. They concluded that obligatory runners and anorectics do not share either psychopathology or the same personality traits. Blumenthal et al.(1985) refer to the literature supporting the positive psychological characteristics of exercisers. Compared to nonexercising individuals, exercisers have been found to be more introverted, intelligent, imaginative and self-sufficient(Clitsome & Kostrubala, 1977; Gontang, Clitsome & Kostrubala, 1977; Hartung & Farge, 1977; Nash, 1986). Exercisers have also been found to have better self-esteem and be less depressed and tense than their

nonexercising counterparts(Blumenthal, Williams, Needles & Wallace, 1982; Thaxton, 1982; Weltman & Stamford, 1983). The authors conclude by saying, "running is generally an adaptive form of behaviour that often serves to enhance physical and psychological functioning"(Blumenthal et al., 1985, p. 245).

Exercise Addiction

"Addiction is a process, rather than a condition....It is an extension of ordinary behavior, a pathological habit, dependence or compulsion"(Sacks & Sachs, 1981, p. 117). Addiction can occur in many different aspects of an individual's life.

The phenomenon of addiction to exercise is a topic that has been investigated by an increasing number of researchers in recent years. The discovery of exercise addiction was accidental when, in order to assess the effects of exercise deprivation on sleep, Baekeland(1970) noted that many potential subjects who were regular exercisers were unwilling to abstain from their exercise to participate in the experiment, even when they were offered money. Glasser(1976) popularized the idea of addiction to exercise

behavior. He stated that exercisers, especially runners, become addicted to exercise in the same way that drug users become addicted to drugs. Each produces withdrawal symptoms if it is withheld from the addicted person. Of the 20 to 30 million joggers in the U.S., as many as 10% may fall under the category of "obligatory runners"(Hathaway, 1984). However, according to Glasser(1976), exercise addiction is a positive addiction because its consequences for the addict are beneficial.

Later, Morgan(1979) questioned the concept that running addiction is always positive, and began to study the negative aspects of addiction in runners. Morgan(1979) hypothesized the existence of negative addiction when two requirements are met. First, the person must feel that exercise is a necessary part of daily life. Second, the person must experience withdrawal symptoms(e.g.,depression, anxiety, irritability) if deprived of exercise. The negatively addicted runner will continue to exercise even when it interferes with other aspects of his/her life, including health, job and personal relationships(Abell, 1975; Weltman & Stamford, 1983). The behavior of the hard-core exercise addict resembles that of other addictions. The toll of heavy training takes form in

decreased concentration, listlessness, irritability, fatigue and constant thoughts about running(Morgan, 1979). Sachs and Pargman(1979) also described an addicted runner as demonstrating psychological and/or physiological dependence on the running routine. They discuss withdrawal symptoms manifested when the runner is unable to exercise for 24 to 36 hours.

The positive psychological effects of running include: a release of tension and anxiety; prevention of depression; reduced muscle tension; promotion of relaxation and good sleep; promotion of good self-esteem and; the possibility of being beneficial in the treatment of psychiatric diseases(Weltman & Stamford, 1983).

Jette(1975) found those who participate in regular exercise to be more tough-minded, prudent and relaxed than non-exercisers. Brunner(1969) found runners to be more extroverted than non-runners. Runners scored below the population mean for tension, fatigue, depression, and confusion and above the mean for vigor(Morgan & Pollock, 1977).

Negatively reinforcing consequences arise from fear of what might happen if the runner misses a day, or if he does not run as much as he thinks he should on a given day(Sacks

& Sachs, 1981). According to Morgan(1979), the negatively addictive process brings about a reordering of priorities. Among married runners, less attention is paid to the spouse and children. As mileage increases, the runner's focus shifts internally. With the reinforcement coming from within, the value of external rewards such as those gained from work diminish. Eventually the family, friends and job are relegated to secondary status. Robbins and Joseph(1980) found that involvement of time and intensity in running is directly related to the level of spouse conflict.

When days of running are missed, withdrawal symptoms become immediately apparent(Sacks & Sachs, 1981). Running has become much more than a means to an end(getting in shape), it has become the end in itself.

For the vast majority of runners, running represents a positive aspect of life. For the few who do become addicted, therapy should be designed to get runners to decrease their involvement reassess their priorities and learn to cope with the initial withdrawal symptoms(Sacks & Sachs, 1981).

A hormonal link has been suggested as the possible mechanism for addiction to exercise. Beta endorphines, the naturally occurring peptides with opium-like properties have been associated, by some, with the occurrence of the

"runner's high" and other positive psychological phenomenon(Appenzeller,1981; Carr et al., 1981; Sacks & Sachs, 1981). The beta-endorphins mask normal pain sensations and perhaps induce analgesia. The endocrine action of the endogenous opiates include promotion of antidiuretic hormone secretion and inhibition of the release of thyrotropin and gonadotropin-releasing hormone (Appenzeller,1981). They play a part in temperature regulation and appetite, and depress the ventilatory response to carbon dioxide. They also affect mood and sleep and have been tentatively linked to drug addiction (Appenzeller, 1981). All these actions seem to parallel the measured changes in physiology and homeostasis of a person trained for endurance. Carr et al.(1981) found that exercise increased plasma levels of beta-endorphins and its precursor, and that training augments this effect. However, a definite cause and effect relationship between beta-endorphins and positive psychological benefits of addiction to exercise has not yet been proven.

Summary

The incidence of anorexia nervosa is increasing in the United States. It is quickly becoming a health issue of

major concern. The health risks associated with the disorder are many, and in some cases death can occur. Diagnosis of anorexia nervosa is a difficult task. It can be accomplished by observation in a clinical setting or through the use of self-report questionnaires. As well as the "typical" population, certain athletes develop eating disorders that can be identified as primary anorexia nervosa and bulimia. Diagnosis of eating disorders in the athlete is especially complicated due to the fact that physiological changes which occur during training can mimic those often seen in anorectics. Exercise addiction is another problem which can develop in athletes. The negatively addicted athlete reorders priorities in his life to accomodate his exercise habit. He displays many of the obsessive-compulsive behaviors exhibited by anorectic patients. The association of eating disorders and exercise addiction is a topic which has not yet been explored, but deserves some attention.

Chapter III
Journal Manuscript

USE OF THE EATING DISORDER INVENTORY IN
DETERMINING EATING DISORDER TENDENCIES AMONG RUNNERS

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ABSTRACT

Thompson, B.E. and Walberg, J.L. Use of the eating disorder inventory in determining eating disorders among runners. Med. Sci. Sports Exerc. The purpose of this study was to use the Eating Disorder Inventory (EDI), Negative Addiction Scale (NAS) and other measured characteristics to determine differences between consistent runners and sedentary controls. 38 male and 23 female local non-team related runners of more than 9 miles per week were studied. They completed the EDI and NAS. 31 male and 30 female nonexercisers completed the EDI. They were drawn from college classes and participated in less than one hour per week of physical activity. Height, weight and body fat were determined for both groups. As compared with anorectics, none of the EDI subscale averages for runners or controls were higher than the 38th percentile. Body dissatisfaction was less for runners than controls. Females scored higher on drive for thinness and body dissatisfaction. Female runners scored significantly higher on drive for thinness than all other groups. The mean NAS score was 78 for the females and 74 for the males. Significant body dissatisfaction subscale differences found between runners and controls were probably due to the runners' lower body fat and weight. In looking at

the male/female differences, females typically have a stronger concern about weight and are less satisfied with their bodies. It is believed that in the group of runners studied, severe eating disorders did not exist.

KEY WORDS: RUNNING, EATING DISORDER, EXERCISE ADDICTION

Reports of eating disorders and the morbidity and mortality associated with them has increased recently (1,8,9,10,12,18,20,27,34,35,44). Diagnosis of anorexia nervosa is complicated and generally must be made by a trained observer. Researchers have developed self-report inventories for the purpose of determining eating disorder tendencies (11,14,15,39). These questionnaires have the advantages of economy, objective scoring and access to psychological information that may be unavailable through conventional clinical assessments. One such questionnaire, the Eating Disorder Inventory(EDI) (15), is a 64 item, self-report, multiscale measure designed for the assessment of psychological and behavioral traits common in anorexia nervosa and bulimia.

Recently, researchers have begun to link certain athletes with obsessional weight loss (6,34,40,43). The athlete's eating behaviors may be so severe that they satisfy the major diagnostic criteria of primary anorexia nervosa. For many of the athletes, the eating disorders are only short-term concerns to achieve perfection or to win during the competitive season. However, for some the goal is forgotten and weight loss becomes the prime concern (6,40). In a study of female collegiate athletes, Rosen, et al.(34)

found 14% used self-induced vomiting for weight control, 16% abused laxatives, 25% routinely used diet pills and 32% of all the athletes studied used at least one form of abusive weight control.

The effects of poor nutrition on physical performance have been documented (2,40,44). Inadequate caloric intake manifests itself in weight loss and eventually a decrease in athletic performance. Vomiting in particular causes low potassium levels, a cation necessary for muscle contraction (44). If the diet is low in carbohydrates, glycogen stores in the liver and muscle are greatly reduced. In a four day food and liquid restriction diet, muscle glycogen content of wrestlers averaged 38% less than the level before restriction (22). This resulted in a significant decrease in muscle strength. The Nutrition Committee of the Canadian Paediatric Society (32) states in an athlete, the amount of body fat can be reduced to as low as five percent of body weight. A loss below five percent will reduce performance.

Diagnosis of eating disorders in the athlete is especially complicated. Certain physiological changes occur in anorectics that can sometimes mimic those seen in highly trained athletes. Coaches, trainers, and parents are often unaware of the attitudes and symptoms of those engaged in

food aversion. The use of objective inventories for diagnosis of eating disorders among athletes has yet to be investigated.

The purpose of this study was to investigate differences in EDI subscale scores between runners and nonexercisers. Other characteristics of the runners, such as exercise addiction, body fat, height, weight, and training were also measured to determine any association with tendency for eating disorders.

METHODS

Two groups of male and female subjects were used for the investigation. The first group was made up of runners, the second group, nonexercisers. 38 male and 23 female runners were surveyed from a local running club. They were non-team related and ran more than nine miles per week. For the runners, 36% reported running between 9 and 20 miles per week, 25% reported 21 to 30 miles per week, 15% ran 31 to 40 miles per week, 8% reported 41 to 50 miles per week and 16% ran more than 50 miles per week. The majority were white-collar and professional workers from Virginia Polytechnic Institute and State University(VPI&SU). The age

range was from 18 to 59, the mean being 33.4 years for the males and 33.1 years for the females.

The comparison group of nonexercisers was made up of individuals who participated in less than one hour per week of physical activity for fitness. This group was drawn from classes at a local community college, VPI&SU classes and other VPI&SU employees. It was assumed that this group was a representative sample of basically inactive people similar in age, sex and other characteristics to the runners. The 31 males and 30 females ranged from 18 to 59 years old with a mean age of 33.9 years for the males and 33.1 years for the females. Descriptive characteristics for the two samples are presented in Table 1.

This study employed the use of two questionnaires. The first was the Multi-Dimensional Eating Disorder Inventory (EDI) for Anorexia Nervosa (15). The EDI consists of eight subscales measuring: 1)drive for thinness; 2)bulimia; 3)body dissatisfaction; 4)ineffectiveness; 5)perfectionism; 6)interpersonal distrust; 7)interoceptive awareness and; 8)maturity fears. Reliability and validity have been established among anorexic patients, clinically recovered anorectics, bulimic patients, obese patients, normal weight but formally obese women and male and female controls (15).

Subjects respond to six point, forced choice items (always, usually, often, sometimes, rarely or never). The scale was scored two different ways. The first scoring system is that used by the developers of the EDI (15). It will be referred to as the three point scale. The most extreme "anorexic" response (always or never depending on the keyed directions) was given a score of 3. The immediately adjacent response 2, the next response 1 and the three choices opposite to the most anorexic response receiving no score(0). The highest possible score with this scoring system is 192.

Some controversy surrounds the original scoring system. Other researchers (20) have scored the EDI on a six point scale in order to treat each response as separate and useful data. In the six point scale each response was given a score. The most extreme anorexic response was given a score of 6. The immediately adjacent response received a 5, the next closest a 4, and the following three responses received 3, 2 and 1 point(s) respectively. The highest possible score with this system is 384. Scale scores are the summation of all item scores for that particular scale. Subjects received eight subscale scores.

The second instrument used, for runners only, was a revised version of the Negative Addiction Scale (19). The scale is presented in Appendix A, and assesses perceptions about running, cognitive style while running, running strategies and motivation for running. The Negative Addiction Scale identifies individuals addicted to their running by focusing on the negative aspects of exercise addiction as stated by Morgan (29). It contains forced choice item responses dealing with addiction ("I run when I have a running-related injury"), withdrawal symptoms ("On days that I don't run I usually feel 1)tense 2)guilty 3)no different") and two questions describing the subject's amount of running (weekly mileage and years of running). The two questions dealing with amount of running were used as descriptive measures, therefore they were not included in the Negative Addiction Scale score.

The scale is scored similarly to the EDI with the most "addicted" response receiving the highest number of points. Some questions had six possible responses, hence were scored by giving the most "addicted" response a six, the least addicted response a one. Some questions had five possible responses, others had four. The highest possible score on the negative addiction scale is 134.

An additional question dealing with the subjects perceived body image was also asked to both groups. It read, "Right now, I feel I am: 1)very overweight; 2)slightly overweight; 3)just the right weight; 4)slightly underweight; 5)very underweight". It will be referred to as body image.

Runners completed both the EDI and and the Negative Addiction scale during a running club meeting. They were weighed and measured for height and body fat after the meeting. Running club members who did not attend the meeting and those not affiliated with the running club completed the questionnaire and were assessed for body composition, height and weight individually by the tester. The nonexercisers completed the questionnaire during their class time or during time arranged individually, and were assessed for body composition, height and weight after questionnaire completion. Body composition analysis was done via skinfold measurements using John Bull constant pressure calipers. Skinfold fat was measured five times at each of three sites, the score was the average of all five measurements. Females were measured at the tricep, supra-iliac and thigh, males were measured at the chest, abdomen and thigh. Generalized equations for predicting body density were used according to Jackson, et al. (25) for women and Jackson and Pollock (24)

for men. Body fat was calculated from body density using the Siri (37) equation. All skinfold measurements, height and weight were performed by a single tester.

All data were analyzed using SAS (36) procedures. The first procedure utilized was a one-way analysis of variance (ANOVA), with the dependent variables being the anthropometric data, the independent variables were male runner, female runner, male control and female control. A Scheffé post hoc test was then used. A two-way ANOVA was also conducted using the EDI subscale scores as the dependent variable and runner/control and sex as the independent variables. A Scheffé post hoc procedure was also employed for this data. The next procedure used for runners only was a forward, multiple stepwise regression. The analysis was done for each of the eight subscales. The independent variables were age, sex, height, weight, years of running, miles run per week, percent body fat, negative exercise addiction and body image for each EDI subscale score. If the two-way ANOVAs found significant difference for sex or the interaction of sex and runner/control, then regression analyses of runners were broken down into male and female runners. The alpha level was set at 0.05.

RESULTS

The two groups were well matched for height, age and body image (Table 1). The runners were found to have a lower weight and percentage of body fat than the nonexercisers.

For the Negative Addiction Scale, the mean was 78.04 for female runners and 74.37 for male runners. The range was 53 to 106. The following percentages of male and female runners answered 'always' or 'usually' for the following Negative Addiction Scale questions: 47% and 56% ran in unfavorable weather; 24% and 13% planned their day around their run; 69% and 74% ran when they did not feel like it; 16% and 13% ran while ill; 27% and 26% ran when injured; 6% and 13% continued to run if the injury became worse. Also, 27% of the males and 30% of the females agreed or tended to agree that running has caused family or interpersonal tension. Ninety-four percent of the men and one hundred percent of the women felt tense or guilty on days they do not run. 3% of the men and 4% of the women ran twice a day 4 to 7 days per week.

For the three point scoring system, percentile rankings have been compiled for EDI subscale scores for anorexic patients, male college students and female college students

(13). Subscale scores from this study which were found to be significantly different among groups were compared to the anorexic and college groups' scores.

The Three Point Scoring System

When the two-way ANOVA was conducted, only one subscale score, body dissatisfaction, was found to differ between runners and controls (Table 2). Nonexercisers had a significantly higher body dissatisfaction score than the runners.

A significant effect of sex was found for two scales. Females scored significantly higher on drive for thinness than males (Table 3). Females' scores were almost four times as high as males'. Males were in the 73rd percentile compared with male college students, females were in the 69th as compared with female college students.

On the body dissatisfaction scale, females also scored significantly higher than males. The average female score was more than three times that of males. Males were in the 67th percentile compared to college males, women were in the 65th percentile with college women.

There were significant interaction effects found between sex and runner/control for drive for thinness and

bulimia (Figures 1 & 2). Post hoc analysis showed that female runners scored significantly higher on drive for thinness ($\bar{x}=7.65$) than female nonexercisers ($\bar{x}=5.00$). Compared to anorectics, female runners were in the 16th percentile, as compared with female college students, they were in the 73rd percentile. Female controls were in the 13th percentile compared to anorectics, and the 64th as compared with female college students. The mean score difference between male runners and male nonexercisers for the drive for thinness subscale was nonsignificant.

For the bulimia subscale, male runners scored significantly lower ($\bar{x}=0.45$) than male nonexercisers ($\bar{x}=1.61$). As compared with anorectics, male runners were in the 3rd percentile, as compared with college students, they were in the 68th percentile. Male nonexercisers were in the 5th percentile compared to anorectics and the 79th as compared with male college students. The difference between female runners' and female nonexercisers' mean scores for bulimia was nonsignificant.

For the multiple regression a cumulative r^2 value of 0.25 (25%) was chosen as a measure of practical significance. Since the ANOVA indicated a significant effect of sex for body dissatisfaction, scores were separated for regression

analysis by sex (Table 4). As a woman's body image score was higher, her score on the drive for thinness subscale was lower. No more variables were practically significant for females and for males, no variables were of practical significance for predicting any subscale score.

The Six Point Scoring System

When the two-way ANOVA was conducted, only one subscale was found to differ significantly between the runners and nonexercisers (Table 5). For body dissatisfaction, controls scored significantly higher than the runners.

A significant sex effect was found for four subscales. For the subscales drive for thinness, body dissatisfaction, ineffectiveness and maturity fears, females scored significantly higher than males (Table 6).

A significant interaction effect was found for drive for thinness and bulimia (Figure 3 & 4). For drive for thinness, female runners scored significantly higher ($\bar{x}=26.83$) than female nonexercisers ($\bar{x}=22.20$). The difference between male runners' and male nonexercisers mean drive for thinness scores was nonsignificant.

For bulimia, male runners scored significantly lower ($\bar{x}=11.50$) than male nonexercisers ($\bar{x}=13.77$). The mean

bulimia score difference between female runners and female nonexercisers was nonsignificant.

For the regression analysis of interoceptive awareness, the runners were not divided by sex since this factor was not significantly different in the ANOVA. An individual with a lower body fat and a lower body weight scored higher on the subscale (Table 7).

All other regression analyses for this scoring system were divided by sex. Female runners with a lower body image scored higher on the body dissatisfaction subscale. Women who were younger scored higher on the maturity fears subscale. Men with a lower body fat scored higher on the ineffectiveness subscale.

DISCUSSION

The runners in this study were not found to exhibit eating disorder tendencies as measured by the EDI. Average scores for all subjects for runners and controls were well below that of diagnosed anorectics. Even examination of individual as opposed to total data did not reveal any incidence of eating disorder tendencies. Other researchers

(3,26,30) have determined that athletes generally have normal personality profiles. Blumenthal et al.(4) found running to be an "adaptive form of behaviour that often serves to enhance the physical and psychological functioning"(p. 245). Perhaps those authors who have discussed eating disorder tendencies among recreational athletes were making conclusions based on a few unusual cases.

Although none of the scores were indicative of pathology, some differences were found between the sexes and between runners and controls. Both scoring systems found runners' body dissatisfaction to be lower than non-exercisers. This could be accounted for by the anthropometric findings which reveal that runners have a lower body fat and weight than nonexercisers.

In addition to positive physical changes, psychological improvements have been shown to occur with regular exercise. As compared with nonexercisers, exercisers have been shown to be more intelligent, imaginative and self-sufficient (7,17,21,31). Exercisers have also been found to have better self-esteem, and be less depressed and tense than their nonexercising counterparts (5,16,41,42). However, in this study, ineffectiveness subscale scores were not

significantly different between runners and controls. Since the ineffectiveness subscale is a measure of inadequacy, insecurity and worthlessness, this does not support the idea that the runners in this study were mentally healthier in this respect.

It is possible that the lack of difference between runners and controls is related to the fact that runners were not related to a team. In the study conducted by Rosen et al. (34), female collegiate team athletes were used. Perhaps team-related athletes are under more stress from coaches, parents and themselves to be leaner and perform better. In the Rosen study the women admitted to pathogenic forms of weight control in an attempt to enhance physical performance.

In the case studies of Yates et al. (43), the "obligatory" runners studied ran more than 50 miles per week. In the present study, the majority ran less than 30 miles per week. In looking at the Negative Addiction Scale score, the mean score was 75.7 out of a possible 134, the range was 53 to 106. Morgan (29) states that two conditions must be met for negative exercise addiction to occur. First, the person must think exercise is essential to his daily life. Second, the person must experience withdrawal symptoms

if he does not exercise. Although the large majority of runners reported tension or guilt if they did not run, the percentage of runners responding that running was always or usually essential to their life was below 50% for most questions. Since there has been little work done with this particular scale, it is difficult to assess the degree of addiction in this group of runners. The runners in Rosen's study (34) were team members and may have been more addicted to the activity than the recreational runners used in this study. Use of the EDI in collegiate athletes would be necessary to substantiate this hypothesis.

None of the variables used in regression analyses to predict subscale scores were found to explain even 50% of the variation in a subscale. Thus, other unmeasured variables must have been important in predicting subscale scores.

Females in this sample has more drive for thinness and body dissatisfaction than males. In a report on body image by Miller, et al. (28), not only those objectively classified as overweight, but also normal weight students were dissatisfied with their bodies. Of the normal weight subjects, 80% of the women desired to weigh less, while none of the men desired the same. Sixty-three percent of the

women in all weight categories had a mildly distorted body image, while forty-five percent of the men perceived themselves incorrectly. Huenemann et al. (23) found that many adolescent girls described themselves as fat, while most of the boys thought they were normal. Our results concur with the finding that women tend to be dissatisfied with their bodies and are concerned with becoming thinner.

Although female runners were leaner than female nonexercisers, they scored significantly higher on the drive for thinness subscale. In a report of female collegiate athletes, Rosen et al. (34) found 32% of the female athletes used at least one form of pathogenic weight control. The eating disorders were used to enhance physical performance, rather than for appearance reasons. The athletes resorted to hazardous weight control techniques if they had perceived themselves as obese at any time in their lives. Thus, coaches and clinicians can expect even lean female runners to be attempting further weight loss.

The original developers of the questionnaire (15) state the subscales drive for thinness, body dissatisfaction and bulimia assess attitudes and/or behaviors related to extreme dieting. They suggest that although disturbances in these areas are central to anorexia nervosa, the attitudes may

also exist in other groups of dieters. In the present study, ten of the twelve significant differences between groups were found in these three subscales. In agreement with other work (23,28,34), Perron and Endres (33) noted 81% of female high school athletes were unhappy with their present weight. Athletes often consume sub-optimal diets with inadequate energy intake (2,33). This study supports the concept that many females in general and female athletes in particular are dissatisfied with their weight.

For this study, the six point scoring system yielded a slightly higher number of significant differences between groups than the three point system. Differences in two additional subscales were not found in the three point scoring method. The six point scoring system is suggested to be better scoring method since all answers are considered useful data. In this study it is not possible to determine which scoring system is better. More research needs to be done to determine the validity of the six point scoring method as compared to the original scoring method.

This study yielded some subtle differences between the two groups tested. Although the runners scored significantly higher on the body dissatisfaction subscale than nonexercisers, both group's scores were low as compared with

anorectics, therefore were not indicative of the disorder. The differences found could be due to dieting or the runners' lower body fat and weight. Although women scored higher on drive for thinness and body dissatisfaction subscales, the score percentiles were low in comparison to anorectics. The differences between men and women were probably due to dieting and/or a distorted body image on the part of the women. It is believed that in the group of subjects studied, eating disorders did not exist.

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Table 1
 Anthropometric and Body Image Data for
 Runners and Controls

Parameter	Runner		Control	
	Male (N=31)	Female (N=30)	Male (N=38)	Female (N=23)
Age(yr)	33.4±1.7	33.1±1.9	33.9±1.9	33.1±1.9
Height(cm)	177.9±1.2 ^{abc}	164.1±1.1 ^{ad}	179.2±1.4 ^{bde}	161.9±1.0 ^{ce}
Weight(kg)	73.6±1.6 ^{abc}	58.4±1.2 ^{ad}	85.4±2.6 ^{bde}	62.2±2.3 ^{ce}
Body Fat(%)	12.4±0.8 ^{abc}	19.5±0.9 ^{ad}	18.2±1.1 ^{be}	25.0±1.1 ^{dce}
Body Image	2.7±0.1 ^{abc}	2.3±0.1 ^a	2.3±0.2 ^b	1.9±0.1 ^c

Values are mean ± SEM

Same letter indicates groups with significantly different
 (p<0.05) means

Table 2
 Mean EDI Subscale Scores for the Three
 Point Scoring for Runners and Controls

Subscale	Runner	%tile**	Control	%tile
Drive for Thinness	3.80±0.62	7	3.43±0.54	7
Body Dissatisfaction	5.08±0.80*	2	10.64±0.18	29
Interoceptive Awareness	3.23±0.20	15	3.29±0.24	15
Bulimia	0.69±0.22	3	1.18±0.30	3
Interpersonal Distrust	1.88±0.31	18	2.56±0.34	24
Maturity Fears	1.18±0.30	24	2.56±0.39	40
Ineffectiveness	1.15±0.31	9	1.77±0.40	9
Perfectionism	5.57±0.47	32	5.15±0.42	32

Values are mean ±SEM

*Indicates difference between means at $p < 0.05$

**Percentile as compared with anorectics(13)

Table 3
 Mean EDI Subscale Scores for the Three
 Point Scoring for Males and Females

Subscale	Male	%tile**	Female	%tile
Drive for Thinness	1.67±0.27*	4	6.15±0.75	15
Body Dissatisfaction	4.13±0.62*	9	12.72±1.25	38
Interoceptive Awareness	3.52±0.22	15	2.92±0.19	9
Bulimia	0.97±0.28	3	0.89±0.22	3
Interpersonal Distrust	2.43±0.32	24	1.94±0.33	18
Maturity Fears	1.51±0.33	24	2.00±0.38	40
Ineffectiveness	1.19±0.30	9	1.81±0.43	9
Perfectionism	5.40±0.42	32	5.30±0.48	32

Values are mean ±SEM

*Indicates difference between means at $p < 0.05$

**Percentile as compared with anorectics(13)

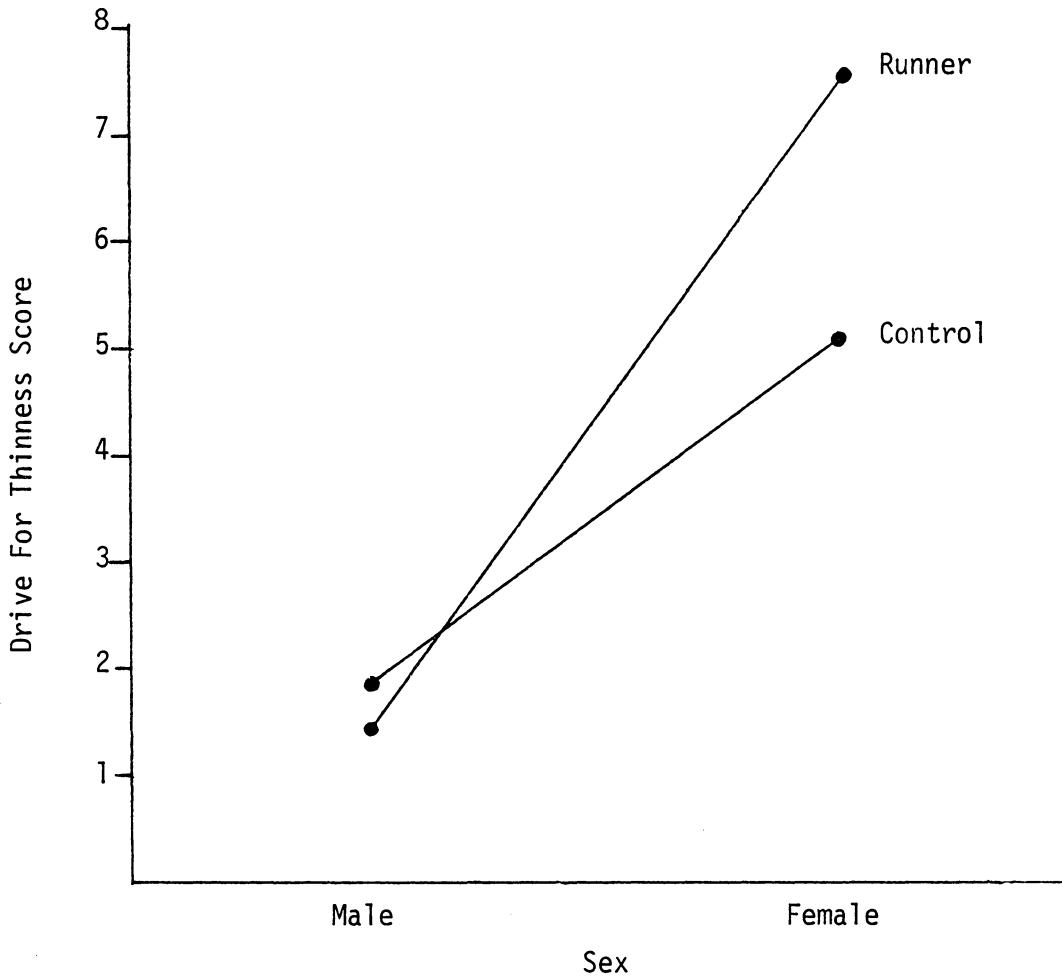


Figure 1 - Mean three point drive for thinness scores for male and female runners and controls.

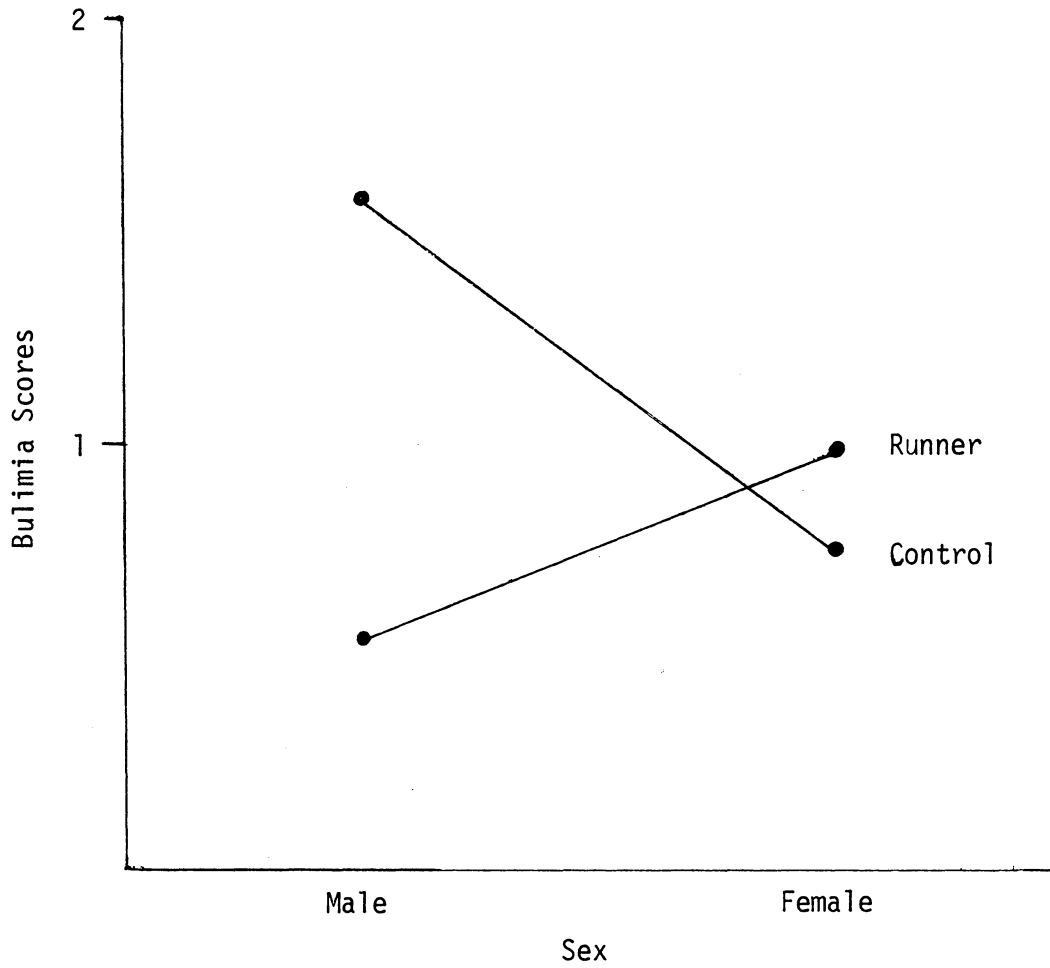


Figure 2 - Mean three point bulimia scores for male and female runners and controls.

Table 4

Multiple Regression of the EDI Subscales for Total Runners,
Male Runners and Female Runners for the
Three Point Scoring System

Subscale	Independent Variable	Total Partial r^2	Male Partial r^2	Female Partial r^2
Drive for Thinness	Sex	0.38*	----	----
	Age	0.04*	----	0.15
	Years Run	0.04*	----	0.10
	Weight	----	0.11*	----
Body Dissatisfaction	Sex	0.39*	----	----
	Body Image	0.08*	----	0.47*
Interoceptive Awareness	----	----	----	----
Bulimia	Body Image	0.07*	----	----
	NAS**	0.08*	----	----
	Age	----	----	0.10
	Miles Run	----	0.10	----
Interpersonal Distrust	----	----	----	----
Maturity Fears	NAS	0.13*	----	----
	Age	0.10*	----	----
Ineffectiveness	NAS	0.11*	----	----
	Age	0.08*	----	----
Perfectionism	NAS	0.07*	----	----

*Indicates significance at $p < 0.05$

**Negative Addiction Scale

Table 5

Mean EDI Subscale Scores for the Six
Point Scoring for Runners and Controls

Subscale	Runner	Control
Drive for Thinness	20.02±1.01	19.26±0.95
Body Dissatisfaction	25.31±1.31*	33.05±1.70
Interoceptive Awareness	21.39±0.43	22.31±0.51
Bulimia	12.84±0.57	13.59±0.66
Interpersonal Distrust	18.41±0.57	18.65±0.66
Maturity Fears	21.95±0.74	24.02±0.38
Ineffectiveness	21.87±0.83	23.05±0.89
Perfectionism	21.75±0.60	21.20±0.59

Values are mean ±SEM

*Indicates difference between means at $p < 0.05$

Table 6
 Mean EDI Subscale Scores for the Six
 Point Scoring for Males and Females

Subscale	Male	Female
Drive for Thinness	16.13±0.61*	24.21±1.10
Body Dissatisfaction	23.09±1.07*	37.11±1.64
Interoceptive Awareness	21.96±0.46	21.72±0.49
Bulimia	12.52±0.57	14.11±0.66
Interpersonal Distrust	18.78±0.60	18.21±0.64
Maturity Fears	21.45±0.74*	24.98±0.82
Ineffectiveness	21.25±0.77*	24.04±0.94
Perfectionism	21.45±0.55	21.51±0.65

Values are mean ±SEM

*Indicates difference between means at $p < 0.05$

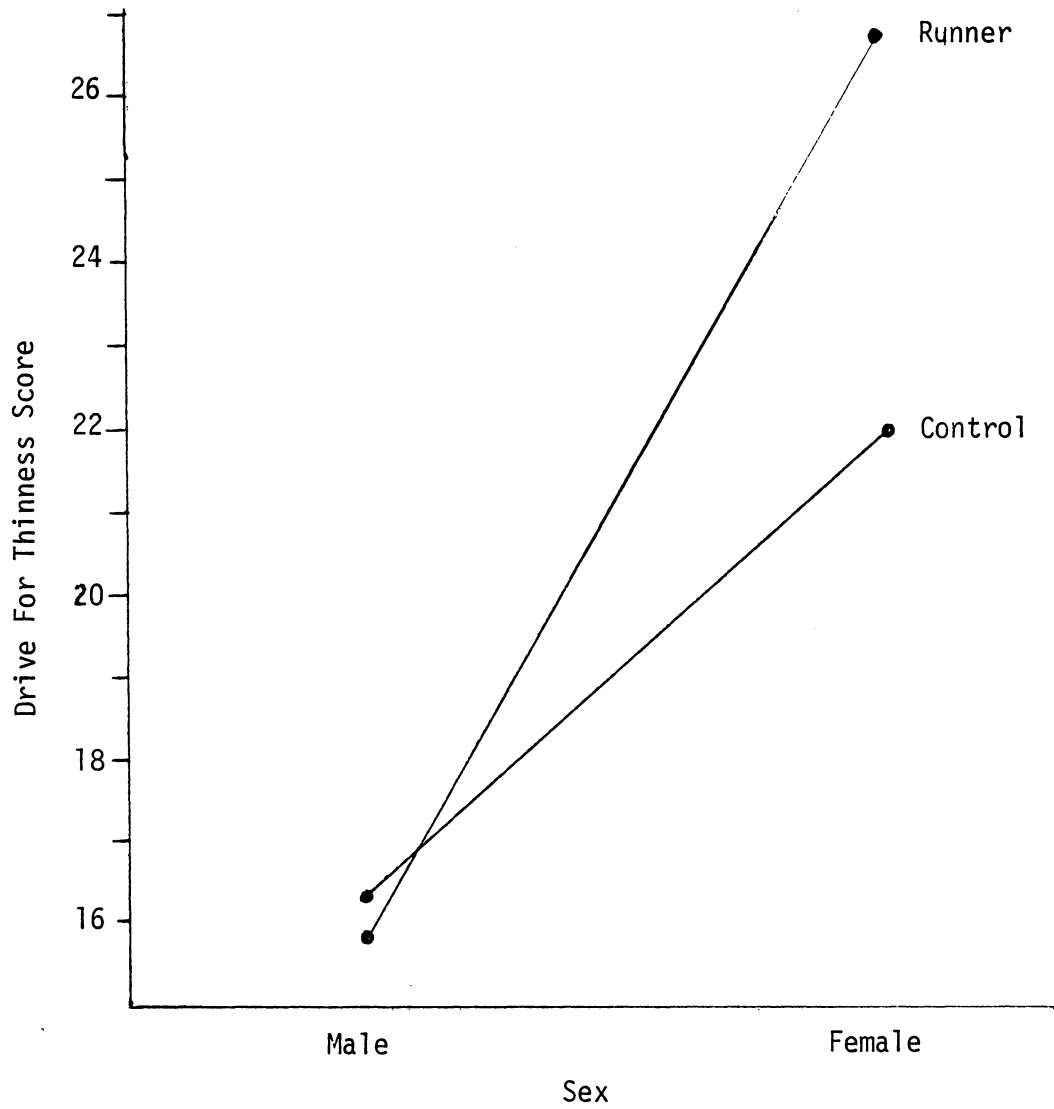


Figure 3 - Mean six point drive for thinness scores for male and female runners and controls.

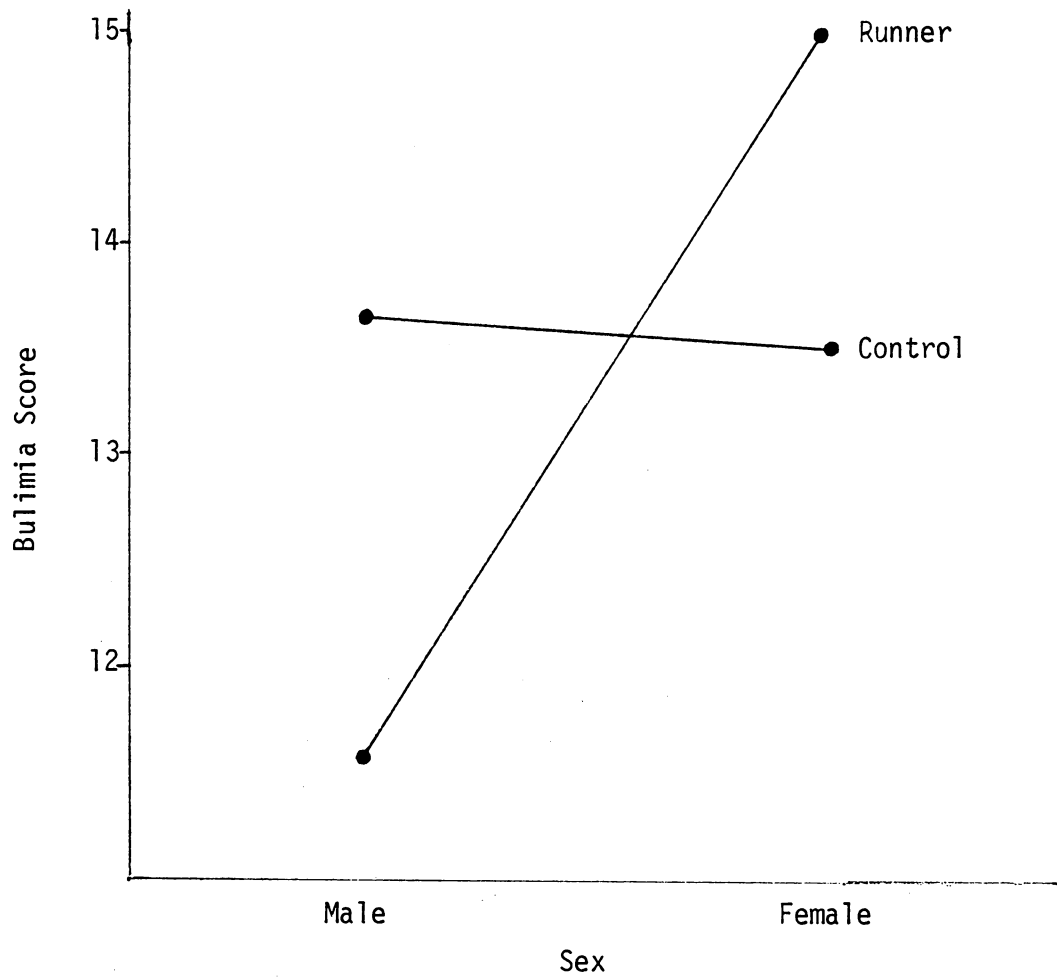


Figure 4 - Mean six point bulimia scores for male and female runners and controls.

Table 7

Multiple Regression of the EDI Subscales for Total Runners,
Male Runners and Female Runners for the
Six Point Scoring System

Subscale	Independent Variable	Total Partial r^2	Male Partial r^2	Female Partial r^2
Drive for Thinness	Sex	0.45*	----	----
	Age	0.04*	----	0.20*
Body Dissatisfaction	Sex	0.53*	----	----
	Body Image	0.04*	----	0.46*
	Miles Run	----	0.16*	----
Interceptive Awareness	Body Fat	0.17*	----	----
	Weight	0.13*	----	----
Bulimia	Sex	0.15*	----	0.11
	Body Fat	----	0.19*	----
Interpersonal Distrust	----	----	----	----
Maturity Fears	Age	0.23*	----	0.30*
	Weight	0.15*	----	----
	Years Run	----	----	0.10
	Body Fat	----	0.34*	----
Ineffectiveness	Weight	0.18*	----	----
	Age	0.08*	----	----
	Body Fat	----	0.27*	----
Perfectionism	----	----	----	----

*Indicates significance at $p < 0.05$

Appendix A

The Negative Addiction Scale

Use the following scale for questions 1-11:

1. always 2.usually 3.often 4.sometimes 5. rarely
6. never

1. I run at approximately the same time every day.
2. I run in unfavorable environments(e.g., rain, cold, heat).
3. I have a consistent weekly running schedule with the same pattern of running and nonrunning days.
4. I run whatever time of the day most convenient to my other daily activities.
5. I have a training partner that I run with whenever possible.
6. I keep a written record of my running.
7. I plan my other daily activities around what time I want to run.
8. I am usually disciplined and do run on days that I don't really feel like doing it.
9. I set weekly mileage goals for myself.
- 10.I am able to meet the weekly mileage goals that I have set.
- 11.I feel that if I don't maintain my self discipline I would stop running completely tomorrow.
- 12.During an average week I run 1)9 to 20 miles 2)21 to 30 miles 3)31 to 40 miles 4)41 to 50 miles 5)over 50 miles.
- 13.How many years have you been running?
1)less than one 2)one to two 3)three to four 4)five to six 5)seven or more.
- 14.Approximately how many days per week do you run more than once per day? 1)none 2)one 3)two 4)three 5)four 6)five or more.
- 15.I run when I have a bad cold, flu, fever or sore throat
1)always 2)usually 3)sometimes 4)rarely 5)never
- 16.I run when I have a running-related injury(e.g., sprained ankle, pulled muscle, pain in knee). 1)always 2)usually 3)sometimes 4)rarely 5)never
- 17.If the illness or injury becomes worse, I continue to run
1)always 2)usually 3)sometimes 4)rarely 5)never

Negative Addiction con't.

18. On days that I don't run I usually feel
1) tense 2) guilty 3) no different from running days

For questions 19-27 please use the following scale:
1) agree 2) tend to agree 3) tend to disagree 4) disagree

19. On days that I don't run I feel depressed or mentally sluggish.

20. On days that I don't run I feel deprived.

21. If I stopped running my physical health would decline significantly.

22. Running is my primary form of recreation.

23. I experience "runner's high" on the majority of my runs.

24. Running is a common topic of conversation for me.

25. It is important for all runners to take some time off from their regularly held running routine.

26. Running has influenced my lifestyle.

27. My interest in running has caused some family or interpersonal tensions.

Revised from Hailey and Bailey (1982). Negative addiction in runners: A quantitative approach. Journal of Sports Behavior, 5, 151-153.

Chapter 4

Summary

Eating disorders are a major health problem in this country today. The results of the disorder can cause serious emotional and physical damage to one suffering from it. Until the past few years, diagnosis of eating disorders had to be done in a clinical setting by trained observers. This was time consuming, expensive and lacked the ability to establish certain psychological attributes. Since this time researchers have developed self-report inventories designed to be given to individuals to detect eating disorder tendencies (Garner et al., 1983; Garner & Garfinkel, 1979; Slade, 1973). With the recent association of eating disorder behaviors and attitudes among athletes (Clark, 1984; Huben, 1983; Liberman & Palek, 1984; Peron & Endres, 1985; Smith, 1980; Sours, 1981; Yates et al., 1983; Zucker, 1985), investigations need to be done on the occurrence of disorders among specific athletic populations.

This study attempted to investigate the differences in eating disorder scale subscores between runners and nonexercisers. It also attempted to determine if certain variables could be used as predictive measures in runners to curb possible development of eating disorder tendencies. One-hundred and twenty-two male and female subjects were

used in this study. Sixty-one subjects were runners who ran more than nine miles per week, sixty-one subjects were nonexercisers participating in less than one hour per week of physical activity. The runners completed an Eating Disorder Inventory(EDI) as well as a Negative Addiction Scale. Nonexercisers completed the EDI only. The EDI was scored in accordance with the original developers(Garner et al., 1983) on a three point system. It was also scored on a six point system. All subjects' body composition, via skinfold measurements, height and body weight were obtained.

For both scoring methods, runners scored significantly lower than nonexercisers on the body dissatisfaction subscale. The runner's lower body dissatisfaction score could be accounted for by their lower body weight and body fat. The few differences found between runners and controls could be due to the fact that the runners studied did not represent negatively addicted athletes.

All females scored higher on the drive for thinness and body dissatisfaction subscales than males. There were interactions found between sex and exercise status for drive for thinness and bulimia. The drive for thinness interaction showed female runners to have a higher score than female nonexercisers. Females in general (Huenemann, Shapiro,

Hampton & Mitchell, 1966; Miller, Coffman & Linke, 1980) and female athletes in particular (Rosen, 1986) have been found to be dissatisfied with their weight. Even though they may be thin, many women desire to lose even more weight.

The six point scoring method yielded an additional difference between the sexes for the ineffectiveness and maturity fears scales.

For female runners, body dissatisfaction could be predicted by the drive for thinness subscale using the three point scoring system. For the six point scoring system, a runner with a lower body weight scored higher on the interoceptive awareness subscale. Female runners with a lower body image scored higher on the body dissatisfaction subscale. Women who were younger scored higher on the maturity fears subscale, and men with a lower body fat scored higher on the ineffectiveness subscale. However, none of the variables used in regression analyses to predict subscale scores were found to explain even 50% of the variation in a subscale. Thus, other unmeasured variables must have been important in predicting subscale scores.

Both groups represented fairly "normal" populations. As compared with anorectics, all groups subscale scores were low. It is believed that for the group of subjects tested, eating disorders did not exist.

Research Implications

The detection of eating disorders is of prime concern for the population in general, but especially for athletes. The effects on athletes can be seen more quickly and can damage health as well as athletic performance. If the disorder remains undiagnosed and untreated, the athlete may suffer permanent physical injury. The short-term weight loss for a desired goal may turn into a lifelong battle of abnormal eating tendencies. This study described the use of a validated eating disorder questionnaire given to a population of runners. This is an important practical contribution because it is the first time an eating disorder inventory has been used among a population of athletes. It is an objective measure that can determine not only tendencies for eating disorders, but also to what extent(intensity). The inventory may be made available to coaches and trainers for detecting eating disorder

tendencies among runners. It should be noted, however, that this has not been validated for the populations in which it was tested(athletes). If an eating disorder tendency is detected from the questionnaire, then further clinical evaluation of the individual should be conducted for positive diagnosis. Coaches and trainers should be aware that women may have a distorted body image and they may be dieting. These factors could cause some subscales to be slightly elevated.

The use of objective measures in determining eating disorders among athletes is something which should be continued. Case studies and interviews with athletes may not be enough to determine an eating disorder tendency. Before a researcher describes eating disorders among athletes, he should make sure adequate testing was done to prove their exixtance. Eating disorders among athletes may not be as prevalent as some researchers are reporting.

Recommendations for Further Study

The following recommendations for further study are made to supplement the results of the investigation:

1. Similar studies should be conducted among different populations of runners, i.e., high school track runners,

college cross country runners and marathoners. This would determine if eating disorder tendencies exist among different populations and which variables are most highly related for specific populations.

2. Points on both scales need to be identified which represent the onset of eating disorders or exercise addiction. A cutoff point needs to be determined at which an individual would be sent for further evaluation. In order to do this, more samples of clinically identified anorectic and bulimic patients should take the EDI questionnaire. A range of scores for these populations could then be developed, rather than from just one sampling. A point could be determined (i.e., 75%) at which an individual is sent for further evaluation.

3. Researchers need to identify specific, targeted groups of runners with a high probability for anorexia nervosa i.e., male runners ages 20-30 who run more than 40 miles per week.

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Appendix A
DETAILED METHODOLOGY

METHODOLOGY

Introduction

The collection of data required to assess the research objectives of this investigation necessitated each subject to complete the questionnaire(s) and be assessed for body fat, height and weight.

Subjects

Two groups of subjects were used in the study, both groups contained males and females. The first group, the runners, had to meet the following criteria: non-team related and run on the average of more than nine miles per week. Nine miles was chosen as an estimate of the minimum requirement to achieve aerobic conditioning. The American College of Sports Medicine recommends 15 to 60 minutes of aerobic training at least three times per week for aerobic conditioning to occur (The American College of Sports Medicine, 1980). From this it was estimated that an individual should be running a minimum of three miles, three times a week. Therefore, nine miles per week was chosen as a criteria for aerobic conditioning to occur.

The runners were predominately from an informal running group at VPI&SU. A few other runners were tested who did not belong to the running club. They included local runners of similar age, characteristics and running habits as the club runners. The runners were mostly white-collar and professional workers from the college community, as well as some VPI&SU students. There were 38 males and 23 female runners surveyed. The age range was 18 to 59, the mean being 33.4 for the males and 33.1 for the females.

The comparison group was drawn from classes at a local community college, VPI classes and other VPI employees. The nonexercisers participated in an average of less than one hour per week of physical activity for fitness. It was assumed that this group was a representative sample of basically inactive people similar in age, and sex to the runners. Since both the nonexercisers and runners were drawn from college populations and the university setting, it was assumed that the two samples were similar in background and status. The 31 males and 30 female nonexercisers ranged from 18 to 59 years old with a mean age of 33.9 for the males and 33.1 for the females. Descriptive characteristics for the two samples are presented in Table 1.

Informed Consent

Consent to conduct the experiment was obtained from the Human Subjects Committee of the Health, Physical Education and Recreation Department, and the Chairman of the Institutional Human Subjects Review Board of VPI&SU. All subjects signed an informed consent to participate in the study (Appendix C).

Instruments

This study employed the use of two questionnaires. The first was the Multi-Dimensional Eating Disorder Inventory for Anorexia Nervosa and Bulimia (Garner et al., 1983). It is a 64 item, self-report, multiscale measure designed for the assessment of psychological and behavioral traits common in anorexia nervosa and bulimia nervosa. The Eating Disorder Inventory (EDI) consists of eight subscales measuring: 1) drive for thinness; 2) bulimia; 3) body dissatisfaction; 4) ineffectiveness; 5) perfectionism; 6) interpersonal distrust; 7) interoceptive awareness and; 8) maturity fears. The authors of the EDI attempted to assess the psychological dimensions which have been found to differentiate anorectic and bulimic patients from those with less severe problems associated with dieting. Reliability (internal consistency)

and validity of the EDI were established among anorectics, clinically recovered anorectics, bulimic patients, obese, normal weight but formerly obese women, and male and female normal controls(Garner et al., 1983). Subjects respond to six point, forced choice items by rating whether each term applies "always", "usually", "often", "sometimes", "rarely" or "never". In accordance with the original authors(Garner et al., 1983), the scale was scored by giving the most extreme "anorectic" response(always or never depending on the keyed direction), a score of 3, the immediately adjacent response 2, the next response 1, and the three choices opposite to the most "anorexic" response receiving no score(0). The EDI was also scored on a six point scoring system. Using this system, the most "anorexic" response received a score of 6, the immediately adjacent response 5, the next response 4 and the remaining three responses 3, 2 and 1 respectively. Scale scores are the sumation of all item scores for that particular scale. Subjects received eight subscale scores. The EDI is presented in Appendix D.

The second instrument used, for the runners only, was a revised version of the Negative Addiction Scale(Hailey & Bailey, 1982). This scale assesses perceptions about running, cognitive style while running, running strategies

and motivation for running. The Negative Addiction Scale identifies individuals addicted to their running by focusing on the negative effects of exercise addiction as stated by Morgan(1979). The scale contains forced choice item responses dealing with addiction, withdrawal symptoms and two questions describing the subject's amount of running (weekly mileage and years of running). These two questions were considered descriptive, therefore, they were not scored with the rest of the scale. The scale is scored similarly to the EDI with the most "addicted" response receiving the highest number of points. The Negative Addiction scale is presented in Appendix E.

Reliability Estimates

The reliability coefficients(Standard Cronbach's Alphas) for anorectic patients and normal controls found by Garner et al.(1983) are as follows: drive for thinness, 0.85, 0.85; bulimia, 0.90, 0.83; body dissatisfaction, 0.90, 0.91; ineffectiveness, 0.90, 0.86; perfectionism, 0.82, 0.73; interoceptive awareness, 0.85, 0.66; interpersonal distrust, 0.85, 0.76; maturity fears, 0.88, 0.65.

The EDI and The Negative Addiction Scale were both assumed to be reliable estimates of eating disorder attitudes and negative addiction among runners. No reliability tests were conducted for the population tested.

Validity Estimates

Validity of the EDI is presented elsewhere (Garner et al., 1983). The validity was determined by comparing mean subscale score of identified anorectics, bulimics, obese patients, formerly obese patients and normal controls. The groups containing patients with eating disorders were found to differ from "normal" eating groups. Recovered anorectic patients did not differ significantly from the normal control group. The authors also found agreement between the questionnaire scores and clinical judgements of experienced eating disorder clinicians familiar with each patient.

The EDI was assumed to be a valid measure of eating disorder tendencies among the populations tested. The Negative Addiction Scale was assumed to be a valid measure of addiction because the population to which it was administered was similar in exercise habits, age and running history to the population for which it was designed (Hailey and Bailey, 1982).

Like all self-report instruments, the EDI and the Negative Addiction Scale are vulnerable to distortion due to response style bias and inaccurate reporting by the subject. To help insure against bias, the respondents were assured confidentiality of their results.

Experimental Procedures

A list of running club members was obtained from the club president. Members were phoned and asked to attend a group meeting for the purpose of questionnaire completion, as well as other club duties. Those members who did not attend the meeting were called back and asked to complete the questionnaires individually at an arranged time. The other runners not belonging to the club were either phoned or approached in person and individually completed the questionnaire. The runners were asked to complete the EDI and the Negative Addiction Scale.

The majority of the control group was obtained from the New River Valley Community College (approximately two-thirds of the sample). Instructors at the college were phoned and asked permission to attend classes for the purpose of data collection. The remaining subjects came from classes at VPI&SU and employees of the college. Subjects filled out the

questionnaire during class time, or on an individual basis with the tester. The control group was age- and sex-matched to the runners.

Subjects were then assessed by the tester for body fat, height and weight. Runners were assessed in the Human Performance Laboratory at VPI&SU. Nonexercisers were assessed at the site of questionnaire completion. Body composition analyses were the same for both groups. However, for the measurement of body weight among nonexercisers, a portable scale was taken to the site. The portable scale was calibrated with the scale at the Human Performance Laboratory. Also, nonexercising subjects were asked to verbally report their height, while the runners were measured. Body fat analysis was done via skinfold techniques through the use of John Bull constant pressure calipers. Skinfold fat was measured five times at each of three sites. Males were measured at the chest, abdomen and thigh, females were measured at the tricep, supra-iliac and thigh as described by McArdle, Katch and Katch(1981). Generalized equations for predicting body density were used according to Jackson and Pollock(1978) for men and Jackson, Pollock and Ward(1980) for the women. These equations have been proven to accurately predict body fat for samples differing in age

and fatness(Jackson & Pollock, 1978; Jackson et al., 1980). Sinning and Wilson(1984) found the Jackson et al.(1980) equations to be an accurate assessment of body fat in the female athletes they studied. All skinfold, height and weight measurements were performed by a single tester.

Research Design

The research design of the study was an ex post facto difference study. The dependent variable was subscale score on the EDI. The independent variable was runner or nonrunner and sex for the first research hypothesis. For the second hypothesis, the independent variables were age, sex, height, weight, years of running, miles run per week, percent body fat, negative addiction score and perceived body image. The dependent variable was EDI subscale score(Table 2). All data were statistically analyzed by computer utilizing the Statistical Analysis System(SAS, 1985). Parametric tests were chosen for analysis because the data were assumed to be interally scaled, because parametric tests are more powerful, and because the sample size was so large. A Wilks' criterion test and a Scheffé' post hoc procedure were

employed using the SAS procedure(1985). The alpha level was set at 0.05. The second procedure employed was a forward multiple stepwise regression.

Appendix B
DATA TABLES

Table 1
 Anthropometric and Body Image Data for
 Runners and Controls

Parameter	Runner		Control	
	Male (N=31)	Female (N=30)	Male (N=38)	Female (N=23)
Age(yr)	33.4±1.7	33.1±1.9	33.9±1.9	33.1±1.9
Height(cm)	177.9±1.2 ^{abc}	164.1±1.1 ^{ad}	179.2±1.4 ^{bde}	161.9±1.0 ^{ce}
Weight(kg)	73.6±1.6 ^{abc}	58.4±1.2 ^{ad}	85.4±2.6 ^{bde}	62.2±2.3 ^{ce}
Body Fat(%)	12.4±0.8 ^{abc}	19.5±0.9 ^{ad}	18.2±1.1 ^{be}	25.0±1.1 ^{dce}
Body Image	2.7±0.1 ^{abc}	2.3±0.1 ^a	2.3±0.2 ^b	1.9±0.1 ^c

Values are mean ± SEM

Same letter indicates groups with significantly different
 (p<0.05) means

Table 2

Mean EDI Subscale Scores for Male and Female Controls
for the Three Point Scoring System

Subscale	Male	Female
Drive for Thinness	1.90±0.49	5.00±0.89
Body Dissatisfaction	6.68±1.13	14.73±1.82
Interceptive Awareness	3.58±0.35	3.00±0.31
Bulimia	1.61±0.54	0.73±0.20
Interpersonal Distrust	3.00±0.51	2.10±0.43
Maturity Fears	2.35±0.62	2.16±0.46
Ineffectiveness	1.77±0.58	1.76±0.56
Perfectionism	5.39±0.58	4.90±0.63

Values are mean ±SEM

Table 3

Mean EDI Subscale Scores for Male and Female Runners
for the Three Point Scoring System

Subscale	Male	Female
Drive for Thinness	1.47±0.28	7.65±1.23
Body Dissatisfaction	2.05±0.44	10.08±1.52
Interoceptive Awareness	3.47±0.29	2.83±0.16
Bulimia	0.45±0.24	1.09±0.43
Interpersonal Distrust	1.97±0.39	1.74±0.52
Maturity Fears	0.81±0.29	1.78±0.63
Ineffectiveness	0.71±0.25	1.87±0.70
Perfectionism	5.42±0.50	5.83±0.76

Values are mean ±SEM

Table 4
 Analysis of Variance of the EDI Subscales
 for Runners and Controls for the
 Three Point Scoring System

Subscale		SS	df	MS	F	P
Drive for Thinness	R/Nr	36.49	1	36.49	2.40	0.124
	Sex	635.45	1	635.45	41.86	0.001
	Rnr x Sex	70.15	1	70.15	4.62	0.034
	Error	1791.40	118	15.18		
Body Dissatisfaction	R/Nr	634.89	1	634.89	13.54	0.001
	Sex	1912.29	1	1912.29	40.79	0.001
	Rnr x Sex	0.01	1	0.01	0.00	0.993
	Error	5532.36	118	46.88		
Interoceptive Awareness	R/Nr	0.58	1	0.58	0.20	0.653
	Sex	11.14	1	11.14	3.89	0.051
	Rnr x Sex	0.03	1	0.03	0.01	0.915
	Error	338.33	118	2.87		
Bulimia	R/Nr	4.87	1	4.87	1.17	0.281
	Sex	0.42	1	0.42	0.10	0.750
	Rnr x Sex	17.05	1	17.05	4.10	0.045
	Error	490.44	118	4.16		
Interpersonal Distrust	R/Nr	14.21	1	14.21	2.19	0.141
	Sex	9.51	1	9.51	1.47	0.228
	Rnr x Sex	3.27	1	3.27	0.51	0.479
	Error	764.11	118	6.47		
Maturity Fears	R/Nr	27.32	1	27.32	3.70	0.057
	Sex	4.48	1	4.48	0.61	0.438
	Rnr x Sex	9.85	1	9.85	1.34	0.250
	Error	870.89	118	7.38		
Ineffectiveness	R/Nr	6.82	1	6.82	0.87	0.353
	Sex	9.79	1	9.79	1.25	0.266
	Rnr x Sex	10.05	1	10.05	1.28	0.260
	Error	925.21	118	7.84		
Perfectionism	R/Nr	6.81	1	6.81	0.55	0.460
	Sex	0.05	1	0.05	0.00	0.950
	Rnr x Sex	5.88	1	5.88	0.47	0.492
	Error	1462.62	118	12.39		

Table 5
 Analysis of Variance of the EDI Subscales
 for Runners and Controls for the
 Six Point Scoring System

Subscale		SS	df	MS	F	P
Drive for Thinness	R/Nr	124.25	1	124.25	3.03	0.084
	Sex	2062.93	1	2062.93	50.28	0.001
	Rnr x Sex	195.96	1	195.96	4.78	0.031
	Error	4841.23	118	41.03		
Body Dissatisfaction	R/Nr	1047.26	1	1047.26	10.72	0.001
	Sex	5273.83	1	5273.83	53.97	0.001
	Rnr x Sex	108.13	1	108.13	1.11	0.295
	Error	11529.71	118	13.84		
Interoceptive Awareness	R/Nr	28.71	1	28.71	2.08	0.152
	Sex	3.78	1	3.78	0.27	0.602
	Rnr x Sex	1.23	1	1.23	0.09	0.766
	Error	1632.76	118	13.84		
Bulimia	R/Nr	2.94	1	2.94	0.13	0.717
	Sex	74.19	1	74.19	3.34	0.070
	Rnr x Sex	113.37	1	113.37	5.10	0.026
	Error	2621.07	118	22.21		
Interpersonal Distrust	R/Nr	1.22	1	1.22	0.05	0.821
	Sex	10.15	1	10.15	0.43	0.515
	Rnr x Sex	20.62	1	20.62	0.97	0.353
	Error	2802.83	118	23.75		
Maturity Fears	R/Nr	72.95	1	72.95	1.97	0.163
	Sex	333.81	1	333.81	9.05	0.003
	Rnr x Sex	20.62	1	20.62	0.56	0.456
	Error	4354.21	118	36.90		
Ineffectiveness	R/Nr	15.38	1	15.38	0.35	0.555
	Sex	219.26	1	219.26	4.99	0.027
	Rnr x Sex	36.77	1	36.77	0.84	0.362
	Error	5183.10	118	43.92		
Perfectionism	R/Nr	14.40	1	14.40	0.66	0.419
	Sex	0.72	1	0.72	0.03	0.856
	Rnr x Sex	25.92	1	25.92	1.19	0.278
	Error	2580.55	118	21.87		

Table 6

Multiple Regression of the EDI Subscales for Total Runners,
Male Runners and Female Runners for the
Three Point Scoring System

Subscale	Independent Variable	Total Partial r^2	Male Partial r^2	Female Partial r^2
Drive for Thinness	Sex	0.38*	----	----
	Age	0.04*	----	0.15
	Years Run	0.04*	----	0.10
	Weight	----	0.11*	----
Body Dissatisfaction	Sex	0.39*	----	----
	Body Image	0.08*	----	0.47*
Interceptive Awareness	----	----	----	----
Bulimia	Body Image	0.07*	----	----
	NAS**	0.08*	----	----
	Age	----	----	0.10
	Miles Run	----	0.10	----
Interpersonal Distrust	----	----	----	----
Maturity Fears	NAS	0.13*	----	----
	Age	0.10*	----	----
Ineffectiveness	NAS	0.11*	----	----
	Age	0.08*	----	----
Perfectionism	NAS	0.07*	----	----

*Indicates significance at $p < 0.05$

**Negative Addiction Scale

Table 7

Multiple Regression of the EDI Subscales for Total Runners,
Male Runners and Female Runners for the
Six Point Scoring System

Subscale	Independent Variable	Total Partial r ²	Male Partial r ²	Female Partial r ²
Drive for Thinness	Sex	0.45*	----	----
	Age	0.04*	----	0.20*
Body Dissatisfaction	Sex	0.53*	----	----
	Body Image	0.04*	----	0.46*
	Miles Run	----	0.16*	----
Interceptive Awareness	Body Fat	0.17*	----	----
	Weight	0.13*	----	----
Bulimia	Sex	0.15*	----	0.11
	Body Fat	----	0.19*	----
Interpersonal Distrust	----	----	----	----
Maturity Fears	Age	0.23*	----	0.30*
	Weight	0.15*	----	----
	Years Run	----	----	0.10
	Body Fat	----	0.34*	----
Ineffectiveness	Weight	0.18*	----	----
	Age	0.08*	----	----
	Body Fat	----	0.27*	----
Perfectionism	----	----	----	----

*Indicates significance at $p < 0.05$

Appendix C
INFORMED CONSENT

HUMAN PERFORMANCE LABORATORY

Division of Health, Physical Education and Recreation
Virginia Polytechnic Institute and State University

INFORMED CONSENT

I, _____, do hereby voluntarily agree and consent to participate in a testing program conducted by the personnel of the Human Performance Laboratory of the Division of Health, Physical Education and Recreation of Virginia Polytechnic Institute and State University.

Title of the Study: An Inventory for Investigation of Eating Patterns and Exercise Habits Among Runners.

The purposes of this investigation include: to compare runner's responses from an eating pattern inventory to inactive controls; to determine if relationships are found within runners, among the eating pattern scale, exercise habits and body composition measurements.

I voluntarily agree to participate in this testing program. It is my understanding that my participation will include: Answering of the questionnaire, body composition analysis and measurement of height and weight.

I understand that participation in this experiment may produce certain discomforts. These discomforts include: measurement of skinfold. No risks are involved.

Certain personal benefits may be expected from participation in this experiment. These include: knowledge of body fat, height and weight.

I understand that any data of a personal nature will be held confidential and will be used for research purposes only. I also understand that these data may only be used when not identifiable with me.

I understand that I may abstain from participation in any part of the experiment or withdraw from the experiment should I feel the activities might be injurious to my health. The experimenter may also terminate my participation should she feel the activities might be injurious to my health.

I have read the above statements and have had the opportunity to ask questions. I understand that the researcher will, at any time, answer my inquiries concerning this experiment.

Scientific inquiry is indispensable to the advancement of knowledge. Your participation in this experiment provides the investigator the opportunity to conduct meaningful scientific observations designed to make significant educational contribution.

If you would like to receive a copy of the results of this investigation, please indicate this choice by marking in the appropriate space provided below. A copy of the results will then be distributed to you as soon as the results are made available by the investigator. Thank you for making this important contribution.

____ I request a copy of the results of this study

Date _____

Time _____

Participant Signature _____

Witness _____ (HPL Personnel)

Project Director: Dr. Janet Walberg

Phone:

HPER Human Subjects Chairman:

Phone:

_____, Chairman, Institutional Review Board for
Research Involving Human Subjects. Phone: _____

Appendix D
EATING DISORDER INVENTORY

The Eating Disorder Inventory

INSTRUCTIONS

This is a scale which measures a variety of attitudes, feelings and behaviors. Some of the items relate to food and eating. Others ask you about your feelings about yourself. THERE ARE NO RIGHT OR WRONG ANSWERS SO TRY VERY HARD TO BE COMPLETELY HONEST IN YOUR ANSWERS. RESULTS ARE COMPLETELY CONFIDENTIAL. Read each question and fill in the circle.

Use the following answer scale:

1. always 2. usually 3. often 4. sometimes
5. rarely 6. never

1. I eat sweets and carbohydrates without feeling nervous.
2. I think that my stomach is too big.
3. I wish that I could return to the security of childhood.
4. I eat when I am upset.
5. I stuff myself with food.
6. I wish that I could be younger.
7. I think about dieting.
8. I get frightened when my feelings are too strong.
9. I think my thighs are too large.
10. I feel ineffective as a person.
11. I feel extremely guilty after overeating.
12. I think that my stomach is just the right size.
13. Only outstanding performance is good enough in my family.
14. The happiest time in life is when you are a child.
15. I am open about my feelings.
16. I am terrified of gaining weight.
17. I trust others.
18. I feel alone in the world.
19. I feel satisfied with the shape of my body.
20. I feel generally in control of things in my life.
21. I get confused about what emotion I am feeling.
22. I would rather be an adult than a child.
23. I can communicate with others easily.
24. I exaggerate or magnify the importance of weight.
25. I wish I were someone else

- 26.I can clearly identify what emotion I am feeling.
- 27.I feel inadequate.
- 28.I have gone on eating binges where I have felt that I could not stop.
- 29.As a child, I tried very hard to avoid disappointing my parents and teachers.
- 30.I have close relationships.
- 31.I like the shape of my buttocks.
- 32.I am preoccupied with the desire to be thinner.
- 33.I don't know what's going on inside of me.
- 34.I have trouble expressing my emotions to others.
- 35.The demands of adulthood are too great.
- 36.I hate being less than the best at things.
- 37.I feel secure about myself.
- 38.I think about bingeing(over-eating).
- 39.I feel happy that I am not a child any more.
- 40.I get confused as to whether or not I am hungry.
- 41.I have a low opinion of myself.
- 42.I feel that I can achieve my standards.
- 43.My parents have expected excellence of me.
- 44.I worry that my feelings will get out of control.
- 45.I think that my hips are too big.
- 46.I eat moderately in front of others and stuff myself when they are gone.
- 47.I feel bloated after eating a normal meal.
- 48.I feel that people are happiest when they are children.
- 49.If I gain a pound, I worry that I will keep gaining.
- 50.I feel that I am a worthwhile person.
- 51.When I am upset, I don't know if I am sad, frightened or upset.
- 52.I feel that I must do things perfectly or not at all.
- 53.I have thought of trying to vomit in order to lose weight.
- 54.I need to keep people at a certain distance(feel uncomfortable if someone tries to get too close).
- 55.I think my thighs are just the right size.
- 56.I feel empty inside(emotionally).
- 57.I can talk about personal thoughts or feelings.
- 58.The best years of your life are when you become an adult.
- 59.I think that my buttocks are too large.
- 60.I eat or drink in secrecy.
- 61.I have feelings that I can't quite identify.

- 62.I think that my hips are just the right size.
- 63.I have extremely high goals.
- 64.When I am upset, I worry that I will start eating.

From Garner, Polivy and Olmsted(1983). Development and validation of a multidimensional eating disorder inventory. The International Journal of Eating Disorders, 2,15-34.

Appendix E

NEGATIVE ADDICTION SCALE

The Negative Addiction Scale

Use the following scale for questions 1-11:

1. always 2.usually 3.often 4.sometimes 5. rarely
6. never

1. I run at approximately the same time every day.
2. I run in unfavorable environments(e.g., rain, cold, heat).
3. I have a consistent weekly running schedule with the same pattern of running and nonrunning days.
4. I run whatever time of the day most convenient to my other daily activities.
5. I have a training partner that I run with whenever possible.
6. I keep a written record of my running.
7. I plan my other daily activities around what time I want to run.
8. I am usually disciplined and do run on days that I don't really feel like doing it.
9. I set weekly mileage goals for myself.
- 10.I am able to meet the weekly mileage goals that I have set.
- 11.I feel that if I don't maintain my self discipline I would stop running completely tomorrow.
- 12.During an average week I run 1)9 to 20 miles 2)21 to 30 miles 3)31 to 40 miles 4)41 to 50 miles 5)over 50 miles.
- 13.How many years have you been running?
1)less than one 2)one to two 3)three to four 4)five to six 5)seven or more.
- 14.Approximately how many days per week do you run more than once per day? 1)none 2)one 3)two 4)three 5)four 6)five or more.
- 15.I run when I have a bad cold, flu, fever or sore throat
1)always 2)usually 3)sometimes 4)rarely 5)never
- 16.I run when I have a running-related injury(e.g., sprained ankle, pulled muscle, pain in knee). 1)always 2)usually 3)sometimes 4)rarely 5)never
- 17.If the illness or injury becomes worse, I continue to run
1)always 2)usually 3)sometimes 4)rarely 5)never
- 18.On days that I don't run I usually feel
1)tense 2)guilty 3)no different from running days

Negative Addiction con't.

For questions 19-27 please use the following scale:

1)agree 2)tend to agree 3)tend to disagree 4)disagree

19.On days that I don't run I feel depressed or mentally sluggish.

20.On days that I don't run I feel deprived.

21.If I stopped running my physical health would decline significantly.

22.Running is my primary form of recreation.

23.I experience "runner's high" on the majority of my runs.

24.Running is a common topic of conversation for me.

25.It is important for all runners to take some time off from their regularly held running routine.

26.Running has influenced my lifestyle.

27.My interest in running has caused some family or interpersonal tensions.

Revised from Hailey and Bailey(1982).Negative addiction in runners:A quantitative approach.Journal of Sports Behavior,5,151-153.

APPENDIX F
Individual Subject Data

Anthropometric and Running Data
for all Subjects

<u>Sub</u>	<u>R/Nr</u> ^a	<u>Sex</u>	<u>Age</u>	<u>Hgt</u> ^b	<u>Wgt</u> ^c	<u>BF</u> ^d	<u>BdyImg</u> ^e	<u>Miles</u> ^f	<u>Years</u> ^g	<u>NAS</u> ^h
1	R	M	23	182	88	9	2	0	2	59
2	R	F	33	172	68	18	3	2	2	78
3	R	F	31	160	55	13	3	2	3	96
4	R	M	28	176	81	16	3	2	1	67
5	R	M	31	179	76	9	3	3	4	74
6	R	M	30	182	68	9	2	3	4	79
7	R	F	30	157	50	13	3	1	1	82
8	R	M	30	169	66	8	2	4	2	88
9	R	F	27	172	71	24	2	2	1	90
10	R	M	19	184	69	7	3	0	1	57
11	R	M	26	169	69	12	2	1	0	77
12	R	M	30	170	54	7	5	4	3	106
13	R	M	35	156	54	9	2	4	4	77
14	R	M	34	174	73	10	2	4	4	84
15	R	M	31	184	76	12	2	4	3	101
16	R	F	29	173	58	16	2	4	4	89
17	R	M	30	178	73	10	3	4	4	77
18	R	F	27	157	55	20	2	0	2	75
19	R	M	26	188	79	15	3	1	3	78
20	R	M	25	173	69	9	2	4	4	74
21	R	M	59	174	71	23	3	0	4	76
22	R	M	28	185	85	13	3	0	1	54
23	R	M	35	185	80	14	3	0	1	61
24	R	F	58	163	50	20	3	0	4	67
25	R	M	28	179	70	7	2	4	4	94
26	R	F	24	172	61	18	2	1	2	86
27	R	M	18	180	73	6	2	1	2	83
28	R	F	19	159	56	22	2	1	4	90
29	R	M	36	170	62	12	3	0	3	63
30	R	F	44	163	59	24	2	1	4	72
31	R	F	27	161	58	13	2	0	2	70
32	R	M	50	182	80	13	2	3	4	85
33	R	F	40	157	51	19	2	2	0	69
34	R	M	19	179	71	7	3	1	3	64
35	R	F	33	169	67	22	1	0	3	77
36	R	M	21	188	77	7	4	2	2	75
37	R	M	30	176	73	17	2	0	3	55
38	R	F	53	158	60	26	2	0	3	63
39	R	F	42	162	55	19	3	1	4	78

Anthropometric and running data con't.

<u>Sub</u>	<u>R/Nr</u>	<u>Sex</u>	<u>Age</u>	<u>Hgt</u>	<u>Wgt</u>	<u>BF</u>	<u>BdyImg</u>	<u>Miles</u>	<u>Years</u>	<u>NAS</u>
40	R	M	20	179	69	6	3	1	2	67
41	R	M	42	159	61	11	3	3	3	79
42	R	M	58	174	69	14	3	3	4	91
43	R	F	32	161	59	20	1	0	4	73
44	R	M	26	175	63	9	3	4	4	91
45	R	F	34	168	60	15	3	1	4	80
46	R	M	48	177	69	11	3	2	4	80
47	R	F	23	159	51	21	2	1	1	83
48	R	M	52	179	76	19	2	1	4	58
49	R	M	36	177	72	11	3	0	2	67
50	R	M	30	181	71	12	5	2	2	81
51	R	M	37	173	72	12	3	0	4	53
52	R	M	41	179	71	20	-	0	4	73
53	R	F	36	164	68	32	2	0	2	71
54	R	F	33	170	57	16	3	0	4	84
55	R	M	35	189	88	21	3	0	1	75
56	R	M	34	198	85	13	2	2	4	67
57	R	F	33	165	59	21	3	0	1	72
58	R	M	39	180	107	26	2	0	1	58
59	R	F	32	161	54	20	2	0	1	56
60	R	M	47	179	87	24	2	1	4	78
61	R	F	22	171	61	17	2	1	4	94
62	NR	F	29	165	62	30	2	-	-	-
63	NR	F	18	155	45	16	2	-	-	-
64	NR	F	22	164	51	21	3	-	-	-
65	NR	M	32	182	72	18	3	-	-	-
66	NR	F	19	163	97	33	1	-	-	-
67	NR	F	44	160	59	25	2	-	-	-
68	NR	F	38	157	66	34	2	-	-	-
69	NR	F	34	163	62	30	1	-	-	-
70	NR	M	21	175	79	14	3	-	-	-
71	NR	M	20	154	83	11	4	-	-	-
72	NR	F	37	167	75	25	1	-	-	-
73	NR	M	45	175	86	26	2	-	-	-
74	NR	F	36	168	76	26	1	-	-	-
75	NR	F	36	156	57	28	2	-	-	-
76	NR	F	42	160	62	30	2	-	-	-
77	NR	F	28	170	81	32	1	-	-	-
78	NR	F	46	161	76	31	1	-	-	-
79	NR	M	23	173	100	23	3	-	-	-
80	NR	M	36	188	95	16	2	-	-	-

Anthropometric and running data con't

<u>Sub</u>	<u>R/NR</u>	<u>Sex</u>	<u>Age</u>	<u>Hgt</u>	<u>Wgt</u>	<u>BF</u>	<u>BdyImg</u>	<u>Miles</u>	<u>Years</u>	<u>NAS</u>
81	NR	M	30	188	72	11	4	-	-	-
82	NR	M	39	191	119	24	2	-	-	-
83	NR	M	48	183	99	26	1	-	-	-
84	NR	M	43	187	104	24	2	-	-	-
85	NR	F	29	165	69	27	2	-	-	-
86	NR	F	34	161	53	27	3	-	-	-
87	NR	F	25	157	50	18	3	-	-	-
88	NR	F	20	157	57	23	2	-	-	-
89	NR	F	37	169	63	31	2	-	-	-
90	NR	F	56	171	82	29	2	-	-	-
91	NR	F	31	168	57	26	2	-	-	-
92	NR	F	55	160	52	18	3	-	-	-
93	NR	F	37	165	70	24	2	-	-	-
94	NR	M	25	175	56	25	4	-	-	-
95	NR	F	19	161	56	27	2	-	-	-
96	NR	F	47	155	68	39	1	-	-	-
97	NR	F	22	157	48	15	3	-	-	-
98	NR	F	32	152	82	32	1	-	-	-
99	NR	M	21	183	94	21	2	-	-	-
100	NR	F	44	152	52	24	2	-	-	-
101	NR	F	20	168	48	17	3	-	-	-
102	NR	F	23	161	44	12	2	-	-	-
103	NR	M	38	175	97	21	1	-	-	-
104	NR	M	55	183	80	20	2	-	-	-
105	NR	M	32	195	78	9	4	-	-	-
106	NR	M	59	179	64	17	3	-	-	-
107	NR	M	26	175	89	26	1	-	-	-
108	NR	M	32	170	75	22	2	-	-	-
109	NR	M	43	183	100	26	1	-	-	-
110	NR	M	49	175	84	21	2	-	-	-
111	NR	M	42	183	102	29	2	-	-	-
112	NR	M	32	178	82	19	2	-	-	-
113	NR	M	28	170	84	25	2	-	-	-
114	NR	M	23	179	85	22	2	-	-	-
115	NR	M	31	170	70	19	2	-	-	-
116	NR	M	20	174	58	9	4	-	-	-
117	NR	M	20	184	111	24	1	-	-	-
118	NR	M	31	179	92	20	2	-	-	-
119	NR	M	43	185	87	22	2	-	-	-
120	NR	M	39	178	80	19	2	-	-	-
121	NR	M	25	185	72	11	3	-	-	-
122	NR	M	33	168	58	30	2	-	-	-

Anthropometric and running data con't.

- a: R=Runner, NR=Nonrunner
- b: Hgt=Height in cm
- c: Wgt=Weight in kg
- d: BF=% Body Fat
- e: BdyImg=Score on Body Image Question. 1=very overweight, 2=slightly overweight, 3=the right weight, 4=slightly under-weight, 5=very underweight
- f: Miles=Miles run per Week. 0=9-21, 1=21-30, 2=31-40, 3=41-50, 4=>50
- g: Years=Years run. 0=<1, 1=1-2, 2=3-4, 3=5-6, 4=7 or more
- h: NAS=Negative Addiction Scale Score

Subject Scores for the Three(T) and Six(S)
Point Scoring of the Eight EDI Subscales

<u>Sub</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>	<u>T5</u>	<u>T6</u>	<u>T7</u>	<u>T8</u>	<u>S1</u>	<u>S2</u>	<u>S3</u>	<u>S4</u>	<u>S5</u>	<u>S6</u>	<u>S7</u>	<u>S8</u>
1	9	21	4	1	1	2	0	4	15	18	18	13	16	18	11	18
2	3	1	1	0	1	0	0	3	30	35	21	20	18	29	29	30
3	9	8	4	1	1	5	4	12	21	21	18	12	19	19	16	28
4	1	8	2	2	1	0	0	4	11	19	17	8	14	12	11	20
5	2	0	3	1	2	0	0	10	25	25	23	18	19	22	21	19
6	8	21	3	0	1	2	0	7	12	25	21	10	18	21	20	25
7	0	2	3	0	0	0	0	4	26	35	25	17	19	27	28	15
8	14	27	3	2	0	4	0	8	13	17	23	22	12	26	12	30
9	4	6	5	0	2	0	1	3	16	32	18	11	12	16	18	19
10	3	0	2	0	0	3	0	7	20	28	27	11	18	22	25	18
11	0	4	3	0	1	0	0	7	22	26	21	12	11	14	26	22
12	6	8	2	1	1	0	1	1	17	13	28	13	16	33	31	23
13	3	1	4	9	1	4	0	14	23	14	27	12	16	24	36	32
14	0	6	3	0	0	0	0	5	10	14	20	11	12	15	16	18
15	0	10	2	1	0	0	0	10	12	13	19	10	14	18	17	16
16	2	4	5	0	1	1	0	3	28	39	19	21	16	30	33	17
17	3	5	3	0	0	0	1	6	21	14	27	10	22	24	26	20
18	0	4	3	0	0	0	0	6	27	32	23	9	21	25	25	20
19	2	0	5	0	2	6	3	6	18	30	18	11	17	23	21	23
20	7	0	7	1	2	2	7	14	16	20	20	12	19	18	22	21
21	0	0	3	0	1	0	0	4	19	21	18	10	13	10	10	21
22	0	0	3	0	0	0	0	0	16	18	24	11	23	20	22	15
23	7	14	3	2	0	4	7	4	13	19	18	10	17	22	17	22
24	4	0	5	0	3	1	0	3	14	28	25	8	24	19	21	29
25	0	0	3	0	0	0	0	0	21	15	22	15	15	22	22	21
26	7	6	2	0	2	0	3	3	38	41	18	28	18	36	28	30
27	1	5	1	0	0	0	0	5	19	33	33	13	30	32	27	35
28	9	2	5	1	2	0	1	7	41	50	27	25	23	39	40	28
29	0	0	1	0	1	0	0	2	18	19	20	10	23	19	20	16
30	3	1	6	0	1	0	0	7	34	45	19	11	20	23	27	29
31	0	3	2	0	1	0	0	0	19	24	21	10	18	23	22	24
32	1	0	3	0	3	0	0	2	16	22	21	10	17	15	20	24
33	10	25	2	13	1	8	5	12	27	36	26	12	18	23	26	22
34	0	0	3	0	0	0	0	5	16	20	22	12	18	26	20	22
35	3	8	7	0	2	4	3	6	22	43	17	10	9	18	14	22
36	3	7	4	0	5	2	0	11	17	29	24	15	19	31	30	21
37	0	4	3	0	0	0	0	2	12	12	25	12	18	20	16	22
38	2	0	2	1	0	0	0	4	19	34	19	13	13	19	23	23
39	1	0	2	0	5	1	0	5	31	34	22	19	20	24	24	28
40	17	14	2	7	0	6	2	12	15	20	23	10	22	25	32	15

EDI scores con't

<u>Sub</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>	<u>T5</u>	<u>T6</u>	<u>T7</u>	<u>T8</u>	<u>S1</u>	<u>S2</u>	<u>S3</u>	<u>S4</u>	<u>S5</u>	<u>S6</u>	<u>S7</u>	<u>S8</u>
41	0	14	2	0	1	0	0	3	11	16	24	12	23	15	18	20
42	1	9	9	2	10	6	3	17	17	18	21	12	22	20	21	29
43	3	5	3	0	2	1	1	8	37	54	20	26	20	29	30	16
44	20	23	4	4	4	10	10	10	10	12	22	11	13	19	15	25
45	9	15	4	9	1	8	1	3	26	19	18	16	22	21	21	27
46	1	2	2	0	3	1	0	2	8	11	21	9	29	19	23	19
47	13	18	2	0	1	1	0	3	35	42	22	14	20	24	19	18
48	0	3	4	0	0	0	0	3	13	28	16	10	22	19	17	19
49	2	4	3	0	0	0	0	6	23	26	21	13	28	23	24	23
50	1	4	3	3	6	3	2	1	24	17	21	11	21	20	23	21
51	0	0	2	0	2	0	0	2	13	17	18	9	20	20	20	19
52	0	1	3	0	3	0	0	8	11	19	24	11	17	19	18	15
53	3	24	5	7	7	15	7	2	30	30	20	9	14	18	15	17
54	7	12	4	0	2	0	1	5	16	22	23	13	15	22	20	21
55	0	0	1	0	2	1	0	4	11	18	21	8	17	15	15	13
56	9	10	6	2	0	0	2	3	17	14	20	10	13	17	17	25
57	1	8	3	0	0	0	0	7	26	29	19	20	18	24	25	25
58	0	6	2	0	6	0	0	0	16	24	15	11	17	18	16	22
59	4	17	2	0	0	0	0	6	18	34	19	12	19	22	16	20
60	2	9	2	0	5	1	3	10	13	19	18	9	15	18	18	22
61	1	9	5	1	2	7	3	5	36	42	25	10	31	35	38	17
62	0	0	6	0	2	2	0	8	15	35	22	9	11	18	16	24
63	1	0	7	0	0	0	0	6	35	52	20	15	13	28	28	18
64	1	7	3	0	0	0	0	5	12	14	21	10	24	24	22	24
65	3	5	7	3	9	8	14	9	9	13	24	9	13	16	20	23
66	10	10	2	1	0	0	1	10	29	47	23	16	23	30	24	18
67	2	2	1	0	2	0	4	0	28	53	23	16	21	3	27	16
68	0	0	3	1	4	0	0	5	26	40	33	19	27	23	23	23
69	1	0	2	0	4	0	1	11	29	44	26	16	22	26	37	18
70	16	27	3	7	2	3	2	0	22	31	27	10	22	22	17	26
71	0	0	3	1	0	0	0	7	12	26	29	15	29	30	38	23
72	7	0	2	0	4	0	0	9	15	48	25	13	26	27	34	17
73	0	0	2	0	9	0	0	3	16	29	22	8	15	20	18	24
74	1	5	4	0	1	0	0	1	30	54	25	23	19	30	28	28
75	14	15	2	0	2	1	0	1	33	51	26	14	14	28	17	14
76	1	3	3	0	3	0	0	5	16	38	16	12	18	18	22	15
77	0	9	3	0	3	0	0	5	33	53	25	17	25	40	41	19
78	0	2	0	0	3	3	0	9	22	54	26	12	15	27	23	26
79	3	3	2	0	8	1	0	7	13	18	23	9	27	14	16	22
80	5	0	2	0	2	0	3	6	8	23	11	10	22	11	16	26
81	0	0	2	0	1	0	0	2	8	11	21	12	24	20	21	25

EDI scores con't

<u>Sub</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>	<u>T5</u>	<u>T6</u>	<u>T7</u>	<u>T8</u>	<u>S1</u>	<u>S2</u>	<u>S3</u>	<u>S4</u>	<u>S5</u>	<u>S6</u>	<u>S7</u>	<u>S8</u>
82	0	19	1	0	0	4	1	7	20	36	18	16	14	20	21	16
83	0	3	4	0	1	0	0	1	20	30	25	20	20	32	23	16
84	10	7	3	0	0	0	0	2	17	38	26	19	19	24	19	27
85	0	0	3	0	0	0	0	4	24	52	18	14	22	29	25	19
86	0	1	5	0	0	0	0	1	20	24	17	8	18	18	15	27
87	2	0	3	0	0	1	0	8	9	16	19	9	14	12	16	23
88	5	3	2	1	1	0	0	7	17	37	28	13	14	29	23	17
89	0	5	3	0	1	0	0	5	31	48	19	10	16	29	32	15
90	1	7	3	0	2	0	0	4	24	35	24	12	16	23	24	27
91	0	3	3	0	0	0	0	6	20	43	25	15	30	38	40	20
92	15	19	4	0	11	9	12	4	18	24	19	11	16	19	15	25
93	14	25	2	1	1	3	2	2	29	48	24	18	17	31	22	21
94	0	0	2	0	3	0	0	6	29	48	24	18	17	31	22	21
95	0	0	4	0	0	0	0	6	26	46	16	10	14	23	19	25
96	8	20	1	0	3	3	2	2	35	54	16	17	13	25	18	23
97	9	26	2	1	2	3	1	2	12	13	22	7	13	22	20	25
98	7	17	9	4	8	4	2	8	21	37	24	20	15	17	21	27
99	9	17	6	1	4	2	8	5	12	24	19	11	9	12	14	24
100	4	8	4	0	3	1	0	8	13	18	21	11	15	22	19	15
101	1	3	8	2	9	4	10	6	13	20	22	13	18	23	20	19
102	1	22	2	1	5	1	6	2	15	22	23	11	15	24	23	11
103	1	6	2	0	0	2	0	7	30	52	22	33	16	31	30	29
104	10	27	3	4	2	1	2	10	16	29	27	7	15	29	24	23
105	12	24	5	2	0	3	1	0	11	22	21	11	14	22	18	16
106	0	11	2	0	2	0	0	0	14	15	22	9	25	25	23	22
107	12	26	2	1	5	10	11	4	15	40	17	11	16	20	16	18
108	5	27	6	0	2	7	0	10	20	24	18	10	15	22	21	26
109	0	2	5	0	9	0	0	7	28	42	21	28	19	35	28	17
110	0	3	0	1	4	0	3	10	14	23	24	9	13	17	17	19
111	0	0	3	0	6	3	2	7	20	25	19	19	27	26	23	17
112	3	9	2	3	0	0	0	2	17	15	23	10	20	18	22	19
113	1	8	6	4	3	6	2	2	23	51	29	26	28	45	37	17
114	2	14	5	1	2	3	0	10	28	34	24	17	15	21	24	20
115	5	25	2	1	4	2	0	4	12	29	21	9	25	17	20	9
116	4	3	3	0	5	0	1	10	8	10	28	9	18	20	20	24
117	0	0	2	0	0	0	0	6	20	33	24	16	25	28	29	28
118	0	11	5	0	0	2	0	1	20	31	29	17	28	31	43	27
119	10	23	3	0	1	1	5	2	17	28	22	12	16	22	20	17
120	8	11	3	2	1	0	1	9	18	22	20	10	20	18	16	22
121	0	16	3	0	9	8	10	3	11	20	17	9	13	20	15	26
122	1	2	3	0	2	0	0	9	16	46	19	11	14	24	22	25

EDI scoring con't.

- S=Six Point Scoring
- T=Three Point Scoring
- 1=Drive for Thinness
- 2=Body Dissatisfaction
- 3=Interoceptive Awareness
- 4=Bulimia
- 5=Interpersonal Distrust
- 6=Maturity Fears
- 7=Ineffectiveness
- 8=Perfectionism

**The vita has been removed from
the scanned document**